Submission No 25

INQUIRY INTO HEALTH IMPACTS OF AIR POLLUTION IN THE SYDNEY BASIN

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Summary

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PARLIAMENTARY INQUIRY INTO THE HEALTH IMPACTS OF AIR POLLUTION IN THE SYDNEY BASIN

NSW GOVERNMENT SUBMISSION

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CONTENTS

Introduction

The NSW Government submission to the Parliamentary Inquiry into the Health Impacts of Air Pollution in the Sydney Basin has been prepared by the Department of Environment and Conservation and the Department of Health in consultation with relevant NSW Government agencies.

The NSW Government manages air quality in accordance with *Action for Air*, the 25 year air quality management plan first released in 1998. *Action for Air* is reviewed publicly every three years through a Clean Air Forum and updates are provided to take into account changing circumstances as well as new information.

Action for Air is based on 7 objectives:

- Integrate air quality goals and urban transport planning
- Provide more and better transport choices
- Make cars, trucks and buses cleaner
- Promote cleaner business
- Promote cleaner homes
- Manage the impact of open burning
- Monitor, report on and review air quality.

Action for Air also links with strategies across those agencies responsible for urban planning and development, transport planning, public transport network management, traffic management, energy, emission controls and health.

An update of *Action for Air* was prepared in 2006 and forms the Government's comprehensive and more detailed input to the Inquiry Terms of Reference. A copy is included as Appendix 1 and a copy of the original *Action for Air* is found at Appendix 2. The 2006 Update:

- Provides an overview of air quality trends in the Greater Metropolitan Region from the mid 1990's to the release of *Action for Air* in 1998 and to the present. It shows that Sydney's air quality has improved substantially and, with the exception of ozone, generally meets the national air quality standards. However, Sydney faces key air quality challenges in the future;
- Summarises actions already taken to address each of the seven *Action for Air* objectives and how these have made a substantial difference in light of Sydney's population and motor vehicle use increase. These actions are particularly directed at addressing ozone and particle pollution;
- Discusses future challenges under each objective and outlines Government initiatives and actions, additional to the measures in *Action for Air*, which are in place or have been announced to address these future challenges.

Overview

NSW has a comprehensive program in place to improve air quality, identify and target air pollution emissions and causes from major sources, and reduce the health impacts of air pollution. Air quality information is provided daily to the public through a comprehensive metropolitan air quality monitoring program. Every three years a Clean Air Forum is held to review the progress of air programs. In addition, the NSW State of the Environment Report outlines the status of air quality every three years.

Air quality in both Sydney and NSW generally is good and has been steadily improving over the last three decades, despite there having been a substantial growth in population and car ownership. This assessment is based on national air quality standards which were approved in 1998 by the National Environment Protection Council. These standards are regularly reviewed. Sydney's air quality also compares well with other major cities around the world.

NSW has made significant gains in air quality, starting with the passage of the Clean Air Act in 1961. Numerous other important air quality reforms have been implemented since that time. Major improvements have been made by:

- significantly reducing air pollution from industrial sources through stronger and more effective regulation in the *Protection of the Environment Operations Act 1997* and the Clean Air Regulations;
- reducing harmful emissions from motor vehicles through the introduction of unleaded petrol and cleaner fuels, particularly since 2000, and progressively cleaner vehicles (including a recent shift to new ultra-clean hybrid technologies); and
- reducing other sources of air pollution by banning backyard burning, tightening emission standards on home woodheaters and providing education to householders on how to run them.

With the significant increases in population, car ownership and the size of the NSW economy that have occurred since 1961, it is recognised that air quality challenges remain. The main challenges we face in air quality are:

- to achieve national ozone standards. Sydney's ozone pollution is caused by the complex mix of emissions of volatile organic compounds and oxides of nitrogen, as well as the meteorology and the unique topography of the Sydney basin. Growth in car ownership continues to make achieving the standards a significant challenge;
- to better control particle emissions, particularly in light of emerging concerns about the health impacts of fine particles; and
- to manage possible climate change impacts that may exacerbate bushfires and dust storms, which contribute to particle pollution and may lead to increased numbers of summer ozone episodes; and
- to manage air quality in road tunnels.

TOR (a)

Changes in the emissions of various air pollutants and the impact of those changes on air quality in the Sydney Basin, over the last three decades, including any "hot spots" where pollution is concentrated.

There is no doubt that air quality in Sydney today is significantly better than it was in the 1960s when the first Clean Air Act was passed. It has also especially improved since the early 1980s.

Sydney's air quality is assessed against national standards set out in the Ambient Air Quality National Environment Protection Measure (NEPM). The pollutants are: carbon monoxide, nitrogen dioxide, photochemical oxidants (measured as ozone), sulfur dioxide, lead and

particles as PM_{10}. Advisory reporting standards apply for particles as $PM_{2.5}$ (particles less than 2.5 microns in diameter).

Ambient levels of harmful carbon monoxide and toxic airborne lead have now fallen dramatically and are below national standards. These improvements are due to the introduction of cleaner exhaust motor vehicle technology, in particular the introduction of catalysts and unleaded petrol. The sale of leaded petrol has been prohibited in NSW since 1 January 2002, eliminating the last major source of airborne lead. Carbon monoxide concentrations have also continued to fall, with the gradual replacement of the vehicle fleet with newer vehicles that are meeting new more stringent emission limits.

Sulfur dioxide concentrations are also well below the national standard in Sydney. These levels have been kept low because of the availability and use of low sulfur fuels in Sydney. In addition, major point sources outside of Sydney (such as the copper smelter at Port Kembla) have closed, which has led to further reductions in sulfur dioxide concentrations in surrounding areas.

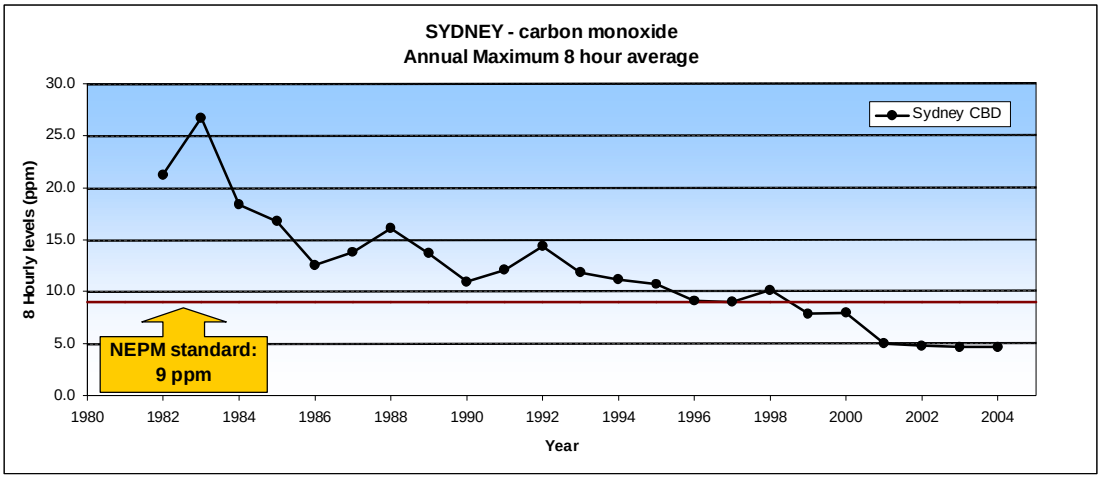
During the late 1990s nitrogen dioxide levels (and exceedences of the national standards) were also significantly lower than those recorded in the 1980s.

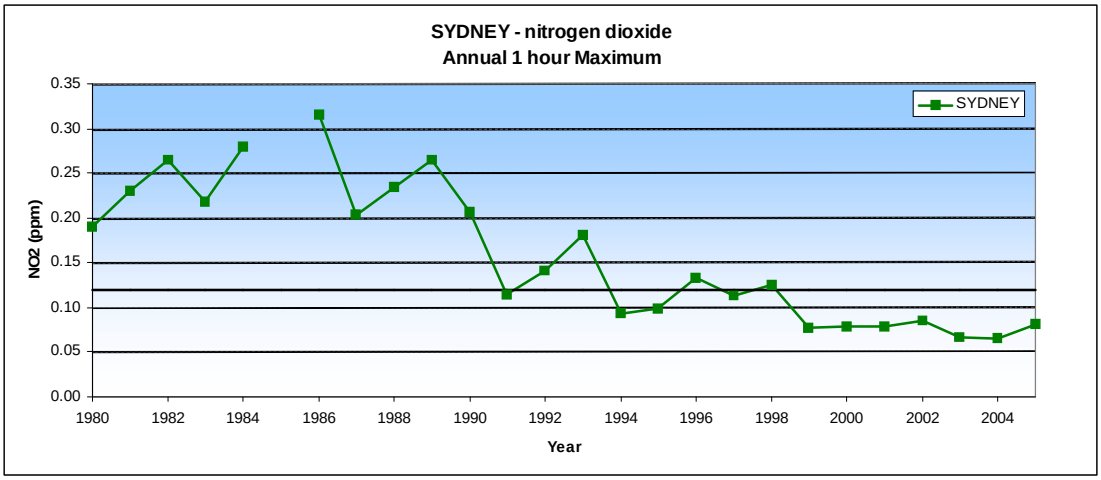
While there have been these many improvements, ozone and particle pollution levels remain a challenge for Sydney. Notwithstanding the variability in levels of ozone due to weather, the underlying emissions mix that forms ozone in the air shed (mainly volatile organic compounds (VOCs) and oxides of nitrogen (NOx)) remains too high. The national ozone standards are exceeded in Sydney on a number of days each year. On some of these days bushfires add to the emission load, but even without the bushfires, ozone would still on occasion breach the 2008 national goals.

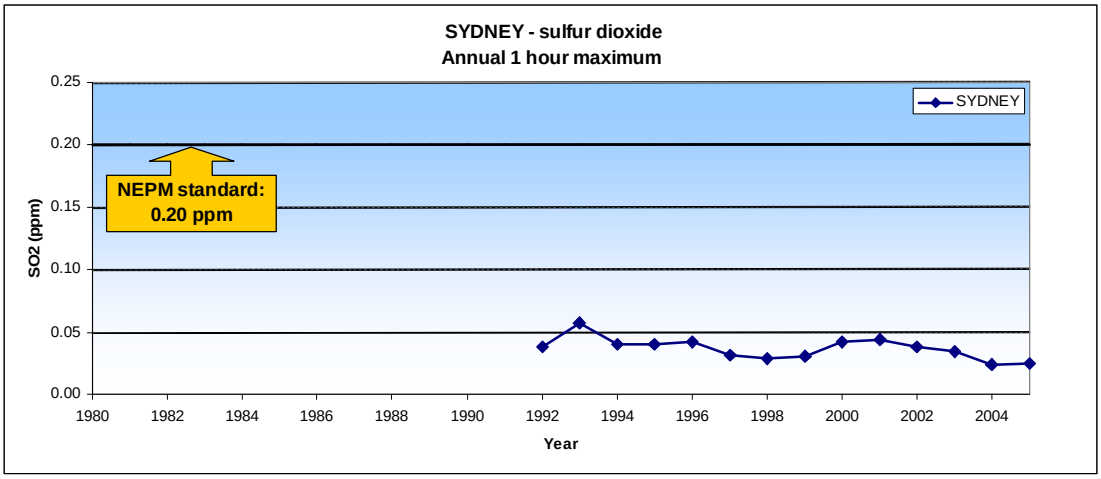
Ozone is of particular concern in the warmer months. How quickly ozone is formed depends largely on the temperature and the mix of the precursor pollutants (VOCs and NOx). Emissions of these pollutants produced by morning peak hour traffic and other sources can be transported offshore. In the presence of sunlight they begin to react to form ozone, and with the arrival of the sea breeze the plume is transported to the west across the Sydney basin.

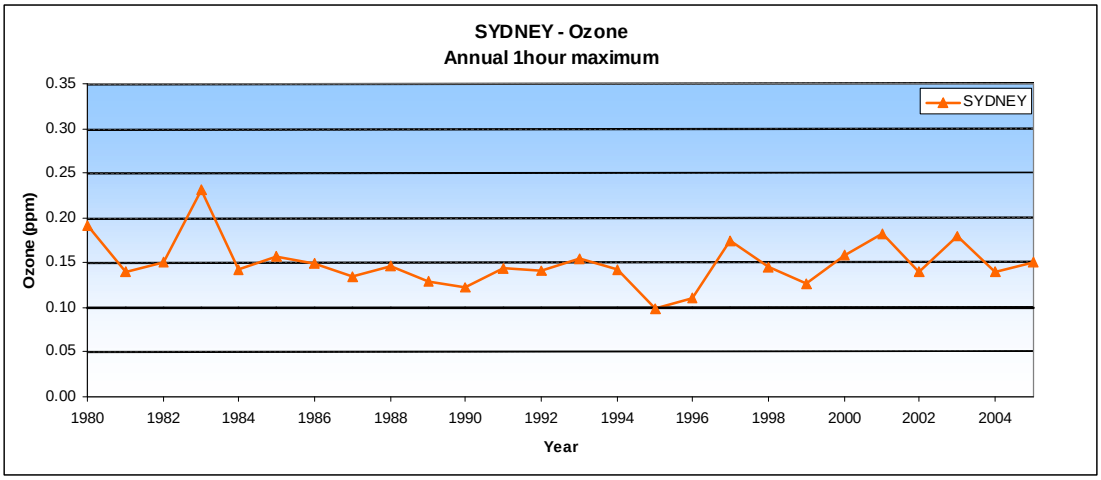
Annual average concentrations of particles measured as PM_{10} (particles less than 10 microns in diameter) in the Sydney region continue to be generally below the national air standards. Exceedences of the standard for particles are normally associated with extreme natural (and unavoidable) events, such as bushfires and dust storms in summer, or planned events such as hazard reduction burning in winter. The national goal of no more than five exceedences of the PM_{10} standard per annum has generally been met in Sydney.

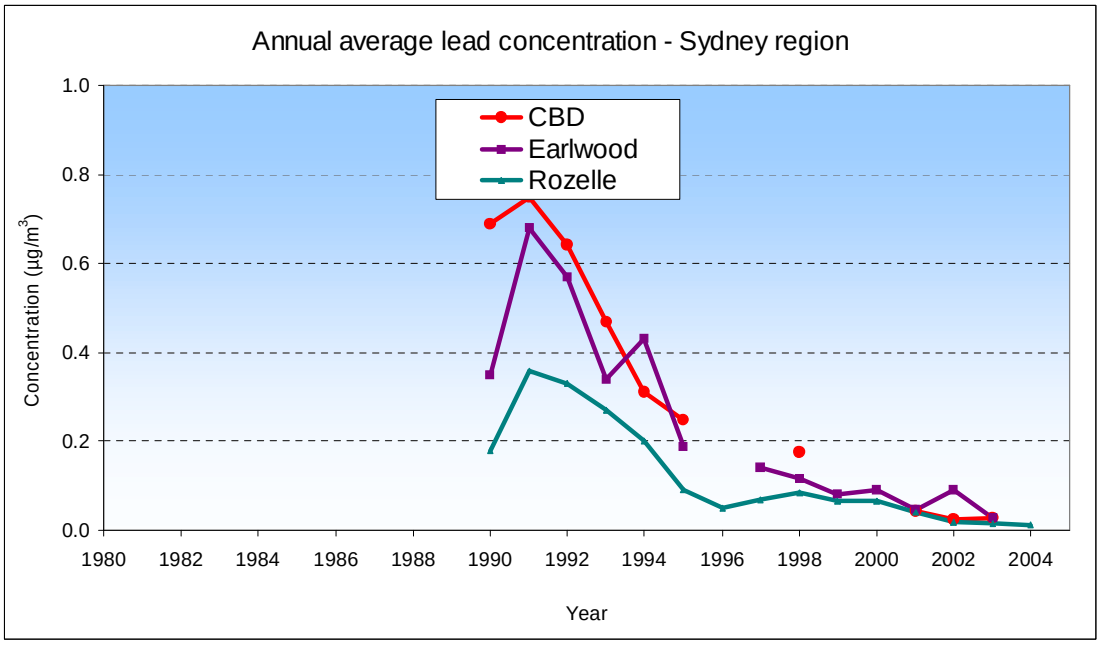
The graphs below provide an overview of trends in Sydney for carbon monoxide, nitrogen dioxide, ozone, sulfur dioxide, lead and particles as PM_{10} and $PM_{2.5}$.

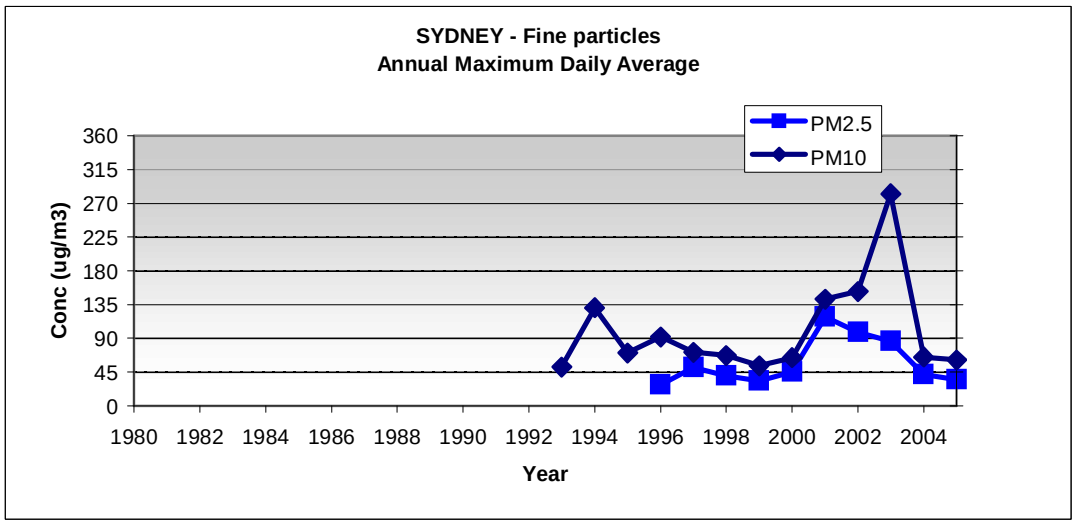

SYDNEY - carbon monoxide
Annual Maximum 8 hour average
8 Hourly levels (ppm)
30.0
25.0
20.0
15.0
10.0
5.0
0.0
Sydney CBD
NEPM standard:
9 ppm
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
Year


SYDNEY - nitrogen dioxide
Annual 1 hour Maximum
NO2 (ppm)
0.35
0.30
0.25
0.20
0.15
0.10
0.05
0.00
SYDNEY
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
Year


SYDNEY - sulfur dioxide
Annual 1 hour maximum
SO2 (ppm)
0.25
0.20
0.15
0.10
0.05
0.00
NEPM standard:
0.20 ppm
SYDNEY
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
Year

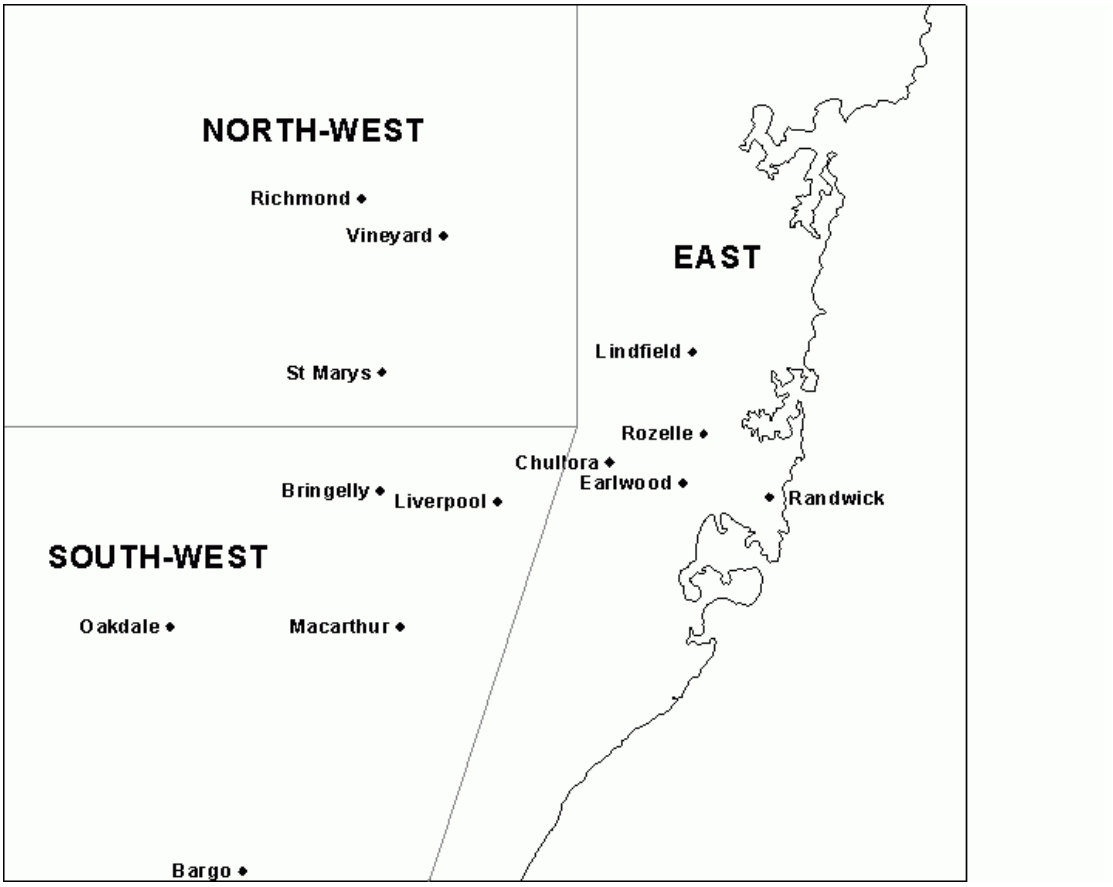






Appendix 6, together with *Action for Air* (Appendix 2) and *Action for Air: 2006 Update* (Appendix 1) provides more detailed information on changes in emissions and trends in Sydney's air quality as assessed against relevant health goals from 1980 to 2005.

NSW has extensive air quality data and information systems. This includes information on emissions since air quality first became an issue of concern to the community and governments around the world in the 1950s. Since its introduction by the NSW Government over 50 years ago, air quality monitoring has developed and expanded, such that today we have a modern, reliable air quality monitoring network. Under DEC's air quality monitoring program, accurate real-time measurements of ambient level pollutants are collected at sites located around Sydney, the Illawarra and the Lower Hunter in the Greater Metropolitan Region, and at selected rural sites. The monitoring locations in Sydney are shown in the map below. The data is used to define the nature and severity of air pollution, identify pollutant trends, support DEC's regional pollution index and forecasting services, and develop air models and air emission inventories. Appendix 6 includes further information on how air quality is monitored in the Sydney region.



Location of air quality monitoring stations in the Sydney area

DEC also maintains and has recently updated the emissions inventory for the Greater Metropolitan Region (GMR). It quantifies emissions of over 90 substances, from all sources, including off-road transport, motor vehicles, large industry, commercial business, domestic and natural sources. The inventory is one of the key sources of information DEC uses to develop programs to maintain and improve air quality.

A discussion of emission sources in the Sydney basin, changes in emissions, and the latest information on emission sources from the new inventory is included as Appendix 3.

Additional information on emissions and impacts on Sydney's air quality is available in:

- *NSW State of the Environment 2003*, available at http://www.environment.nsw.gov.au/soe/soe2003/ ;

- National Environment Protection Council Annual Reports, available at http://www.ephc.gov.au/php/list_document_types.php and Compliance reports, available at http://www.ephc.gov.au/nepms/air/air_nepm.html ; and
- "State of the Air: National Ambient Air Quality Status and Trends Report 1991-2001", published by the Commonwealth Department of the Environment and Heritage in 2004, available at http://www.deh.gov.au/atmosphere/airquality/publications/status/index.html

TOR (b)

The impact of NSW air pollution laws (including the Clean Air Act 1961, the Protection of the Environment Operations Act 1997 and any regulations made under those Acts) on air quality over the past three decades

As a result of significant smoke pollution events being experienced in the inner suburbs of Sydney, the NSW Parliament first took up the issue of air pollution in the 1950s. Both the Government and Opposition raised the issue, and expressed concern about the potential health impacts. During debates at this time, Members also referred to various international air pollution events, including those in Belgium in 1938 and London in 1952.

On 17 November 1954, then NSW Premier Renshaw announced that the Government would establish a special committee to investigate the smoke nuisance in NSW. This Committee ultimately recommended that new legislation was needed to address the growing air pollution problem.

The NSW Government introduced the Clean Air Act in 1961, the drafting of which was informed by air quality measurements that had begun in 1951 and were carried out routinely from 1953. Pollution control programs, first commenced under the original Clean Air Act, have made a major contribution to overcoming many serious or potentially serious air pollution problems.

However, by the mid-1990s, it had become clear that the Clean Air Act was outdated and required reform. This resulted in this Act's integration into a much stronger piece of pollution control legislation, the landmark *Protection of the Environment Operations Act* passed in 1997 (the POEO Act). For the first time in the State's history, the POEO Act recognised the importance of integrated pollution control across air, water, noise and waste, and significantly increased the offences and penalties available to better control air pollution and prosecute offenders. It also introduced new and innovative market based mechanisms, such as load based licensing which linked emissions to licence fees, to provide an additional economic incentive to reduce emissions from industry. A short history of air pollution legislation and regulation in NSW is attached as Appendix 4.

The Auditor General's 2001 Performance Audit Report, *The Environment Protection Authority: Controlling and Reducing Pollution from Industry*, stated that:
"... the introduction of the Protection of the Environment Operations Act 1997 which commenced 1 July 1999, restructured, streamlined and strengthened pollution legislation and established a regulatory framework consistent with international best practice." (p. 12)

The POEO Act was updated in 2005 by the Government to further improve its pollution control provisions, including increased penalties for pollution offences. Industrial air emissions are now more strictly regulated than ever before under the amended Protection of the Environment Operations (Clean Air) Regulation 2002. This Regulation, which was further strengthened in 2005, and its predecessor, the Clean Air (Plant and Equipment) Regulation, show how significant air quality gains can be achieved over time by providing minimum performance levels that all industry must achieve. It is no exaggeration to say that these recent

changes have revolutionised the regulatory framework for controlling and reducing industrial air emissions in NSW.

Appendix 5 outlines how, under the POEO Act, DEC uses the following key tools to protect air quality:

- Licensing
- Pollution Reduction Programs
- Environmental audits
- Load Based Licensing
- Enforcement programs.

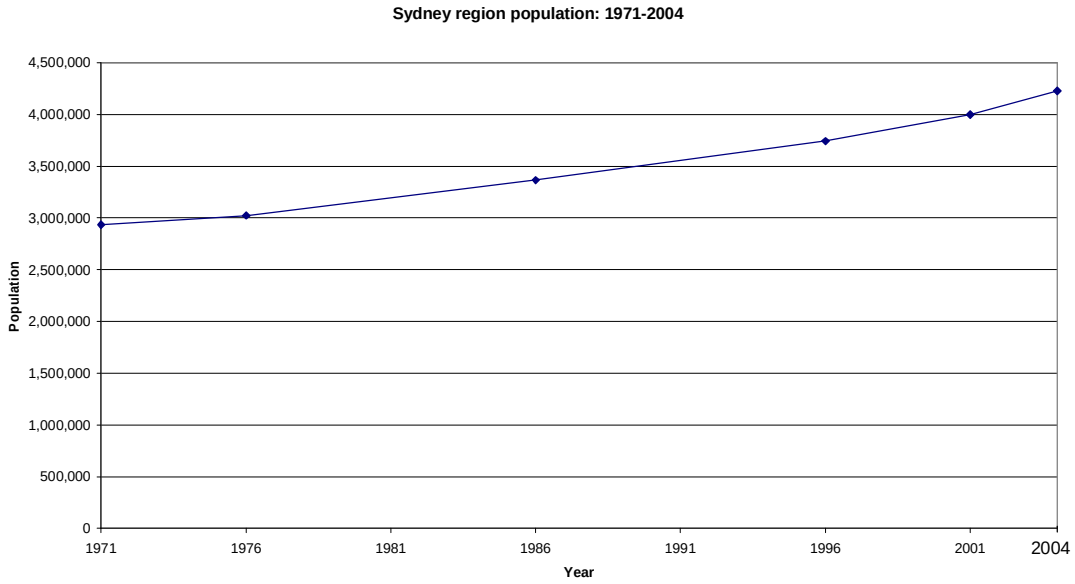
The legislative changes discussed above have had a significant impact on the air quality improvements over the last three decades.

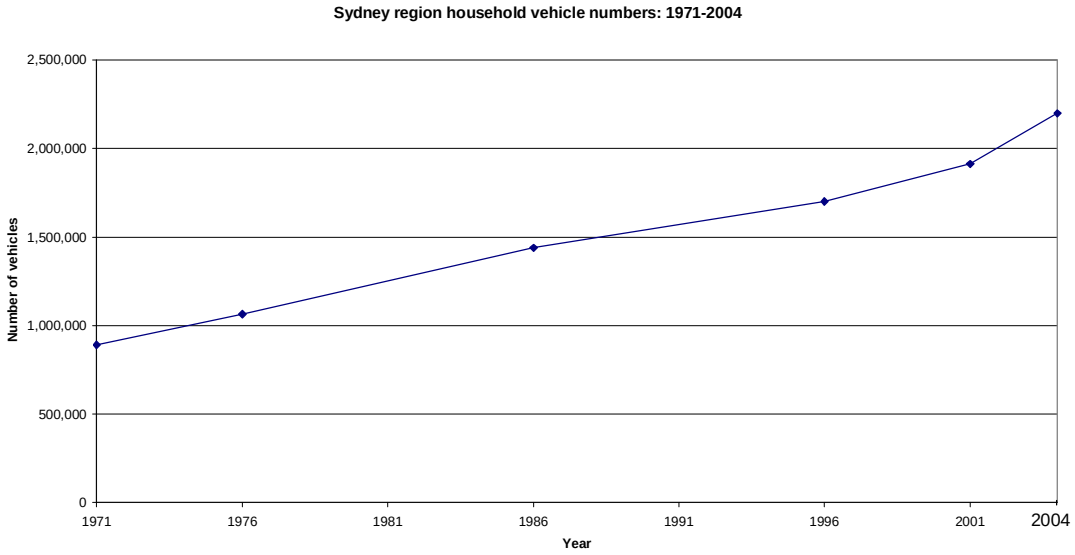
TOR (c)

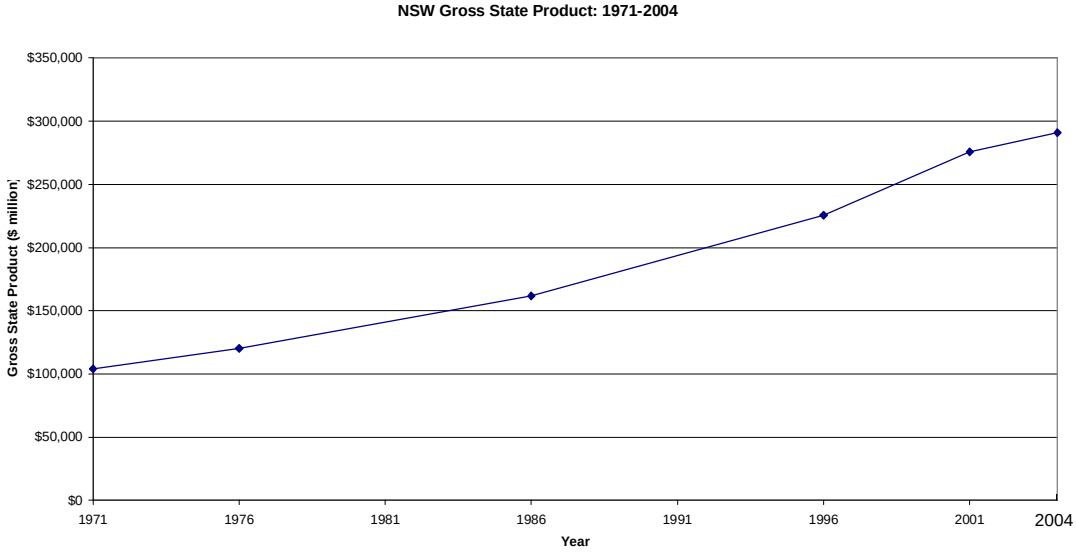
The causes of air pollution in the Sydney basin over the past three decades

Over the past three decades the major causes of air pollution have changed. As particular causes of pollution have been better controlled and, in some cases, eliminated altogether (such as the backyard burning and lead in petrol), other sources have become relatively more significant. For example, as industrial air pollutants have been more tightly controlled, the focus has increasingly turned to motor vehicle emissions. Population growth, the growth in the State's economy, and the continued growth in motor vehicle ownership have resulted in significant changes to the dynamics of air pollutants.

The following graphs show how population, car ownership and gross state product have significantly increased from 1971 to 2004.







Increasing population and car ownership place pressure on air quality. In the face of these increases, the fact that NSW has seen such dramatic reductions in such a wide range of air pollutants over this time is a significant achievement.

Consideration of the causes of air pollution in the Sydney basin requires that attention be paid to pollutant emissions produced from a range of sources, the air chemistry of the Sydney basin, and the influence of meteorology and topography on both the formation of pollution and where the highest concentrations occur.

In Sydney motor vehicles are the most significant source of precursor pollutants for ozone, (about 71% of NO_x and 38% of anthropogenic VOC emissions), with commercial-domestic sources estimated to contribute 49% of anthropogenic VOCs and major industry about 15% of NO_x and 11% of anthropogenic VOCs.

The major sources of anthropogenic particle emissions in the Sydney Region are industry (36%); the commercial and domestic sectors (35%); and motor vehicles (12%). Domestic wood heating makes up a significant proportion of commercial / domestic emissions and diesel vehicles are the major contributor to motor vehicle emissions.

Appendix 3 provides a more detailed breakdown of the sources of NOx, VOCs and particle emissions in the Sydney region, and briefly discusses sources of other pollutants measured under the Ambient Air Quality NEPM (carbon monoxide, sulfur dioxide and lead).

A discussion of the formation of the principal pollutants of concern in the Sydney basin, namely photochemical smog (ground-level ozone) and particles is provided at Appendix 6. Reference is also made to the principal emission sources contributing to those pollutants.

TOR (d)

The health impacts of air pollution on any "at risk" groups

Knowledge of the health effects of air pollution is derived from several types of research:

Observational studies are where fluctuations in air pollution are compared to changes in health outcomes such as the rate of death, number of asthma attacks, etc. These are usually referred to as *time series studies,* as several years of data on populations and air pollution are collected and analysed over the time period.

The majority of observational studies are conducted on whole populations, and susceptible groups are inferred from the types of health outcomes associated with air pollution. This is the most common type of air pollution health research.

Another type of observational study is the *cohort study.* In a cohort study information is gathered on individuals (such as smoking, occupation) and the individuals are observed over time to measure health outcomes. The rate of health outcomes can be compared according to the air pollution the individuals have been exposed to. This type of study provides a higher level of evidence about the adverse health effects of air pollution, however it is far more logistically difficult and costly to undertake.

Experimental studies are conducted where individuals are exposed to fixed doses of air pollution and immediate health effects are measured. This type of study typically involves small groups of people, sometimes from groups thought to be susceptible to air pollution, based on findings of observational studies.

Occupational cohorts may document the adverse impacts of very high exposures to particular air pollutants, or mixtures of air pollutants.

Toxicology studies may demonstrate mechanisms of health effects on cell or animal models (e.g. mice).

The outcomes from different types of studies all contribute to the strength of evidence about the effects of air pollutants on health. For health evidence to be convincing, effects should be **reproducible** by different investigators and different methods, have **biological plausibility** (which can be demonstrated by toxicology studies), and demonstrate a **dose-response effect** (that is, increasing exposure results in increasing health effects). Another important consideration is **generalisability** – whether effects observed in other countries are applicable in Australia. For this reason local research is important.

In NSW, air pollution health research started with the Health and Air Pollution Research Program (HARP) from 1993-96. The outcomes of HARP are summarised in Appendix 7. HARP studies demonstrated adverse health effects of air pollution in NSW in cohort and time series studies.

Subsequent to HARP, further air pollution and health research has continued in NSW, and the outcomes of this research are detailed in Appendix 8. Most research since HARP has been

time series type studies. NSW Health has also been a partner in two national studies of air pollution and health, and the results from the first national collaboration are also included. The results of the second collaboration, the Multi-city Mortality and Morbidity Study commissioned by the Environment Protection and Heritage Council, are not yet finalised.

Based on research both from overseas and NSW, there is growing evidence that some groups are more sensitive to air pollution than others, and hence may develop adverse health effects at lower exposure levels. Groups at risk due to demographic factors could include the elderly, unborn babies, infants, children, people with a residence, work or school near pollution hotspots, people whose work or recreation is outside during ozone events, and possibly people of low socio economic status.

Groups at risk due to health determinants include:

- people with asthma or chronic respiratory disease;
- people with cardiovascular disease;
- possibly people with diabetes; and
- possible genetic susceptibility.

Health impacts on at risk groups vary by:

- group; and
- pollutant.

but include:

- increased cardiorespiratory mortality, admissions, and episodes of illness;*
- reduced birth weight;*
- increased perinatal mortality;
- increased lung cancer; and
- learning difficulties (associated with lead).*

*evidence from local studies

Research in Sydney is consistent with overseas research in demonstrating increased mortality, hospital admissions and attendances, increased blood lead levels, and reduced birth weight associated with air pollution, and in demonstrating that some demographic groups are at increased risk of suffering adverse effects of air pollution compared to the general population (Appendices 7, 8 and 12).

Most commonly monitored air pollutants show an association with health impacts in Sydney. As several of the pollutants have common sources, and tend to be highly correlated, it is difficult to determine if the observed health effects are due to particular pollutants, or whether it is the mix of pollutants that cause the health effects. The exception to this is ozone, the concentration of which is not correlated with the other criteria pollutants, and is consistently associated with increased adverse respiratory effects in summer in Sydney.

Studies have not been commenced in Australia to investigate whether long-term health effects, such as lung cancer, are associated with air pollution. However, this effect has been demonstrated in North America (Pope, American Cancer Society Cohort and Beeson, Adventist Health Study on Smog) and Europe (Nafstad, Norwegian men, Nyberg, Stockholm residents).

TOR (e)

The financial impacts of air pollution on the NSW health system

The health costs of air pollution are derived from statistical estimates of the observed association between air pollution and health outcomes.

For any individual health event it is rarely possible to determine whether, or to what extent, air pollution may have played a role in its development.

In recent years there have been several attempts to estimate the economic costs of air pollution on health (Kunzli, Ostro, BTRE, DEC). Two of these studies have included health costs for Sydney. The Australian Bureau of Transport and Regional Economics examined the health costs of transport generated air pollution, including estimates for Sydney, in its report *Health impacts of transport emissions in Australia: Economic costs.* The NSW Department of Environment and Conservation, in consultation with NSW Health, looked at the health costs of air pollution in its report *Air Pollution Economics: Health costs of air pollution in the Greater Sydney Metropolitan Region*, (available at: http://www.environment.nsw.gov.au/resources/airpollution05623.pdf).

The financial impacts of air pollution on the NSW health system may be roughly extrapolated using some of the estimates from the DEC report (those for respiratory and cardiovascular admissions) and deriving similar estimates for hospital attendances related to air pollution. The DEC study did not include the hospital attendance costs separately, as it used "willingness to pay" estimates for outcomes such as avoiding asthma attacks and chronic bronchitis, which are assumed to include direct costs such as emergency department attendances. The estimated annual costs of air pollution on the NSW health system for five common air pollution-related health outcomes are provided in the Table below.

Estimated increased annual cost to NSW Health system for respiratory and cardiovascular admissions; and emergency department attendances by the elderly (for cardiac and respiratory disease) and children (for asthma).

Health outcome	**Cost estimate per episode[5] $**	Estimated increased annual cost due to air pollution **($ '000)**
Cardiovascular admissions[1]	7099	3,982- 8,561
Respiratory admissions[1]	5336	1, 917 – 4,185
ED attendances – cardiac, 65+ [2]	359	94
ED attendances – Respiratory, 65+[3]	359	150
ED attendances – asthma 1-14 years[4]	359	541
	Total	**6,685 – 13,533**

[1] *Methodology based on DEC 2005a*
[2] *Jalaludin 2006a*
[3] *Jalaludin 2003*
[4] *Jalaludin 2006b*
[5] *NSW Health Hospital Costs Data Collection 2003-4 (adjusted to 2005-6$)*

The DEC report adopted the standard approach of using PM_{10} as the sole indicator pollutant to calculate the fraction of health costs attributable to air pollution. This does not mean that all identified health effects are due to PM_{10}. In economic analyses such as this, the use of unadjusted effect estimates for PM_{10} will account for health effects due to most of the urban pollutants, with the possible exception of summer ozone peaks. By using PM_{10} as the sole

indicator of health impacts of air pollution, double-counting of health impacts due to similar pollutants is avoided.

The estimate in the above Table indicates that the costs to the NSW Health system for admissions and attendances related to air pollution in Sydney may be in the range of $6.7 to $13.5 million per annum. Although the methodology employed in deriving this estimate is an accepted approach to estimating health costs of air pollution, and local estimates of effect and cost are used where available, the true cost of air pollution on the health system cannot be ascertained.

Long-term exposure to air pollution has been associated with increased mortality and lung cancer in North American and European research. Mortality costs are accounted for in economic analyses by Value of a Statistical Life, or other similar measures. These costs are not borne by the health system specifically. To our knowledge, health cost analyses have not been able to account for the increased cost on the health system for outcomes such as increased cases of lung cancer due to air pollution.

TOR (f)

The effectiveness of current laws and programs for mitigating air pollution

Industrial regulation

The NSW Government manages a comprehensive set of laws, clean air regulations, licences, pollution reduction programs, compliance audits programs, enforcement actions, prosecutions and public information in relation to air pollution. These include cleaner production programs and market based instruments such as load based licensing. These programs have been effective in substantially reducing industrial air pollution.

The regulation of industrial air emissions in NSW is achieved primarily through the Protection of the Environment Operations (Clean Air) Regulation 2002. This Regulation and its predecessor, the Clean Air (Plant and Equipment) Regulation, have already achieved substantial air quality improvements over time by setting minimum performance levels based on contemporary technology that all industry must achieve.

As part of each five year review of the Regulation, the emission standards that will apply to new industry are determined based on the state of knowledge of air pollutant health effects, and the level of emission control that can be achieved using contemporary emission control equipment. Over time this has led to progressively more stringent standards for new industry, while ensuring that the emission controls needed are cost effective.

In 2005, the amended Regulation introduced for the first time in NSW a framework for the review of the performance of old air emission standards. By providing suitable lead times (of between 3 to 8 years), the requirements allow sufficient time for industry to plan and budget for the introduction of more stringent standards for existing plant and equipment. Older industry must either justify staying at existing emission limits (in terms of meeting and addressing health and environmental impacts) or else move to more modern emission limits, which are closer to the standards which apply to newer industry. Over the next twenty years, the Regulation is expected to further improve air quality by avoiding pollution emissions of up to:

- 26,727 tonnes of solid particles (or 1,336 tonnes per year);
- 366,062 tonnes of nitrogen oxides (NOx) (or 18,303 tonnes per year);and
- 94,316 tonnes of sulfur oxides (SOx) (or 4,716 tonnes per year).

It is estimated that this will result in avoiding health costs of up to $1.26 billion over the next twenty years.

The effectiveness of other air pollution-related regulatory programs for industry is further discussed at Appendix 10.

Motor vehicle and fuel emissions

In conjunction with the States and Territories, the Commonwealth regulates fuel and vehicle standards via the *Fuel Quality Standards Act 2000,* the *Motor Vehicle Standards Act 1989* and the Australian Design Rules. NSW has actively engaged in the process of setting national standards. Improvements to the standards have already produced significant gains in reducing vehicle emissions. The stricter standards that are being progressively introduced mean that, despite the predicted increases in vehicle use, motor vehicle emissions of carbon monoxide, VOCs, NO_x and particles in the Sydney GMR are forecast to fall by at least 75%, 46%, 67% and 40% respectively from 2002 to 2020 (DEC, 2005b). This will result in further air quality improvements across Sydney over the next 14 years, including in those pollutants where concerns remain.

There are also a significant number of NSW-specific policies that address motor vehicle emissions. Among the more significant is the regulation of petrol volatility during summer through the Clean Air Regulation. The Regulation is estimated to reduce motor vehicle VOC emissions in the GMA by around 17% over the summer period. This equates to a reduction in VOC emissions of over 2,500 tonnes each summer, and will help to reduce ozone in the Sydney area, with consequent health benefits for Sydney residents.

Local emissions sources

Programs to tackle local emissions sources have generally relied on voluntary and education programs, such as the Clean Air Program grants to local councils and the recent Air Quality Toolkit to help local councils manage the emissions they regulate.

Improvements in public transport and other strategies

There is a comprehensive range of other strategies and programs in place across NSW Government agencies that contribute to improvements in air quality. This includes agencies responsible for urban planning and development, transport planning, public transport network management, traffic management, energy and health. Actions, for example, under the Government's Greenhouse Plan, Metropolitan Strategy and State Infrastructure Strategy will have a major role in improving air quality.

Land use and transport actions under the Metropolitan Strategy, in particular, are critical in meeting the *Action for Air* objectives to integrate air quality goals and urban transport planning, and to provide more and better transport choices.

Key Government commitments to improve public transport (which will also deliver improvements in air quality) are contained in the State Infrastructure Strategy, and include the following:

- in 2006-07 alone, investment in rail, new rail carriages, the acquisition of rail corridors, bus priority measures and Transitways totals $1.6 billion, while investment in roads by the State and Commonwealth Governments amounts to $1.4 billion;
- the introduction of the new CityRail timetable in September 2005 has seen more than 90,000 additional customers use the rail network each week. The increases include:
    - CBD up 24,000 passengers a week;
    - Main North Line up 9,000 passengers a week;
    - Western Line up 21,400 passengers a week;
    - Bankstown Line up 5,800 passengers a week;
    - Inner West Line up 14,700 passengers a week;
    - East Hills Line up 6,400 passengers a week; and
    - South Line up 12,300 passengers a week;
- reliability will improve with the implementation of the $1.5 billion Rail Clearways program. This will untangle the metropolitan rail network by separating 14 rail

routes into five independent clearways. The program is underway and scheduled for completion by the end of 2010;

- since 1995, the NSW Government has delivered 22 transport interchanges and 17 new or expanded car parks, making it easier for people to use public transport;
- the new $105 million Parramatta Transport Interchange provides commuters with enhanced access to both rail and bus services. The interchange was complemented by $50 million of essential track infrastructure and roadworks;
- the $346 million Liverpool to Parramatta Transitway links to the new Parramatta Interchange, and has tripled patronage levels on the Transitway since its introduction three years ago. It is the fastest growing passenger service in New South Wales;
- the $2 billion Epping to Chatswood Rail Line is on track for completion in 2008. The line will provide services from mid-2008 via three new underground rail stations, connect to a new bus interchange at Chatswood and provide additional CityRail capacity on the western line;
- the CityRail network will be complemented by a network of 43 strategic bus corridors linking regional centres, railway stations, hospitals, education facilities and other community facilities;
- recent bus reforms will allow the strategic network to be integrated with local bus services to create regions that better serve communities' travel needs. This will be progressively implemented from 2006. Supporting these reforms, the Government will provide 505 State Transit Authority buses, including 250 ultra-low emission 'Euro 5' diesel buses, and 255 Compressed Natural Gas buses for heavily-trafficked inner city areas. The new buses will generate the lowest emissions of any mass produced conventional buses in Australia. They will result in emissions savings of:
    - 194 tonnes per year of greenhouse gases;
    - 7.2 tonnes per year of particulates;
    - 172.4 tonnes per year of NOx; and
    - 41.6 tonnes per year of carbon monoxide (see Appendix 9 for more details on emission savings measures in the State Transit fleet).

The NSW Government is also actively encouraging and increasing the use of ethanol blended fuels. Ethanol blended fuel (E10) was added to the State fuel contract from July 2006. All Government owned vehicles will be required to use E10 where this is practicable, available and cost effective. This will help to reduce emissions of certain air pollutants.

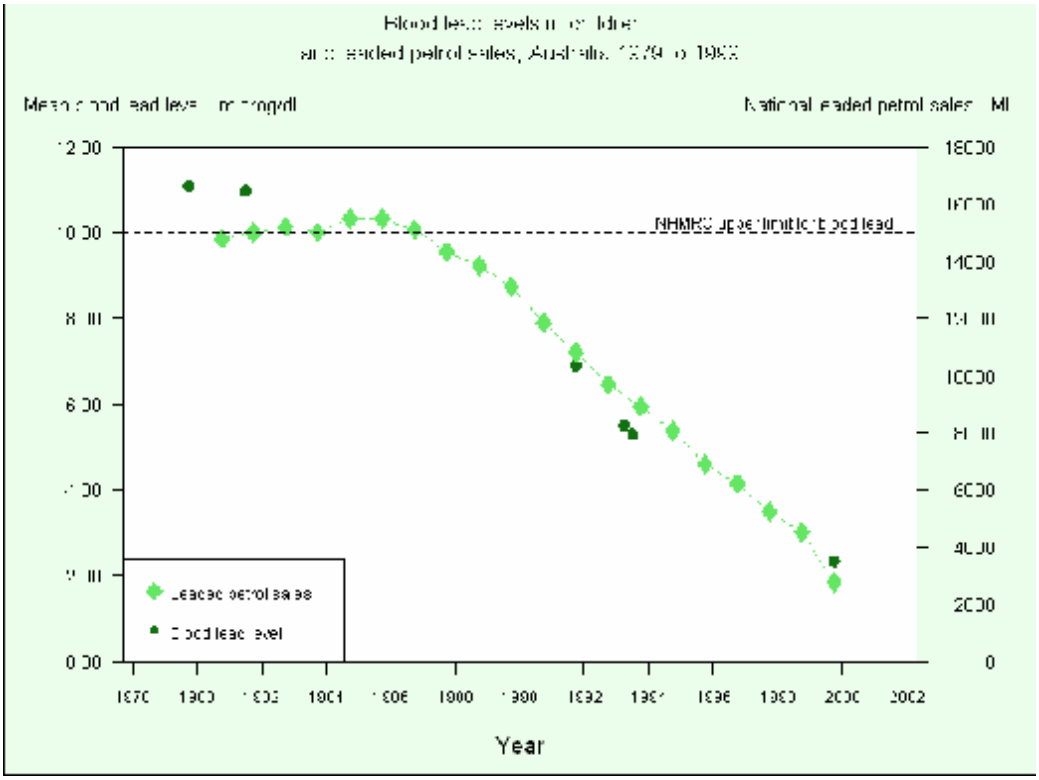
The NSW Government is implementing a number of initiatives to encourage the transport of freight by rail and thereby reduce emissions from road freight. These include working with the Commonwealth Australian Rail Track Corporation to construct the Southern Sydney Freight Line, a dedicated rail freight line from Sefton to Macarthur. The NSW Government will also reduce pressure on our roads by shifting a significant proportion of containers leaving Port Botany to rail.

Progress in implementing the full range of Government programs and initiatives to improve air quality is discussed in the *Action for Air 2006 Update*, at Appendix 1.

TOR (g)

Strategies to reduce the health impacts of air pollution

Successful air pollution reduction programs also reduce the health impacts of air pollution. This is well illustrated by the programs that successfully removed lead from air and other exposure sources in NSW, and were also associated with a concomitant reduction in children's blood lead levels, as shown in the figure below.



In the Sydney basin the following strategies were employed to reduce exposure to lead and blood lead levels in children:

1960s	lead-free paints available;
1970s	cessation of lead arsenate crop sprays;
1980s	replacement of lead solder in food cans;
1986	introduction of unleaded petrol;
1990s	reduction of lead content of leaded petrol;
	Lead Alert and Lead Safe community education programs;
2002	removal of lead from petrol altogether; and
2005	DIY Safe community education resources.

Current air pollution reduction programs are described in more detail in the Action for Air Update (see Appendix 1). It is expected that by reducing emissions and concentrations of air pollutants in the Sydney basin, there will be concomitant reductions in health effects and associated costs from air pollution.

More detail is also provided below on the following activities undertaken by NSW Government agencies to limit the health impacts of existing and potential sources of air pollution in Sydney:

- operating the air pollution health alerts system; issuing media releases as required to alert the community about air pollution incidents and ways to reduce adverse effects; and liaising with the Asthma Foundation of NSW and other patient support organisations to provide information to their members;
- implementing measures to reduce bushfire/hazard reduction burning impacts;
- reducing emissions and exposure to air pollution through planning legislation and policies; and
- developing a climate change adaptation strategy.

<u>Air Pollution Health Alert System</u>

This is a joint NSW Health/DEC program that provides information to the community and health care providers about the adverse health effects of air pollution and the ways to reduce

these effects. The system issues health alerts on days when high air pollution is expected, and provides specific information for recognised high risk groups – people with asthma, and people with chronic lung and/or heart disease.

The system commenced in November 2004. The components of the system are:

- NSW DEC webpage – provides twice daily reports of the regional pollutant index, and gives notice when air pollution alerts are in place: http://www.epa.nsw.gov.au/airqual/aqupd.asp;
- NSW Health webpage – provides information about air pollution and health, a description of health alerts and the steps to take when alerts are in place, and a link to the DEC page for current reports and alerts: http://www.health.nsw.gov.au/living/airpollution.html;
- information brochures for community and health professionals are distributed via community health centres and divisions of general practice, and are also available on the NSW Health webpage at http://www.health.nsw.gov.au/living/index.html (Appendix 11);
- routine pollution reporting and health alerts (when applicable) are distributed to electronic and print media outlets twice daily; and
- routine pollution reporting and health alerts are available via a free call line, updated twice daily.

Information about the air pollution health alert system has also been disseminated via conferences, professional journals, the general media and the Asthma Foundation of NSW.

The implementation of the system is reviewed annually by NSW Health and DEC.

Reducing health impacts of bushfire smoke

In response to the emerging research on bushfire smoke health effects, liaison between DEC, the Rural Fire Service and NSW Health has resulted in the implementation of the following strategies:

- scheduling hazard reduction burns to minimise the impacts of smoke on residential areas;
- routine provision of information to impacted communities regarding avoiding health impacts of hazard reduction burns;
- additional media messages about avoiding health impacts of bushfire smoke during unplanned/extreme events; and
- posting a fact sheet on bushfire smoke health effects on the NSW Health website, at http://www.health.nsw.gov.au/pubs/factsheet/pdf/bushfire_fs.pdf

Planning Legislation and Policies

Review of Environmental Assessments

On 1 August 2005, the new Part 3A provisions of the Environmental Planning and Assessment Act (EP&A Act) commenced. Part 3A of the EP&A Act provides an assessment and approvals regime specifically tailored for Major Projects where the Minister for Planning is the approval authority.

Under Part 3A, NSW Health and DEC can review Major Project proposals likely to contribute to local or regional air pollution, make submissions to the Department of Planning regarding any identified increase in exposure to air pollution associated with proposed developments, and suggest mitigation measures where appropriate.

Where a license under the POEO Act is required, DEC will also provide the Department of Planning with recommended conditions of approval to control emissions of air pollution where appropriate.

If a project is not a Major Project, and requires consent, the integrated development assessment (IDA) procedures under Part 4 of the Act continue to apply. DEC is an approval body where a development requiring development consent also needs to hold an environment protection licence under the POEO Act. As an approval body, DEC may require certain information to be provided about emissions and exposure to air pollution, and can stipulate conditions to control emissions of air pollution that must be reflected in a development consent.

A POEO licence must be substantially consistent with a major project approval or development consent up until the first review of the licence.

DEC licensing under the POEO Act is discussed at Appendices 5 and 10.

Human health impacts of climate change - adaptation projects

Funded by the NSW Greenhouse Office and managed by NSW Health, this project aims to identify human health impacts from climate change in NSW. The project will develop public health programs and policies to reduce the burden of disease associated with anthropogenic climate change. The project includes research and investigation of the important combined effects on human health of high temperatures and air pollution – for example:

- the impact climate change will have on the frequency, magnitude and location of ozone events; and
- the impact climate change will have on air pollution associated with bushfires.

Understanding air pollution and climate change will go some way towards developing timely, appropriate and effective public health intervention strategies.

Inquiry Terms of Reference and Relevant Appendices	
Term of Reference	**Where addressed in appendices**
a) Changes in the emissions of various air pollutants and the impact of those changes on air quality in the Sydney Basin, over the last three decades, including any "hot spots" where pollution is concentrated.	Appendix 2: *Action for Air:* See Chapter 1, "The Issues in Brief", pp. 9-16, in particular: • Emissions in the Sydney region of reactive (volatile) organic compounds (VOCs), oxides of nitrogen ($NO_{x)}$ and total suspended particulates, 1992 (Figs 3-5) • Ozone concentrations in GMR and number of days ozone exceeded health goals for GMR sub-regions, 1980-1997 (Figs 6 & 7) • Nitrogen dioxide ($NO_{2)}$ concentrations in GMR and number of days NO_2 exceeded health goals for GMR sub-regions, 1980-1997 (Figs 8 & 9) • PM_{10} concentrations and annual average PM_{10} at EPA sites in the Sydney region, 1988-96 (Figs 10 & 11) Appendix 1: *Action for Air 2006 Update:* See "Air Quality in the Greater Metropolitan Region", pp. 7-9, in particular: • Comparison of 1992 and 2003 Sydney Region emissions by source (Tables 2 & 3) • Ozone concentrations in GMR sub-regions and number of days exceeding NEPM standards for ozone, 1994-2005 (Figs 1-4) • PM_{10} and $PM_{2.5}$ concentrations in Sydney region and GMR and number of days exceeding NEPM standards for PM_{10} 1994-2005 (Figs 5-7) Appendix 3: *Emission Sources in the Sydney Basin:* • See pie charts providing breakdown of anthropogenic sources of NO_x, VOCs and PM_{10} in Sydney region, 2003. Appendix 6: *Air Pollution in the Sydney Basin* • See discussion of ambient air quality and figures for trends in levels of concentrations of criteria pollutants under the NEPM, compared against the NEPM goals.
b) The impact of NSW air pollution laws (including the Clean Air Act 1961, the Protection of the Environment Operations Act 1997 and any regulations made under those Acts) on air quality over the past three decades	• Appendix 4: *Brief History of NSW Air Pollution Legislation and Regulation in NSW, 1951-2005* • Appendix 5: *Air Pollution Legislation and Regulation administered by DEC* See also, as under (a), monitoring data contained in *Action for Air* and the *Action for Air 2006 Update* at Appendices 1 & 2, as these are a key means of measuring the impact of air pollution legislation and regulation.
c) The causes of air pollution in the Sydney basin over the past three decades	• Appendix 6: *Pollution in the Sydney Basin* Refer also to: • Appendix 2: *Action for Air* (Chapter 1: "The Issues in Brief") • Appendix 1: *Action for Air 2006 Update* o Air Quality in the Greater Metropolitan Region o Issues and Priorities – includes discussion of emission sources and trends in activity • Appendix 3: *Emission Sources in the Sydney Basin*

Inquiry Terms of Reference and Relevant Appendices	
Term of Reference	**Where addressed in appendices**
d) The health impacts of air pollution on any "at risk" groups	• Appendix 7: *Outcomes of HARP Studies*, NSW Health, 1993-96 • Appendix 8: *Findings of air pollution and health research, NSW Health, 1996-2006* • Appendix 12: *Effects of outdoor air pollution on the respiratory health of children, Children's Hospital Westmead*
e) The financial impacts of air pollution on the NSW health system	• *Health Costs of Air Pollution in the Greater Metropolitan Region*, available at http://www.environment.nsw.gov.au/resources/airpollution05623.pdf
f) The effectiveness of current laws and programs for mitigating air pollution	• Appendix 9: State Transit Authority – Emission reductions from the fleet • Appendix 10: *Effectiveness of DEC Programs under the Protection of the Environment Operations Act* Refer also to: • Appendix 1: *Action for Air2006 Update* o "Issues and priorities" – includes discussion of progress in implementing actions under *Action for Air*, 1998-2005, and key actions announced subsequently o "Appendix 2:Action for Air – Implementation Status"
g) Strategies to reduce the health impacts of air pollution	Noting that all actions to improve air quality are directed to mitigating health impacts of air pollution, refer to: • Appendix 1: *Action for Air 2006 Update*: o "Issues and priorities" – outlines, in relation to each objective under *Action for Air*, strategies to improve air quality, 1998-2005, and new initiatives aimed at addressing emerging challenges. o "Emerging issues and directions"– indicates future directions for air quality management in response to emerging issues. • Appendix 11: *Air pollution health alerts*

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GLOSSARY	
Air NEPM/AAQ NEPM	Ambient Air Quality National Environment Protection Measure (1998) The NEPM includes standards for 6 pollutants which set out the maximum allowable concentration for each pollutant over particular averaging periods. The NEPM goal is that these standards be achieved within 10 years of their introduction ie by 2008. In meeting that goal, one or more exceedences of the standard are allowed for a number of pollutants to take account of the impact of extreme meteorological conditions.
AQMN	Air Quality Monitoring Network consisting of 14 multi parameter sites in the Sydney region which measure a suite of pollutants on a regional scale.
BaP	Benzo(a)pyrene, one of the polycyclic aromatic hydrocarbons
BTRE	Bureau of Transport and Regional Economics (Commonwealth)
CO	Carbon monoxide. A colourless, odourless poisonous gas, formed when fuels containing carbon are burnt in conditions where oxygen is limited.
CSIRO	Commonwealth Scientific and Industrial Research Organisation
DEC	Department of Environment and Conservation (NSW)
EP&A Act	Environmental Planning and Assessment Act 1979 (NSW) – the principle planning legislation in NSW
EPHC	Environment Protection and Heritage Council
GMR	Greater Metropolitan Region
HARP	Health and Air Pollution Research Program (1993-96)
IDA	Integrated Development Assessment under the EP&A Act
LBL	Load based licensing
MAQS	Metropolitan Air Quality Study
NO_x	The gases nitric oxide (NO) and nitrogen dioxide (NO_2). NO is predominantly formed in high temperature combustion processes and can subsequently be converted to NO_2 in the atmosphere.
O_3	Ozone - ground level ozone is formed in the lowermost part of the atmosphere from the reaction of nitrogen oxides and volatile organic compounds in the presence of sunlight.
ppm	parts per million
PAH	Polycyclic aromatic hydrocarbons are a large number of naturally occurring and man-made chemicals. Well-known PAHs are benzo[a]pyrene, fluoranthene, naphthaline and anthracene.
PM_{10} and $PM_{2.5}$	Particulate matter in ambient air with a diameter less than 10 or 2.5 millionths of a metre respectively. Particles are made up of a complex mixture including soot (carbon), sulphate particles, metals and sea salt.
POEO Act	Protection of the Environment Operations Act 1997 (NSW)
PRP	Pollution Reduction Programs
RTA	Roads and Traffic Authority (NSW)
SMEC	Snowy Mountains Engineering Corporation
SO_x	Sulfur oxides. The most common sulfur oxide is sulfur dioxide (SO_2), a colourless gas with a penetrating, choking odour.
STA	State Transit Authority (NSW)
VKT	Vehicle kilometres travelled – a measure of total distance travelled by cars
VOCs	Volatile Organic Compounds (such as solvents or components of paints and varnishes) which are emitted to the atmosphere from natural sources or as a result of human activities.
µg/m3	Micrograms per cubic metre

ACTION FOR AIR

2006 UPDATE

Department of **Environment and Conservation** NSW

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Contents

Executive summary

The Air Quality Management Plan

Action for Air is the Government's 25-year air quality management plan for the Greater Metropolitan Region of New South Wales. It contains a range of measures to reduce emissions from transport, industrial, commercial and domestic sources in order to control the two main air pollutants of concern: photochemical smog (ozone at ground level) and fine particle pollution.

The original plan was released in 1998 and its progress reviewed at triennial forums in 2001 and 2004. At the November 2004 Clean Air Forum, the Minister for the Environment announced that an update of *Action for Air* would be prepared.

Some actions to support the plan's objectives – as stipulated in 1998 – are complete, others are ongoing and in some cases alternative approaches have been adopted. *Action for Air: 2006 Update* reviews progress in achieving each objective over this eight-year period. It also outlines future challenges to achieving each objective and highlights recent Government initiatives and actions to meet those challenges.

Action for Air: 2006 Update retains the seven objectives of Action for Air:

- Integrate air quality goals and urban transport planning
- Provide more and better transport choices
- Make cars, trucks and buses cleaner
- Promote cleaner business
- Promote cleaner homes
- Manage the impact of open burning
- Monitor, report on and review air quality.

It provides a current picture of air quality and its management in NSW by drawing on the proceedings of the 2004 Clean Air Forum, as well as advances in air pollution and health research over the past eight years, and developments in state and national policy.

Protecting and improving air quality across NSW in the longer term requires a whole-of-government approach. *Action for Air* relies on linked strategies across those agencies responsible for urban planning and development, transport planning, public transport network management, traffic management, energy, emission controls and health. These linked strategies include the *City of Cities: A plan for Sydney's future* (the Metropolitan Strategy), the *NSW Greenhouse Plan* and the *State Infrastructure Strategy New South Wales 2006–07 to 2015–16*. Along with *Action for Air*, these strategies should provide a comprehensive framework for managing air quality in NSW in the future.

Introduction

In 1998 the NSW Government released *Action for Air*, a comprehensive 25-year plan to make sure the air we breathe is clean. The plan brought together scientific, health, urban planning and economic expertise, and input from the community, industry and government to deliver an integrated approach to tackling air quality issues.

Action for Air concentrates on the Greater Metropolitan Region of NSW – Sydney, the Lower Hunter and the Illawarra – home to about 70% of the State's population. The plan's focus has been on regional (area-wide) air pollutants, particularly photochemical smog (ground-level ozone) and fine particle pollution. At the same time it draws strong links between local and global issues, thereby supporting the Government's overall air quality agenda, especially its other priority campaigns to reduce greenhouse gas emissions and promote the sustainable use of energy.

Action for Air contains an ambitious set of goals, objectives and actions to reduce emissions from motor vehicles, industrial and commercial sources, and everyday household activities. Crucial yardsticks in the plan are the national ambient air quality goals adopted by NSW for ozone, nitrogen dioxide and particles (which relate to photochemical smog and brown haze), as well as goals for carbon monoxide, sulfur dioxide and lead.

Action for Air provides a sound framework for managing air quality. However, it is not meant to be a static plan but to be adapted as new information and issues emerge, technological advances are made, and changes occur to Government priorities, policies and portfolios. Regular review of *Action for Air* is therefore necessary to direct efforts to where they are most needed. A public Clean Air Forum is held every three years for this purpose. The first of these in 2001 resulted in *Action for Air: An Update*. The update identified the need for continuing action to reduce ozone and particles and included additional Government initiatives to address emerging challenges.

The second forum in November 2004 drew attention to the emerging links between climate change and air quality, and helped improve the understanding of health issues associated with air pollution. It also reaffirmed that ozone and particles remain the two biggest challenges we face in managing air quality – regionally and, increasingly, on a localised scale.

This latest update gives a picture of current air quality and its management in NSW by drawing on the proceedings of the 2004 forum, advances in air pollution and health research over the past eight years, and developments in state and national policy and administrative arrangements. It provides:

- an overview of air quality trends in the Greater Metropolitan Region from 1998 when *Action for Air* was released to now
- a summary of actions already taken to address each of the seven *Action for Air* objectives
- a discussion of future challenges under each objective
- a snapshot of Government initiatives and actions, additional to the measures in *Action for Air*, that are in place or have been announced to address future challenges.

Action for Air: 2006 Update also foreshadows new issues and directions in air quality management that will be covered in a comprehensive review of *Action for Air* in 2007. These include climate change, energy supply, health and liveability, and the health costs of air pollution, and a renewed focus on transport-related air pollution. These issues are also relevant to a number of other Government plans and policies – the Greenhouse Plan and Metropolitan Strategy. The 2007 review of *Action for Air* will further explore the links between these issues and air quality, and link *Action for Air* with these other Government plans to ensure that the various management strategies support and reinforce each other as far as possible. While there has been consultation among relevant Government agencies to date, there will need to be further close liaison, particularly between the Department of Environment and Conservation (DEC) and other relevant agencies, to ensure a consistent approach to urban transport planning and air quality management policies.

DEC is currently updating its understanding of air emission sources in the Greater Metropolitan Region. This new inventory, which will be used to underpin future air quality management strategies and identify priority areas for action, will be available in 2006.

These will be reflected in further reviews of *Action for Air*.

Appendix I summarises the implementation status of all the individual actions under the seven *Action for Air* objectives.

Appendix II outlines stakeholder views on air quality and priorities canvassed at the 2004 Clean Air Forum and feedback received in the lead-up to the forum.

Action for Air:2006 Update reports on progress from 1998 to 2005. A number of initiatives from the first half of 2006 have also been included to provide a more complete picture.

Our air quality goals

Air quality is assessed against health-based standards and goals for pollutants. NSW has adopted the national standards and goals in the National Environment Protection Measure for Ambient Air Quality (the 'Air NEPM'), which was issued in 1998. NSW played an active role in developing these national goals and standards.

Table 1 summarises the national air quality goals and standards against which NSW currently reports. The standards set out the maximum allowable concentration for each pollutant over particular averaging periods. The Air NEPM goal is that these standards be achieved within 10 years of their introduction, i.e. by 2008. In meeting that goal, one or more exceedences of the standard are allowed for a number of pollutants to take account of the impact of extreme meteorological conditions.

Ongoing research is providing a better understanding of the health effects of air pollution. There is therefore a process for regularly reviewing the national goals to ensure that they continue to protect public health. This includes a comprehensive review of the Air NEPM, which commenced in 2005.

An example of an emerging issue is the growing concern about the finer fractions of particles, which appear to be more closely associated with health risks. The Air NEPM currently uses PM_{10} as its standard for particles but was amended in 2003 to introduce an advisory reporting standard as well as additional reporting on levels of $PM_{2.5}$. This is not a compliance level but is designed to collect information for future consideration.

Recently international concern has also turned to a number of air pollutants (known as 'air toxics') which, though found in relatively small concentrations, have the potential to adversely affect human health and the environment through long-term exposure. A NEPM for Air Toxics was introduced in 2004. NSW was a member of the working group which developed the NEPM.

The purpose of the Air Toxics NEPM is to gather data for future consideration, rather than compliance with specific pollutant goals. It establishes 'Monitoring Investigation Levels' for five air toxics (benzene, toluene, xylenes, formaldehyde and polycyclic aromatic hydrocarbons). The NEPM requires monitoring for

National standards and goals for ambient air quality			
Criteria pollutant	**Averaging period**	**Maximum concentration**	**Goal within 10 years (i.e. 2008): Maximum allowable exceedences**
Carbon monoxide	8 hours	9.0 ppm	1 day a year
Nitrogen dioxide	1 hour	0.12 ppm	1 day a year
	1 year	0.03 ppm	None
Photochemical oxidants (as ozone)	1 hour	0.10 ppm	1 day a year
	4 hours	0.08 ppm	1 day a year
Sulfur dioxide	1 hour	0.20 ppm	1 day a year
	1 day	0.08 ppm	1 day a year
	1 year	0.02 ppm	None
Lead	1 year	0.50 $\mu g/m^3$	None
Particles as PM_{10}	1 day	50 $\mu g/m^3$	5 days a year
Advisory reporting goals			
Particles as $PM_{2.5}$	1 day	25 $\mu g/m^3$	Goal is to gather sufficient data nationally to facilitate a review of the goal.
	1 year	8 $\mu g/m^3$	

Table 1: Health-based standards and goals under the Air NEPM

these five air toxics where significantly elevated levels are likely to occur; where there is a likelihood of significant population exposure; and where there are not already programs in place to manage emissions of concern. Elevated levels of the air toxics could occur at locations close to specific sources, such as clusters of industrial sites, heavily trafficked or congested roads, busy airports and areas affected by woodsmoke.

NSW undertook a three-year monitoring program, resulting in a comprehensive report on air toxics which was published in 2002 (EPA 2002).

Air quality in the Greater Metropolitan Region

When Action for Air was released

Our air quality has generally been improving since the 1980s. This was evident at the time *Action for Air* was released in 1998.

Ambient levels of carbon monoxide and lead had fallen dramatically and at that time were mostly well below national standards. These improvements were due to cleaner motor vehicle technology, mainly the introduction of catalysts and unleaded petrol. Sulfur dioxide concentrations were also well below the national standard. Around large point sources, like the smelting operations in Wollongong, concentrations were higher, but still below the standard.

In the decade prior to 1998, concentrations of ozone exceeded the Air NEPM standards on a number of days. These often coincided with major bushfires in the Sydney Basin.

During the 1990s nitrogen dioxide levels (and exceedences of the standards) were significantly lower than those recorded in the 1980s. However peak concentrations in the five years to 1998 were clustered around the national standard.

In the seven-year period prior to the release of *Action for Air*, the Sydney region would have met the 24-hour PM_{10} Air NEPM goal, except in 1991, 1994 and 1997 as a result of bushfires in the area.

Current picture

Regional (area-wide) air pollutants

There has been little change in the trends for monitored air quality since 1998. Those pollutants which were below national standards in 1998 continue at low levels while the ozone and particle pollution levels remain a challenge.

Ambient concentrations of **lead** have continued to fall since 1998 as the number of vehicles using leaded petrol continues to decline. The sale of leaded petrol has been prohibited since 1 January 2002, eliminating the major source of ambient levels of lead. Given the low levels, NSW ceased monitoring for lead from the end of December 2004. Likewise, **carbon monoxide** concentrations have continued to fall with the gradual replacement of the vehicle fleet with vehicles meeting more stringent emission limits. Since 1998 exceedences of the national standard for **nitrogen dioxide** have also been rare.

Sulfur dioxide concentrations continue to be well below the national standard in Sydney and the Lower Hunter. In the Illawarra, concentrations were below the standard around its major point source – the copper smelter at Port Kembla – even when the plant was operating. Its subsequent closure has led to further reductions in sulfur dioxide concentrations in surrounding areas.

There is no trend to indicate improvement in ozone levels (Figures 1–4). Notwithstanding the variability in levels and exceedences due to weather, the underlying emissions mix that forms ozone in the air shed (mainly volatile organic compounds and oxides of nitrogen) remains high.

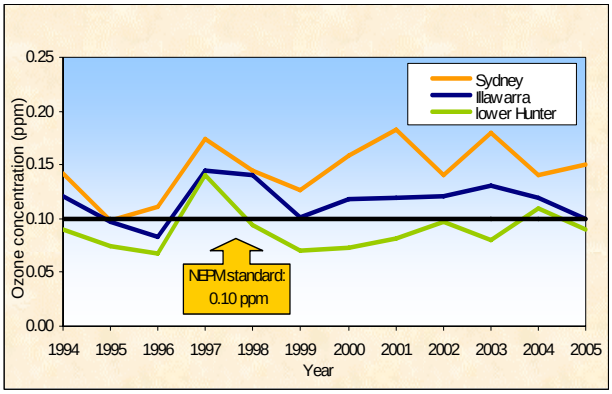

Figure 1: Annual maximum one-hour ozone concentration in the Greater Metropolitan Region, 1994–2005

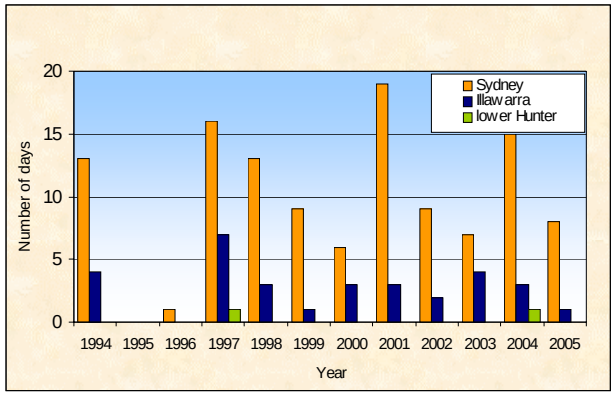

Figure 2: Number of days exceeding the NEPM standard for one-hour ozone concentration in the Greater Metropolitan Region, 1994–2005

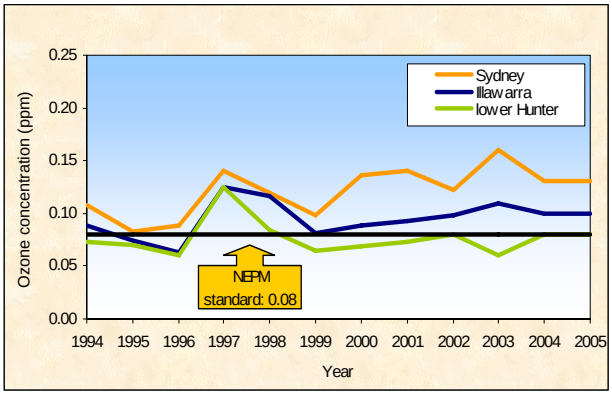

Figure 3: Annual maximum 4-hour ozone concentration in the Greater Metropolitan Region, 1994–2005

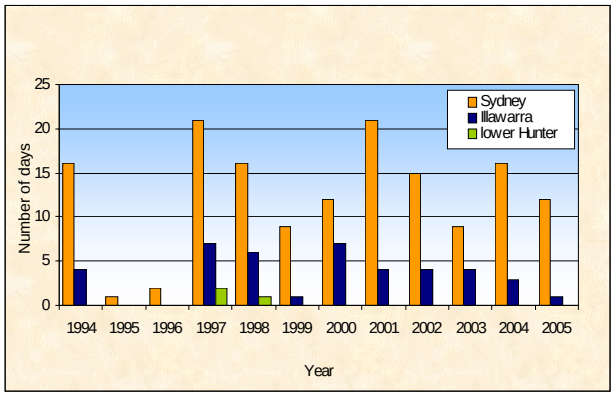

Figure 4: Number of days exceeding the NEPM standard for 4-hour ozone concentration in the Greater Metropolitan Region, 1994–2005

The ozone standards have been exceeded in Sydney and the Greater Metropolitan Region on a number of days each year. In 2001 and 2002 some of these were days when bushfires blazed, which added to the emission load. Nevertheless, even without the bushfires, ozone would still have breached the 2008 goals at times.

As was the case in 1998, exceedences of the national standard for **particles** are normally associated with extreme events such as bushfires in summer, hazard reduction burning in winter, and dust storms during severe droughts. The national goal of no more than five exceedences of the PM_{10} standard per annum has generally been met in Sydney (Figure 5). However, in years with significant bushfire activity or dust storms such as 2002 and 2003, many sites in the Greater Metropolitan Region recorded more than the five allowable exceedences (Figure 6).

$PM_{2.5}$ levels in NSW are generally below the Air NEPM advisory reporting standard established for a 24-hour level but are currently above the annual reporting level (Figure 7). Continuing drought across NSW and associated extreme events such as bushfires, hazard reduction burns and dust storms have accounted for a number of exceedences. Annual average $PM_{2.5}$ levels were slightly lower in the Lower Hunter and the Illawarra, but were still at or above the annual advisory reporting standard.

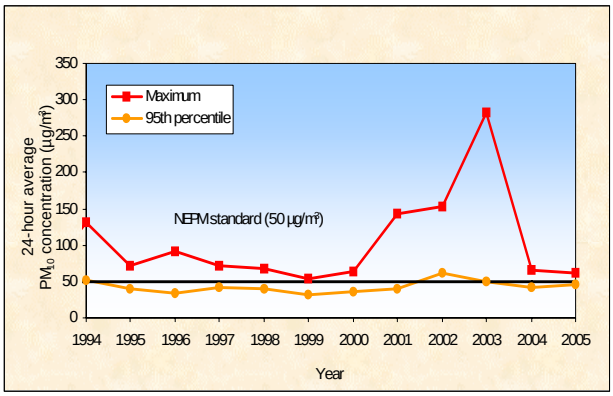

Figure 5: 24-hour PM_{10} concentration in the Sydney Region, 1994–2005

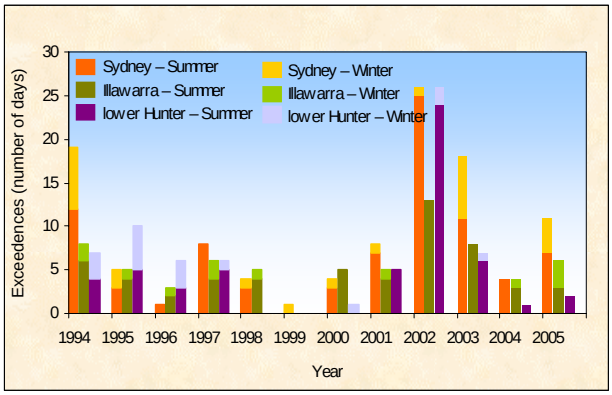

Figure 6: Number of days exceeding the NEPM 24-hour standard for PM_{10} in the Greater Metropolitan Region, 1994–2005

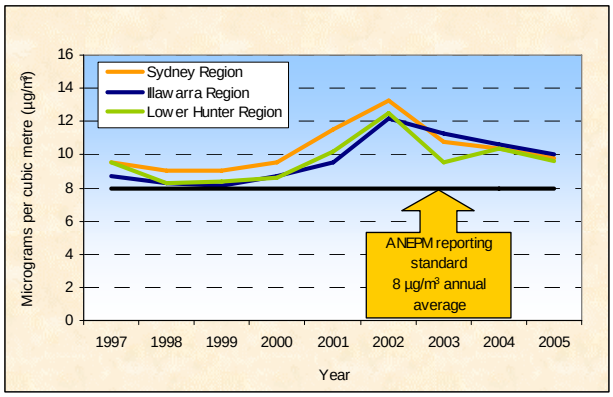

Figure 7: Annual average $PM_{2.5}$ concentrations in the Greater Metropolitan Region, 1997–2005

Air toxics

Action for Air included a commitment to undertake a monitoring program for air toxics. From 1996 until 2001, DEC monitored air toxics at sites in the Greater Metropolitan Region and some regional centres (EPA 2002). The study examined dioxins, organic compounds, polycyclic aromatic hydrocarbons and heavy metals, and found that ambient levels of most air toxics in NSW were low and well below current international standards and benchmarks.

The levels of dioxins, a compound that remains in the environment for a long time, are very low, indicating that Government programs to reduce dioxin emissions have been effective.

Similarly, levels of benzene, xylenes and toluene, substances mostly produced by motor vehicles, were generally low. The Air Toxics NEPM's Monitoring Investigation Levels for these pollutants were met at all sites. The introduction of a 1% limit on benzene in petrol nationally from mid-2006 will further reduce ambient benzene levels.

Nevertheless, benzene, formaldehyde and polycyclic aromatic hydrocarbons at some sites, as well as 1,3-butadiene, will need to be watched to ensure they remain at acceptable levels in the future.

The study also found that winter levels of polycyclic aromatic hydrocarbons in some country towns and parts of Sydney are at times higher than the Air Toxics NEPM's Monitoring Investigation Levels, primarily due to the use of solid fuel heaters, vehicle emissions and the topography of the areas.

Pollution sources

As well as reviewing monitored air quality data, changes to pollution levels can be inferred from inventory emissions data. In 2002, DEC updated its air emissions inventory for Sydney. The inventory estimates are based on a 1992 Metropolitan Air Quality Study inventory, projected to 2002 using such factors as population growth and energy use, and incorporating updated information on vehicles and kilometres travelled, where available.

Table 2 shows the contribution by sector of volatile organic compounds (VOCs) and oxides of nitrogen (NO_x), the precursors to the formation of ozone, and particle emissions for the Sydney Region in 1992 and 2002. The relative contribution from motor vehicles of each pollutant has fallen over this period, and is expected to decline further over the next 10–15 years. Nevertheless, mobile sources remain the major source of air pollution in Sydney.

	VOCs (%)		NOx (%)		Particles (%)	
	1992	2002	1992	2002	1992	2002
Industry	10	14	13	18	33	40
Mobile	49	44	82	76	31	19
Commercial/ domestic	41	42	5	6	36	41

Table 2: Comparison of 1992 and 2002 Sydney Region emissions by source

What is also notable from Table 2 is the significant contribution made by the commercial/domestic sector – 42% of VOCs and 41% of particle emissions in 2002. The relative contribution of this sector is likely to increase as emissions from motor vehicles continue to fall.

Table 3 shows the contribution of pollutants by sector for the Greater Metropolitan Region for 1992 and 2002. Here industry is increasingly the largest source of NO_x and particles. As in Sydney, the commercial/domestic sector is a major source of VOCs and the contribution of motor vehicles to air pollution, while still significant, has fallen.

DEC's new emissions inventory will provide current and more detailed information on the contribution of the various emissions sources for both Sydney and the Greater Metropolitan Region.

	VOCs (%)		NOx (%)		Particles (%)	
	1992	2002	1992	2002	1992	2002
Industry	10	12	51	60	68	72
Mobile	49	42	46	37	16	12
Commercial/ domestic	41	46	3	3	16	16

Table 3: Comparison of 1992 and 2002 Greater Metropolitan Region emissions by source

Action for Air: Issues and priorities

Objective 1: Integrate air quality goals and urban transport planning

Goal: To reduce the growth in vehicle kilometres travelled by effectively integrating urban and transport planning and improving transport choices

Despite ongoing improvements in vehicle and fuel technologies, vehicle emissions will continue to be a factor in the exceedence of air quality goals. Managing travel therefore remains a priority in reducing emissions and improving Sydney's performance against the NEPM goals.

The structure of cities influences the demand for travel and the choice of transport. Historically, Australian cities have been characterised by low density and dispersed land uses. This has encouraged reliance on private motor vehicles as the principal means of transport. Motor vehicles, both cars and trucks, are a significant source of the emissions that produce ozone and particle pollution.

Growth in the ownership and use of motor vehicles, both for an increasing number of short trips and over greater distances, is continuing. To combat the emissions this brings, *Action for Air* set ambitious targets to contain the per capita growth in vehicle kilometres travelled (VKT) by 2011 and then stop it completely by 2021 by integrating urban and transport planning and improving transport choices. This requires a whole-of-government approach, with coordinated strategies for urban planning and development, transport planning, management of the public transport network and traffic, and emission controls. Although urban and transport planning policies and principles apply across NSW, their emphasis is on the Greater Metropolitan Region as this is where the majority of the State's population growth is expected.

Progress 1998–2005

Since the early 1990s urban consolidation has significantly slowed the rate of Sydney's areal expansion despite ongoing population growth. Almost 70% of new dwellings have been built in established areas rather than at greenfield locations.

However Sydney's growing population will continue to generate planning and transport pressures into the future and a range of strategies and policies are in place or being developed to ensure coordinated and responsive planning solutions.

Metropolitan and regional strategies

The Government released the Metropolitan Strategy – *City of Cities: A plan for Sydney's future* (DoP 2005) in December 2005. The strategy outlines the vision for Sydney and its future form, and the types of centres and corridors. A planning strategy for the Lower Hunter is currently being developed. Together these strategies contain policies and actions to meet the challenges created by the population growth forecast for the Greater Metropolitan Region over the next 30 years. Sustainability, including the protection of urban air quality and integrated land-use and transport planning, are underlying principles. The plans will help manage the region's ecological footprint and improve environmental, social and economic outcomes.

Integrated land use and transport

A key plank of the Government's strategy to integrate urban and transport planning and help contain VKT has been the Integrating Land Use and Transport policy package ('ILUT') (DUAP 2001), released in September 2001. ILUT aims to advise and support local councils, State agencies and the development industry to achieve better land use and transport integration in urban centres throughout NSW.

The Metropolitan Strategy builds on the ILUT policy directions and principles to implement smart urban design in both greenfields developments in north-western and south-western Sydney and urban renewal in existing areas. The policy directions are being reflected, for example, in the structure plans for the north-west and south-west sector growth areas, the master planning of Edmondson Park, the realignment of Bonnyrigg shopping centre to integrate it with the Liverpool–Parramatta Transitway, and the design of Landcom's Stanhope Gardens Estate at Blacktown.

Local transport plans

Transport Management and Accessibility Plans (TMAPs) are another planning tool providing guidance for major developments. Developers for new land

releases and rezonings in greenfield sites are required to prepare them to address public and private transport issues as well as the movement of pedestrians and cyclists. TMAPs have been prepared for a number of sites in western Sydney, including Eastern Creek and the former ADI site at St Marys.

State Environmental Planning Policy (SEPP) 53 also requires transport studies as part of residential development strategies for the Greater Metropolitan Region. SEPP 53 aims to support urban consolidation on sites that are well located in relation to transport, jobs and services.

Targets for journeys to work by public transport have been set in the Parramatta Access Strategy (60% of such trips to be by public transport) and are being developed for other major development sites in western Sydney.

The Roads and Traffic Authority's *Guide to Traffic Generating Developments* (RTA 1993) requires developers to lodge a traffic study as part of the development application process, with particular attention to the demand for parking and its provision.

Walking and cycling

In January 2005, the Government released its *Planning Guidelines for Walking and Cycling* (DIPNR 2004) to help councils, communities and the development industry improve planning for walking and cycling. The guidelines include information, concepts, case studies and illustrations to assist planners and related professionals to consider walking and cycling in their work. They add a walking and cycling component to the Government's ILUT package and also complement the RTA's *NSW Bicycle Guidelines* (RTA 2003) for planning and designing bicycle facilities. Influencing travel choices to encourage more sustainable travel by improving local and regional walking and cycling infrastructure through implementation of the *Planning Guidelines for Walking and Cycling* is an action in the Metropolitan Strategy (Action D3, DoP 2005).

Future challenges

Sydney is forecast to grow by an average 40,000 people a year over the next 30 years, with population expected to reach five million by 2022. The population of the Greater Metropolitan Region will grow to 5.91 million over the same period. With this growth will come increased industrial and residential development, and continuing pressure for growth in motor vehicle ownership and use. This will generate significant shifts in travel patterns, create demand for more flexible transport services and result in increased freight movements.

The Metropolitan Strategy identifies that 60–70% of new residential development over the next 25 years will occur in established areas, predominantly in existing centres and corridors, and the remainder in greenfield developments.

VKT and the number of trips are also increasing. In 2002, over 70% of all weekday trips in Sydney were made by private car (Transport and Population Data Centre 2004). A growing economy and lower unemployment, together with an increase in car sales since 2000, has generated greater demand for mobility and led to an increase in travel for all purposes. An increase in household incomes has resulted in greater disposable income for spending on social and recreational activities and domestic support services. Transport needs are also changing as the result of an ageing population, an increase in single-person households, and healthier, more active retirees.

Employment has grown in areas that favour a dependency on the car, particularly in parts of western Sydney. Pressures to replace some employment land close to transport nodes with higher density residential uses also threatens to increase the use of motor vehicles for travel to work that has been relocated. In many areas, there has been a growth in the use of cars for activities such as shopping, taking children to school and accessing other community facilities, leading to increases in the number and length of non-work related journeys.

A significant trend has been the growth in VKT outstripping the increase in population. Between 1991 and 2002, all indicators of car travel in Sydney increased at a faster pace than population growth (Transport and Population Data Centre 2005a). While population rose by 1.3% per annum:

- the number of car driver and passenger trips over a weekday increased by 1.8% per year
- the total number of household vehicles increased by 2.2% per year
- the number of vehicle licence holders increased by 2.1% per year
- VKT increased by 2.3% per year.

The related rise in traffic congestion on both local roads and major roadways results in an increase in local air pollution problems, despite overall regional air quality improvements because of cleaner cars and fuels.

Half the trips made each day in Sydney are short and less than five kilometres. The majority of these are by car, with a shift away from walking and cycling, bringing adverse impacts not only for air quality but

also for local amenity and community health. There is an ongoing need to support local government in providing high quality and safe walking and cycling facilities for trips to school, shops and other neighbourhood facilities. Recent data on rail patronage from CityRail indicate that an extra four million passengers travelled by train between September 2005 and May 2006, compared with the previous year.

The growth in freight travel in the region is also an issue for the future. Commercial vehicle movements by road grew by nearly 6% annually between 1996 and 2002 (Transport and Population Data Centre 2005b).

One new and challenging area that has emerged since publication of *Action for Air* has been the management of emissions associated with the stacks and portals of road tunnels, including the M5 East, the Cross City and the Lane Cove Tunnels. This has been prompted by community concern about in-tunnel air quality. The Government has undertaken a number of health-based reviews and technology assessments to help respond to these concerns about management of air quality in and around the tunnels.

Before their construction and operation, all major urban road tunnels now require independent assessment by the Department of Planning and approval by the Minister for Planning under new provisions in Part 3A of the *Environmental Planning and Assessment Act 1979*. The measures provide for the review of a range of factors, such as air quality and impacts on specific areas, by independent assessment panels. All existing approvals contain emission limits and monitoring conditions to ensure that emissions from tunnel stacks do not cause adverse environmental impacts. DEC provides technical advice on operational air quality impacts and works with other Government agencies to protect air quality around motorway tunnels.

New initiatives

The Metropolitan Strategy sets the new directions for Sydney and its future form, and the types of centres and corridors. The integration of land-use and transport planning is a key principle underlying the strategy.

The distribution of activities and land uses in the Metropolitan Strategy recognises the strengths of the existing transport system and builds on these to accommodate future growth.

Key directions and initiatives under the Metropolitan Strategy based on integrated land-use and transport planning include:

- concentrate activities in centres and make better use of existing infrastructure
- concentrate development to strengthen centres, towns, villages and neighbourhoods focused around public transport
- locate the majority of new housing in strategic centres, smaller centres and corridors within walking distance of shops, jobs and other services concentrated around public transport nodes
- improve the existing transport system and transport between centres
- extend rail and bus networks to connect centres and serve new growth areas and investigate high-capacity transport modes and protect corridors for future needs
- influence travel choices to encourage more sustainable travel
- maximise the efficiency of freight transport and the proportion of freight transported by rail.

In June 2006 the Minister for Roads announced the NSW Government's air quality improvement plan for the M5 East tunnel. The plan includes:

- video detection of pollution-causing heavy vehicles. Polluting vehicles will be identified and directed into emissions testing and treatment under the Clean Fleet Program
- increased ventilation with additional 12 jet fans to allow for greater operational flexibility and safer incident response
- a trial of filtration technology – the plant will have a 200 cubic metre per second capacity to filter particulate matter and a 50 cubic metre per second capacity to remove nitrogen dioxide.

Objective 2: Provide more and better transport choices

Goal: To improve transport choices and encourage reduction in vehicle trips and kilometres travelled by both passenger and commercial vehicles

Providing more and better alternatives to private car use presents a major challenge. Government has a role in the provision of infrastructure and services to give people access to jobs, activities and services by sustainable transport modes, essentially public transport, walking and cycling. It can also help to change travel behaviour, while still recognising the central place that cars and trucks have in transporting people and goods in NSW. The community also has a role in making sustainable transport choices. This combination of Government and community actions is necessary to ensure the level of vehicle emissions is consistent with acceptable air quality.

Progress 1998–2005

The Government commenced a wide-ranging reform of the transport sector in 2003 to increase public transport's share of passenger travel, and thereby contribute to containing the growth in vehicle emissions. This program involved a number of structural reforms to focus the various agencies on their core missions and help support the delivery of clean, reliable and safe public transport services.

Services and infrastructure

The Unsworth review of bus services identified 43 strategic bus corridors in Sydney. A new integrated network based on these corridors will be in place by 2009. This will be supported by satellite and communications technology to identify and direct traffic signal priority to late running buses ('PTIPS') by 2007 and physical bus priority infrastructure on all corridors by 2012.

The RTA has implemented a number of initiatives to maximise the effectiveness of bus lanes, mainly by improving motorists' compliance with the rules governing their use. These include the deployment of enforcement cameras to minimise illegal use of bus-only lanes, colouring Sydney's bus lanes red to increase their visibility, and public education campaigns to raise road users' awareness of how bus lanes should be used.

Significant progress has also been made in introducing new public transport infrastructure. Projects completed include construction of the Airport rail link, the Sydney Olympic Park rail loop and the Liverpool–Parramatta Bus Transitway, extension of the light rail to Lilyfield, Parramatta transport interchange, new bus contracts designed to deliver improved service levels, and continued extension of road-based bus priority measures.

Public transport information

Public transport information has been upgraded and now covers all public transport services, with delivery via a staffed call centre, an automated phone line (131 500 Infoline) and a website (www.131500.com.au). Services include point-to-point journey planning, timetable information and the ability to locate bus stops. Usage statistics reveal the public is increasingly relying on the 131500 website as a source of public transport information, with yearly growth in visits of 60% over the last two years. Around 74% of customer inquiries were via the automated website and interactive voice response modes. In 2004–05, call centre operators handled 2.4 million calls.

Cycling facilities

BikePlan 2010 (RTA 1999) involves the construction of over 200 kilometres of cycleways per year and installation of bike lockers at transport interchanges. Cyclists and pedestrians can use more than 1100 kilometres of off-road shared pathways across NSW, while a further 2100 kilometres of road have dedicated cycle lanes. The RTA's Pedestrian Access and Mobility Plans, together with financial assistance, are helping local councils to implement local area traffic management schemes and traffic calming devices. Seventy-two of the plans have been developed across the State, including 7 completed in 2005–06. The RTA has also continued to support councils in implementing the pedestrian facilities in these plans to enhance safety, convenience and mobility on links between public transport and other key centres of pedestrian movements.

Behavioural change programs

Changing peoples' travel behaviour through education is another key strategy. The Department of Planning, State Transit and the Australian Greenhouse Office have run the NSW TravelSmart™ Pilot Project in two areas of the Greater Metropolitan Region – Woy Woy on the central coast and Ermington in Sydney. This is a voluntary travel behaviour change program which aims to increase the use of more sustainable travel

modes and reduce car dependency. The pilot was evaluated in 2005 and proved to be successful.

The RTA has established telecentres for its staff at Penrith, Parramatta and West Gosford, and provides ongoing assistance and advice on teleworking to business and government. In addition, the RTA assists business and government to develop and produce transport access guides that show how to travel to a site or workplace by walking, cycling and public transport. The RTA also assists workplaces to develop green business travel plans that support and facilitate walking, cycling and access to public transport.

Economic incentives

Pricing mechanisms can signal to motorists the impact of private vehicles on the environment. Parking space levies are a key pricing mechanism for managing travel demand in NSW, by imposing a cost disincentive on parking in congested commercial centres. The levies apply to the commercial centres of Sydney's CBD, North Sydney, St Leonards, Parramatta, Chatswood and Bondi Junction, all centres well-served by public transport. These funds are channelled into infrastructure projects that facilitate access to public transport services. Between $30 and $40 million is collected each year and applied to interchanges, commuter car parks, bus priority measures and the North-west Bus Transitway network stations.

Freight management

In October 2005, the Government released a report by the Freight Infrastructure Advisory Board, which made recommendations on actions to significantly increase rail's share of container freight to and from Port Botany. The report was referred to Professor David Richmond, head of the Premier's Infrastructure Implementation Group, to take submissions, consult with Commonwealth and State agencies and the freight and logistics industry, and subsequently advise the Government on a container freight plan to support an expanded Port Botany.

The Ports growth plan is underway and includes:

- Port Botany expansion delivering the necessary infrastructure for trade growth
- $140 million to relocate general cargo and car stevedoring from Port Jackson to Port Kembla as existing leases expire
- facilitation of the construction of a new coal loader by the private sector to add capacity at Newcastle Port.

National transport reforms

Significant transport initiatives are being progressed at the national level which have the capacity to contribute to improved air quality in NSW. Projects being undertaken as part of the Council of Australian Governments (COAG) reform agenda, to which NSW is a signatory, include:

- an intergovernmental review of urban congestion trends, impacts and solutions
- examination of strategies for travel demand management by the Australian Transport Council with the Environment Protection and Heritage Council
- examination of programs and strategies to encourage the uptake of more fuel efficient and low emission passenger and freight vehicles
- the Productivity Commission's freight infrastructure pricing inquiry.

Future challenges

Providing more and better transport choices, now and in the future, is closely linked with the objective (and challenges) of integrating air quality goals and urban transport planning. As noted under Objective 1, the most recent indicators of Sydneysiders' travel patterns show a continued increase in vehicle travel at a slightly faster rate than population growth. A notable change in travel patterns is in children's travel to school. In just 20 years between 1981 and 2002, the proportion of children driven to school has doubled to more than 50%, while the proportion walking has almost halved to less than 25% (Transport and Population Data Centre 2004). In this context, strategies to encourage greater use of alternative modes of transport remain a priority, not only from an air quality perspective, but also in addressing other car-related health impacts, such as obesity.

Altering these trends to encourage greater public transport use will require a combination of integrated land use and transport planning under the Metropolitan Strategy, improvements to the public transport system to build confidence in its availability, reliability and safety, and direct measures to influence travel behaviour.

New initiatives

Metropolitan Strategy

The Metropolitan Strategy includes improvements to promote a shift from reliance on private vehicles to greater use of public transport and to reduce the impacts of freight transport. The Transport Strategy (component 'D' of the strategy) includes initiatives to:

Improve the existing transport system and connections between Sydney's centres

Sydney's major centres will have improved transport links with fast, safe and reliable train services and, in line with the 2004 Unsworth Report, a network of strategic bus corridors connecting the centres across the city (see 'Bus service improvements' below).

Provide major infrastructure improvements

Projects will include the new $8-billion North West-CBD-South West Rail Link announced in June 2005 and the $1.5-billion Rail Clearways Program to improve train service reliability across the city. The Premier's Infrastructure Implementation Group will ensure timely delivery of major transport projects underway, such as the Epping–Chatswood rail link.

The 2006–07 Budget committed an investment of more than $830 million for rail capital projects.

Integrate public transport modes

Better integration will be supported through introduction of Tcard integrated ticketing for all public transport during 2007, regional planning forums and community consultation as part of bus service improvements (see below), and upgraded interchanges, stations, bus stops and wharves and improved trains and buses, including the achievement of accessibility targets for public transport.

Support more sustainable travel

Key initiatives include:

- improved local and regional walking and cycling networks through the implementation of the *Planning Guidelines for Walking and Cycling* (DIPNR 2004).
- development and implementation of a metropolitan parking policy aiming to support the use of more sustainable modes to locations with good public transport access and support the Government's investment in public transport. The policy will build on the Improving Transport Choice Guidelines in *Integrating Land Use and Transport* (DUAP 2001).
- implementation of TravelSmart voluntary travel behaviour change programs targeted at households, schools and centres and other locations which generate travel.

Reduce impacts of freight movements

The strategy includes actions to maximise the efficiency of freight movements in Sydney and increase the proportion of freight transported by rail, and to facilitate upgrading of the metropolitan rail network. It also provides for planning of freight corridors to reduce impacts from freight transport on surrounding land uses and for actions directed specifically at reducing emissions from diesel freight vehicles.

Bus service improvements

Major changes are underway in how bus services are planned and delivered in metropolitan Sydney and the outer metropolitan areas of the Lower Hunter, Central Coast, Blue Mountains and Wollongong to better align services with passenger needs. Expected benefits include:

- a network-wide service delivery approach replacing the previous focus on local area services alone
- improved services for local users as a result of consultation between bus operators, the Ministry of Transport and the public during service planning

- greater frequency and reliability of services, particularly along identified strategic corridors
- uniform fare and concession arrangements
- a funding model that provides operators with an incentive to increase patronage
- availability of better service and timetable information on the 131500 Transport Infolines
- consistency of service levels and standards across all providers through requirements like on-time performance reporting, Euro 3 or equivalent emission standards, Clean Fleet accreditation, fleet renewal planning and eco-driving training requirements.

Fleet improvements

Services are being upgraded through fleet replacement on rail, bus and ferry services, including:

- 600 new and replacement air-conditioned train carriages for the suburban network
- 122 new outer suburban rail cars
- 141 Millennium rail cars
- 505 new Compressed Natural Gas and Euro 5 diesel buses costing $254 million over 5 years.

Infrastructure planning

In May 2006 the Government released the *State Infrastructure Strategy New South Wales 2006–07 to 2015–16* (NSW Treasury 2006) which provides a 10-year plan for infrastructure provision. It identifies transport infrastructure as a priority over the next decade with investment of $1.6 billion on public transport in 2006–07. The range of infrastructure projects for rail, buses, ferries and freight are discussed throughout *Action for Air: 2006 Update*.

Other

NSW is also advocating changes to Commonwealth tax legislation to provide public transport users with tax incentives comparable to those provided for car users.

Objective 3: Make cars, trucks and buses cleaner

Goal: To reduce exhaust and evaporative emissions from new and in-service cars, trucks and buses

Action for Air aims to reduce exhaust and evaporative emissions from new and in-service motor vehicles. It supports continuing improvements to vehicle technology and fuels, including diesel vehicles which contribute a disproportionately high level of emissions. It also encourages use of alternative fuel sources, such as natural gas, in private and public fleets. Significant gains have been made in these areas since *Action for Air* was released in 1998, due largely to national actions strongly advocated by NSW.

Progress 1998–2005

Motor vehicle emissions and fuel standards

The Commonwealth Government regulates vehicle emissions and fuel quality in Australia. Vehicle emission standards for new cars are set in the Australian Design Rules, which are enforced nationally under the *Motor Vehicle Standards Act 1989*. Australian emission standards are now aligned with international standards (referred to as 'Euro standards').

Since the release of *Action for Air*, the Australian Government has been progressively tightening the emission standards for cars, trucks and buses in Australia (Table 4). By 2007, emission standards for new diesel vehicles will be about 15 months behind those applying in Europe and the United States. The Euro 3 standards for petrol vehicles, which came into effect in Europe in 2000, were adopted here in 2005.

In 2000 the Australian Government introduced the *Fuel Quality Standards Act 2000*, which establishes

Emission standards for light duty petrol vehicles		Emission standards for heavy duty diesel vehicles	
Standard	**Implementation dates**	**Standard**	**Implementation dates**
Euro 2	2003–2004		
Euro 3	2005–2006	Euro 3	2002–2003
Euro 4	2008–2010	Euro 4	2007–2008
Euro 5 (not finalised)	n/a	Euro 5	Proposed for 2010–2011

Note: First year is for new model vehicles and second year is for all vehicles

Table 4: Implementation timetable for vehicle emission standards in Australia

national environmental standards for motor vehicle fuels. Since 2000, standards for a range of constituents of petrol and diesel have been phased in, with completion expected in 2006. In particular, reducing the sulfur content of fuel is important as this enables the use of more advanced vehicle emissions control technology. When *Action for Air* was released, the average sulfur content of Australian diesel was 1500 parts per million (ppm). The regulated limit for sulfur in diesel is now 50 ppm. The sulfur limit for all grades of petrol is currently 150 ppm. The required benzene content of petrol is limited to 1% from mid-2006.

A review of the fuel and motor vehicle emissions standard to apply beyond 2006 commenced in 2003. In July 2004, the Federal Minister for the Environment announced that the sulfur content of diesel would be limited to 10 ppm from 2009 and of premium unleaded petrol to 50 ppm from 2008. These are standards which NSW argued for in its submission to the review. The NSW submission also supported adoption by 2008 of the most stringent European emission standards for light vehicles and by 2010 for heavy vehicles.

Taken together, the new fuel and vehicle emission standards are expected to lead to a significant fall in emissions. Despite the expected increases in VKT, motor vehicle emissions of carbon monoxide, VOCs and NO_x in the Greater Metropolitan Region are forecast to fall by 62%, 40% and 55%, respectively, from 2002 to 2020 (DOTARS 2004). Nevertheless, mobile sources remain the major source of air pollution in Sydney.

NSW Cleaner Vehicles Action Plan

To maximise the environmental benefit from the improvements to vehicle emission standards, the Government introduced the NSW Cleaner Vehicles Action Plan to encourage the early uptake of cleaner vehicles. The plan has a number of components:

- Clean Car Benchmarks, released in 2003, which rate new light vehicles according to their greenhouse gas and noxious air emissions performance
- the Cleaner NSW Government Fleet Program, which requires all general government sector agencies to develop Fleet Improvement Plans that encourage the purchase of smaller, less polluting vehicles, in order to meet specific targets to reduce both noxious and greenhouse gas emissions, and at the same time save vehicle purchase and running costs
- encouragement of local government and public trading enterprises to adopt these vehicle purchasing principles as an integral part of their business
- contribution to the development of a Commonwealth *Green Vehicle Guide* (available at www.GreenVehicleGuide.gov.au), based on the NSW Clean Car Benchmarks
- testing and development of a voluntary Clean Fleet Program by 80 private companies, with 13 of them participating in a pilot in early 2005 to test and refine the procedures, documentation and administration of the program.

Regulation of summer petrol volatility

Petrol is highly volatile and in summer evaporative emissions are significant sources of the VOCs which contribute to the formation of ozone. Since petrol volatility is not covered by national fuel standards, DEC negotiated an agreement in 1998 with the fuel industry whereby companies would voluntarily reduce petrol volatility each summer. A regulation to limit petrol volatility in summer was subsequently made and applied from summer 2004–05.

The volatility limit of 62 kilopascals now applying in the Greater Metropolitan Region is lower than that for

any other Australian urban air shed. The regulatory requirement will be reviewed again in 2007, when the possibility of a lower limit will be examined.

Managing emissions from in-service vehicles

International research shows that emissions from diesel vehicles, in particular the fine particle emissions they produce, have a significant impact on air quality. Although comprising only a small percentage of the vehicle fleet, diesel vehicles contribute an estimated 60% of Sydney's particle pollution from mobile sources. Diesel vehicles also emit disproportionately high levels of NO_x. Diesel vehicles are therefore the main focus of efforts to reduce emissions from in-service vehicles.

NSW was instrumental in developing the National Environment Protection Measure for Diesel Vehicle Emissions which was adopted in June 2001 and contains guidelines for programs to reduce their impact.

In 2005, DEC and the RTA launched a 12-month trial of new 'after-treatment' technology in which devices were retro-fitted to over 40 older diesel trucks, buses and off-road engines from both Government and private fleets.

DEC administers the Smoky Vehicle Enforcement Program which targets visibly polluting vehicles. The community can also report smoky vehicles, via the phone or DEC's website.

The RTA has emission-tested nearly 3000 diesel vehicles and required repairs to be carried out on the worst performers. This has led to average reductions of 25% in emissions from these vehicles. Information from this program has been used to develop maintenance guidelines that form the basis of the NSW Government's voluntary Clean Fleet Program for diesel fleets. To support this program, the RTA has developed a diesel emissions training course available through TAFE for diesel mechanics and fleet/workshop managers. A CD-ROM is being developed to enable the information to be distributed more broadly.

The RTA continues to offer free voluntary emissions testing of petrol vehicles to the public at its Botany and Penrith facilities. The RTA and DEC also worked with Fairfield Council to provide incentives for the repair of older vehicles in a program funded through the Environmental Trust.

Alternative and cleaner fuels

Alternative fuels can provide emissions benefits over petrol and diesel. State Transit has over 400 buses powered by CNG (compressed natural gas) and its newest diesel buses have the same level of environmental output as the CNG buses (i.e. Euro 3). DEC and the RTA have funded investigations by Camden and Newcastle councils into the environmental benefits of biodiesel. The trials have shown that reductions in particle emissions are possible from using biodiesel.

The NSW Government is also actively encouraging and increasing the use of ethanol blended fuels. A contract has been established by NSW Procurement for the purchase of ethanol blended fuel (E10) for the Government fleet. This will help to reduce emissions of certain air pollutants.

Future challenges

Significant emission reductions from the motor vehicle fleet are expected over the next 10–15 years. Nevertheless, there is opportunity for increasing the magnitude of the benefits of improved fuel and vehicle emission standards by measures which bring forward the adoption of the cleaner technology in conventional vehicles and hybrids. Given the growth in road freight, the scope to reduce the impacts of in-service light commercial and heavy duty vehicles must also be explored.

New initiatives

Additional measures announced by the Premier at the 2004 Clean Air Forum to improve the environmental performance of the NSW vehicle fleet included:

- development of an environmental rating scheme for heavy vehicles
- a Voluntary Green Registration program
- banning the purchase of V8 vehicles on Government contract (other than where required for emergency services)
- targets for the environmental performance of the Government vehicle fleet, commencing in July 2005. The initiative mandates progressive targets that, when reached, will see a 20% improvement in overall environmental scores and a 20% reduction in greenhouse gas emissions.

  There has been a reduction in the number of vehicles in the large passenger category purchased by Government, down by approximately 1,000 vehicles on the figure for 2004–05, and a corresponding increase in purchases in the small and medium/micro categories. Hybrid petrol electric vehicles now make up about 1% of the Government's passenger vehicle fleet.

A DEC–RTA trial of after-treatment technology on older diesel vehicles.

DEC is participating in a steering committee for an Australian Government project to examine non-road emissions.

Sydney Ferries trialled the use of biodiesel fuel in 2005.

The NSW Government has added ethanol blended fuel (E10) to the State fuel contract from July 2006. All Government owned vehicles will be required to use E10 where this is practicable, available and cost effective.

Older diesel buses are being replaced with new Euro compliant vehicles under a 7 year plan to achieve an average age for buses of 12 years and a maximum age of 25 years by 2012.

The State Transit Authority will purchase 250 ultra-low emission Euro 5 diesel buses and 255 Compressed Natural Gas buses for heavily trafficked inner city areas commencing 2006–07. The new buses will generate the lowest emissions of any mass produced conventional commercial buses in Australia. State Transit Authority will be complying with the tougher Euro 5 standards that are not proposed to apply in Australia until 2010.

The NSW Government is working with the NSW Taxi Council on a trial of an environmentally friendly taxi for Sydney's metropolitan area.

Objective 4: Promote cleaner business

Goal: To improve the regulation of industrial emissions that contribute to air pollution

A. INDUSTRIAL EMISSIONS

Action for Air seeks to reduce emissions from the industrial sector through an environment protection framework of strong legislation, regulation and economic incentives. Reduction strategies introduced in the 1980s have been successful in controlling VOC emissions from large industrial sources, meaning the strategies in *Action for Air* have concentrated more heavily on the control of NO_x.

Progress 1998–2005

Clean Air Regulation

The *Protection of the Environment Operations Act 1997* sets the mechanism to manage emissions from major sources through the pollution licensing system. The framework for managing air pollution from licensed premises, including the setting of emission standards, was initially provided in the Clean Air (Plant and Equipment) Regulation 1997. This was reviewed in 2004–05 and changes arising from the review incorporated by amendment into the Protection of the Environment Operations (Clean Air) Regulation 2002. These include more stringent air pollution standards for future industry, equipment that undergoes major modification, and equipment which is replaced in the Greater Metropolitan Region; phased retirement from 2008 to 2012 of standards that apply to older industry; and additional standards for air toxics when non-standard fuels are used.

The licensing system may also require scheduled activities to undertake and comply with a mandatory environmental audit program, pollution studies and pollution reduction programs (PRPs). Since 2001 DEC has negotiated more than 200 new PRPs, with investment of over $60 million by companies and councils to reduce air pollution (including odour).

Load-based licensing

To drive pollution reduction below what is required by the Protection of the Environment Operations (General) Regulation 1998 or licences, load-based licensing (LBL) commenced in July 1999. The scheme introduced a

'polluter pays' licence fee framework, providing industry with an incentive to improve environmental performance by reducing pollutant emissions. In the Greater Metropolitan Region, two critical zones for emissions of NO_x and VOCs have been defined – Sydney–Wollongong metropolitan areas, and Newcastle–Central Coast metropolitan areas.

Historically, the Sydney–Wollongong metropolitan areas exceed the Air NEPM standards for ozone more frequently than the Newcastle–Central Coast metropolitan areas. Therefore, the load fees for emissions of NO_x and VOCs in these areas are set at higher levels as an incentive to manage ozone impacts where they are of greatest concern.

Air pollution fees under LBL increased from 1 July 2004 after DEC found that the polluter pays approach had worked well for waterways but had not achieved its full potential to reduce air pollution. This was because, in some cases, air emission fees were too low to have an impact on companies' bottom lines. The Regulation covering LBL is currently being reviewed.

Energy efficiency programs

The Energy Smart Business Program run by the Department of Energy, Utilities and Sustainability (DEUS) was a government-business-industry partnership to enable greenhouse and energy efficiency improvements in medium and large NSW organisations. Some 240 industrial, business and government organisations took part in the program since it was established in 1997. Together, they invested more than $75 million in energy efficiency, resulting in reductions of over 500,000 tonnes of polluting greenhouse emissions and a saving of more than $30 million annually. This voluntary program has now been replaced by the requirement for large energy users to prepare Energy Savings Action Plans and by the complementary Energy Savings Fund (see new initiatives below).

The Australian Building Greenhouse Rating Scheme enables building owners, managers and tenants to rate the greenhouse performance of their facilities based on actual energy use over 12 months. It encourages best practice in the design, operation and maintenance of commercial buildings to minimise greenhouse emissions and provides participants with market recognition and a competitive advantage for low greenhouse emitters and energy-efficient buildings. The scheme was initially NSW-based, but is now administered on a national basis by DEUS.

Future challenges

Industrial emissions comprise about 18% of NO_x and 14% of VOC emissions in Sydney, and 40% of particles (EPA 2002 inventory estimates). In the Lower Hunter and Illawarra regions, industrial facilities such as power stations, mines and major industrial developments contribute the majority of NO_x emissions and are a key source of particles and dust. (Motor vehicles remain the main source of NO_x in the Sydney region.)

DEC is currently compiling a new emissions inventory for the Greater Metropolitan Region which will provide a more accurate picture of the relative contribution of industrial emissions to the total inventory. Requirements on industry may need to be tightened as emission control technology improves and more knowledge about the health impacts of emissions becomes available. DEC will also continue its program of improvements in industrial emissions, while high energy users will need to find ways to save energy as population and economic growth put more pressure on energy resources.

New initiatives

Implementation of the updated Protection of the Environment Operations (Clean Air) Regulation 2002.

Development of a strategy for managing emissions of NO_x and VOCs from EPA-licensed sources for each region within the Greater Metropolitan Region, i.e. Sydney, the Lower Hunter and the Illawarra.

Implementation of the Air Toxics NEPM, including investigation of hot spots and population exposure to air toxics (particularly polycyclic aromatic hydrocarbons and benzene) to ensure they do not become future problems.

Implementation by DEUS of:

- obligations on large energy users to prepare Energy Savings Action Plans under the *Energy and Utilities Administration Act 1987*, setting out measures to save energy
- the complementary $200-million Energy Savings Fund over five years to support energy savings initiatives by large private sector users, as well as government and the residential sector.

B. SMALL BUSINESS

For smaller commercial premises that produce regional pollutants, the broad goal of *Action for Air* is to reduce emissions of VOCs in the most cost-effective way. The actions supporting this goal will also reduce air toxics and workplace exposure to toxic chemicals.

Progress 1998–2005

Cleaner production

DEC's Cleaner Industries Unit (now called the Business Partnerships Section) was established in 1998 with the objective of improving the environmental performance of businesses that are not licensed. It has produced booklets on cleaner production practices for use by a wide range of industries. These include dry cleaners, printers, the composites industry, foundries, auto dismantlers and motor vehicle service and repair shops. These booklets provide tips to help businesses increase efficiency while reducing waste and pollution.

In addition, the Industry Partnerships Program has made $5 million available since December 2001 for projects by individual companies and industry associations to encourage adoption of cleaner production. To date, more than 400 businesses have been involved in projects to reduce air emissions, energy use and transport impacts. Air pollution-related projects include:

- development of a model environmental management planning tool for the composites industry
- development of an environment management system and update of the industry code of conduct with the Galvanisers Association of Australia
- a program on waste management and cleaner production in the smash repair industry with the owner of the NRMA Insurance brand, Insurance Australia Group (IAG), to introduce improved environmental practices across the NRMA's network of preferred smash repairers.

A new phase in these partnerships is now being pursued through Sustainability Compacts, which are agreements between DEC and leading Australian companies operating in NSW to work together on sustainability projects.

Clean Air Fund

The Clean Air Fund has operated since 2002 and includes a number of initiatives to reduce pollution from unlicensed activities (not necessarily confined to the industrial sector).

Between 2002 and 2004, a grants program provided funds to local councils to conduct innovative projects to reduce air pollution from small businesses, such as charcoal chicken shops, construction sites, gardening and ground maintenance, sawmills, smash repairers, and other industrial operations like spray painting, wood and metal working, powder-coating and boat building. Initiatives were developed in consultation with stakeholders to ensure chosen strategies addressed priority issues in local areas.

Other major programs addressed so far through the Clean Air Fund include:

- a trial of Stage 2 (petrol) vapour recovery equipment
- DEC's Woodsmoke Reduction Program
- a cleaner small engines project
- low emission paints
- the DEC–RTA diesel after-treatment technology trial.

Future challenges

VOC emissions from smaller industry are likely to increase in significance as Sydney's population grows. Control of the numerous small emission sources requires a multi-strand approach that will minimise emissions from products, equipment and activities; minimise the effects of those emissions; and reduce use by either lowering demand or promoting alternative products or equipment with less impact on air quality. Cleaner production practices by commercial and small industrial activities will also become increasingly important. The variety of Business Partnerships Section and Clean Air Fund initiatives already in place reflects the multi-strand approach adopted for this sector.

New initiatives

- Investigation of cost-effective options such as consumer labelling and point of sale education to increase the availability and use of cleaner products, such as surface coatings and thinners, solvents and aerosol products.
- Investigation of new proposals to reduce petrol vapour emissions from service stations in the Greater Metropolitan Region.
- Development of an air quality toolkit to help local councils manage emissions from the activities they regulate, generally commercial and light industrial premises.

Objective 5: Promote cleaner homes

Goal: To maximise home energy efficiency and reduce emissions of fine particles and VOCs from domestic fuel consumption

Homes are a significant source of VOCs and fine particle emissions, mainly from solid fuel heaters. *Action for Air* includes strategies to reduce emissions from woodheaters and to improve the energy efficiency of homes. Appliances used around the home, such as petrol lawnmowers and garden tools, are another significant contributor. Sources such as these increasingly require emission control strategies.

Progress 1998–2005

Woodsmoke reduction

Smoke from woodheaters causes high levels of particle pollution in winter in a number of regional areas. To address this problem, in the winters from 2002 to 2004, the Government funded the Woodsmoke Reduction Program with grants from the Clean Air Fund for councils to run education and enforcement programs on correct woodheater operation. It also provided cash incentives for households to replace outdated woodheaters with cleaner heating alternatives. By the end of the program, over 2000 woodheaters had been replaced with cleaner heating alternatives.

The DEC website contains information on how to minimise the impact of woodsmoke on winter air quality and a resource kit for councils to implement a woodsmoke campaign in their local area.

Energy-efficient homes

From 1997 the Sustainable Energy Development Authority (now part of DEUS) worked with local government and the building industry to implement its Energy Smart Homes Program to reduce the energy used to heat, cool and ventilate new and existing homes. Sixty councils participate in the program, applying Energy Smart Policy requirements in their development controls. This represents 80% of approved residential applications in NSW.

The program is being wound up as the Government implements its new Building Sustainability Index (BASIX) program. BASIX is a web-based design tool that ensures each new residential dwelling design meets the Government's targets to reduce consumption of potable water by up to 40% and greenhouse gas emissions by 25%, compared with the average home. The greenhouse target will increase to 40% for most new freestanding homes from July 2006. A BASIX certificate is required for all new single, dual-occupancy and multi-unit dwellings. A BASIX certificate for major alterations and additions to existing dwellings will also be necessary from October 2006.

DEUS is also the NSW regulator for the national mandatory energy labelling and Minimum Energy Performance Standards programs which promote energy efficiency in domestic whitegoods and thus reduce greenhouse gas emissions from the household sector.

Future challenges

Emissions from the domestic sector are increasing as NSW's population rises. The most effective approach to improve the emissions performance of products used in and around the home has been to introduce national requirements as these products are generally part of a national market.

Some significant contributors to air pollution from this sector are not regulated. This includes emissions from products using small engines, such as lawnmowers and outboards. The Metropolitan Air Quality Study (EPA 1994) estimated that lawnmowers generate 10% of the total VOCs and 9% of total benzene emissions in the Greater Metropolitan Region over a summer weekend.

Population growth also means increasing demand for energy, so measures to manage this and improve energy efficiency will remain important elements of the Government's management strategies. The residential sector will be one of the sectors targeted under the Government's new Energy Savings Fund.

New initiatives

Identification of cost-effective options for increasing the availability and use of cleaner small engines, such as lawnmowers, hand-held garden equipment and outboards.

Additional measures to reduce the impact of woodsmoke in winter, including:

- in conjunction with the Australian and other state governments, development of a better certification scheme for new woodheaters
- encouraging the use of planning instruments to ensure woodheaters are correctly installed and that their location in the home optimises both environmental performance and energy efficiency
- introduction of an offence under the *Protection of the Environment Operations Act 1997* for allowing a domestic chimney to emit excessive smoke.

Introduction of the Building Sustainability Index (BASIX).

Implementation of the Energy Savings Fund, worth $200 million over five years, to improve energy efficiency in the residential sector.

The NABERS (National Australian Built Environment Rating System) Home Rating scheme for existing homes, including a greenhouse performance rating and diagnostic audit tool to highlight opportunities for energy efficiency in a particular home.

Objective 6: Manage the impact of open burning

Goal: To implement effective smoke management programs, recognising the importance of hazard reduction burning in controlling bushfires

Major reductions in pollution from open burning activities have been achieved since the late 1980s, particularly in metropolitan areas with the prohibition of backyard incinerators. The key smoke management issues now, especially for Sydney's air quality, are hazard reduction burns. The impact of prescribed burning on air quality can be greatly reduced if best practice smoke minimisation is understood and implemented.

Progress 1998–2005

Control of Burning Regulation

The Protection of the Environment Operations (Control of Burning) Regulation 2000 operates to effectively ban backyard burning in metropolitan areas and restricts it to varying levels in more rural areas. The Regulation specifically exempts from control any hazard reduction burning carried out under the *Rural Fires Act 1997*.

Smoke Management Guidelines

The NSW Bush Fire Coordinating Committee has issued Smoke Management Guidelines for use by bushfire management committees, land managers and firefighting authorities to minimise the adverse impacts of smoke from hazard reduction burning in smoke-sensitive areas and communities. A guide to statutory requirements for open burning and clean air is available to those responsible for hazard reduction and other burning. This guide also forms part of a community information package on open burning restrictions which is available through bushfire brigade depots, local councils, fire stations and the DEC Environment Line.

No Burn Notices

When weather conditions suggest burning is likely to contribute to a build-up of air pollution, DEC may issue a No Burn Notice. Before doing so it must consult with the NSW Rural Fire Service (RFS) which may declare certain planned hazard reduction burns to be strategically important. DEC can exempt these burns from the notice. Following the 2001–02

bushfires, DEC and the RFS developed a protocol to improve rigour and transparency in the selection of any exemptions. DEC still decides the final exemptions under the No Burn Notice, but takes into account the RFS assessment of the strategic priority of any burns.

Future challenges

Smoke from bushfires and bushfire hazard reduction burning will continue to be a threat to air quality, particularly as the incidence of bushfires is expected to rise with global warming.

New initiatives

- Joint NSW-Australian Government research into bushfire risk to guide the NSW response to fire and its consequent air quality implications.
- Review of the Protection of the Environment Operations (Control of Burning) Regulation 2000.

Objective 7: Monitor, report on and review air quality

Goal: To provide for the ongoing monitoring and future development of the NSW Air Quality Management Plan, based on new scientific, economic and social information, wide collaboration and open consultation

Action for Air is a long-term plan that is monitored and evaluated against its own goals and objectives and modified so that responses to air pollution are continually improved. It includes actions to improve access to information and provides forums for public input on air quality strategies. Each new stage of research and planning takes account of the cumulative impact of strategies from previous phases.

Progress 1998–2005

Air quality reporting

Twice-daily regional pollution indexes (RPI) are provided on the DEC website along with a summary of air quality for the previous 24 hours for all sites in the monitoring network. Historical RPI and quarterly air quality monitoring reports are also available.

DEC reports each year to the National Environment Protection Council (NEPC) on performance against the Air NEPM. These reports are available on the NEPC website and in the NEPC Annual Report.

NSW also collects data for the National Pollutant Inventory. This provides information from a broad range of diffuse and industrial point sources on emissions to air, land and water and is available to the community over the internet.

Public consultation

Two Clean Air Forums – in November 2001 and November 2004 – have encouraged public input on air quality trends and strategies. The 2004 forum also emphasised links between climate change and air quality.

Forum proceedings were produced after both the 2001 and 2004 forums. All documents are available on the DEC website.

Future challenges

Air quality trends and issues change over time as control strategies in different sectors are effectivelyimplemented, and in response to emerging population and demographic factors. The air quality monitoring network also needs to be dynamic. This means keeping abreast of technological advances, and ensuring the location of monitoring stations reflects changing urban land-use patterns and pollutant priorities. It also means that we must continually update our understanding of pollutant sources and their impacts.

As Sydney's population grows, its air quality, in particular ozone and particles, will remain a concern. DEC has modelled the impact on ozone concentrations in Sydney in 2020, based on implementation of current mandated vehicle emissions and fuel standards. This indicates that with today's strategies, meeting the ozone standards in Sydney will continue to be a challenge. Further, population growth may lead to an increase in the number of people being exposed to these exceedences compared with the present.

Another consideration for the future is research on the health impacts of air pollution. Recent health studies have strengthened the evidence that short-term exposure to ozone can have significant effects on mortality and respiratory disease.

It is vital to maintain and improve our air quality monitoring and modelling systems, and report on and provide the community with access to air quality data while remaining open to public scrutiny of the air quality management plan.

New initiatives

- Application of state-of-the-art continuous monitoring technology and installation of extra equipment (nephelometers) in four existing monitoring stations in the Greater Metropolitan Region.
- DEC's air emissions inventory for the Greater Metropolitan Region, covering over 90 substances from all source sectors, including off-road mobile, industrial, commercial, domestic-commercial and biogenic, which will be instrumental in identifying the key areas for action in the 2007 review of *Action for Air*.
- DEC–NSW Health pollution health alerts to inform the public about days of high air pollution and possible health impacts.

Emerging issues and directions

As air emission controls are successfully implemented in one sector, the relative contributions from other sectors change. All sectors will need to continue to play a part in reducing emissions but, as indicated in previous sections, we will need to direct some of our efforts to areas that have not previously been subject to significant control. This will help to ensure that the likely emission increases in certain sectors due to population and economic growth – such as major industry, smaller commercial premises and the domestic sector – are balanced against the forecast emission reductions elsewhere – motor vehicle emission control technology and fuel improvements.

DEC's new emissions inventory for the Greater Metropolitan Region will play a critical part in the analysis of priority pollutants and their sources, and adopting the best policies and programs to manage them.

Sydney's growing population, and the increasing economic activity and use of cars and trucks also means tackling transport-related air pollution, and the associated traffic congestion will remain a high priority. Other issues are emerging that have implications for air quality, and the Government must also focus some effort on these complex new problems. The 2007 review of *Action for Air* will expand on the implications of these issues.

Climate change

Climate change, related to anthropogenic greenhouse gas emissions, is likely to affect air quality in metropolitan and regional areas of NSW, potentially worsening summer photochemical smog, winter particle pollution and incidences of bushfire smoke and duststorms. The type and extent of air quality impacts will be determined partly by future climatic conditions, such as changes in temperature, wind, humidity and precipitation, and partly by changes in pollutant emissions and their response to changed climate conditions. Further research on the impacts of climate change is being undertaken under the NSW Greenhouse Plan, including actions to increase public awareness of the issue, reduce greenhouse emissions, and adapt to unavoidable climate change impacts.

Energy

The Government seeks to ensure households, businesses and industry have access to a reliable, affordable, sustainable and secure electricity supply. It recognises the potential for energy efficiency and managing the growth in demand. It has a number of programs in place to improve its own energy management and, through DEUS, to start transforming the broader energy market. With energy consumption rising faster than the population, demand management will remain a priority.

Health and liveability

Sydney's infrastructure, transport network, natural environment and cultural heritage are all under pressure from its growing population, with consequent impacts on the quality of life enjoyed by its residents. It is becoming more important to recognise and incorporate amenity values into the planning and management of local communities. This means adopting design principles for new and redeveloped areas that provide alternatives to car travel. As well as reducing emissions, greater reliance on walking, cycling and public transport will improve community health, both physical and mental, through increased physical activity.

Health costs of air pollution

DEC has undertaken a study to estimate the health costs of ambient air pollution in the Greater Metropolitan Region. Health costs of annual emissions of common ambient air pollutants from all sources were conservatively estimated to be between $1 billion and $8.4 billion per annum over the period 2000 to 2002 (DEC 2005). Information from the study will assist in the development and consideration of cost-effective programs and policies that may affect air quality. These may include environmental impact assessment of major public infrastructure and industrial proposals, valuation options for transport planning, and development and evaluation or review of practical measures or regulatory proposals to reduce pollutant emissions.

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Appendix I: Action for Air – Implementation status

The following table summarises the implementation status of:

- committed Government actions under *Action for Air*, released in February 1998
- additional Government commitments made following the 2001 Clean Air Forum and referred to as 'Responses' below and in *Action for Air: An Update*, issued in September 2002.

✓ Implemented ◐ Being implemented ● Accommodated in new strategies ● Revised approach

Action or response	Status	Comment
Objective 1: Integrate air quality goals and urban transport planning		
Action 1.1 Develop a transport plan to reduce VKT growth	◐ ●	To be further developed in the context of the Metropolitan Strategy, *City of Cities: A plan for Sydney's future,* released in December 2005 (www.metrostrategy.nsw.gov.au). The Government also released its Growth Centres documents in December 2004, and further detailed background documents in July 2005. In October 2005 the Government released the Freight Infrastructure Advisory Board (FIAB) report, which provided recommendations on actions required to significantly increase rail's share of Port Botany container freight. The FIAB report has been referred to the Premier's Infrastructure Implementation Group, to further consider and provide advice on a container freight plan to support an expanded Port Botany. All councils are required to consider integrated land use and transport when preparing local environmental plans, pursuant to Ministerial Direction no. 17 under section 117 of the *Environmental Planning and Assessment Act 1979*.
Action 1.2 Make the reduction of VKT a planning priority across government	◐ ●	
Action 1.3 Integrate transport issues in regional and local planning	◐ ●	
Action 1.4 Implement accessibility criteria for new residential development	✓ ●	
Action 1.5 Set targets for journey to work by public transport at key centres	◐ ●	
Action 1.6 Develop and implement an integrated freight strategy	◐ ●	
2002 Update response 1.1 Submissions on the draft SEPP on Integrating Land Use and Transport have been received by PlanningNSW [now the Department of Planning]. In completing its review of submissions PlanningNSW will consider additional measures that could be adopted to ensure that the SEPP objectives will be pursued in all significant plan making and development assessment situations.	●	

Action or response	Status	Comment
2002 Update response 1.2 The current processes for bus sector reform will continue with a view to promoting patronage growth, service standards, value for money and accountability, including effective assessment of operator performance against contract requirements. A review by Transport NSW [now the Ministry of Transport] of bus reform options is expected to be finalised in the second half of 2003, following which it will be forwarded to the Minister for Transport for consideration by the Government.	◐	Ongoing commitment. The review has been completed, and the NSW Transport Reform Taskforce is overseeing implementation of reforms which will deliver more frequent, direct, faster and integrated bus services. New legislation (*Passenger Transport Amendment (Bus Reform) Act 2004*) has been put in place, and new bus contracts entered into within the Sydney metropolitan area. The review identified 43 strategic bus corridors. The new integrated network of 43 corridors will be implemented by 2009, supported by Public Transport Information and Priority Systems (PTIPS) by 2007 and physical bus priority infrastructure on all corridors by 2012. The first corridor between Miranda and Hurstville commenced operation in May 2006.
Objective 2: Provide more and better transport choices		
Action 2.1 Consider funding for public transport (focus on areas of greatest need such as Western Sydney)	◐ ●	Facilitated by the Government's response to the Parry Inquiry and further developed in the context of the Metropolitan Strategy. The detailed plans for the growth centres in Sydney's north-west and south-west include capital works estimated at $7.5 billion over 25 to 30 years, including an estimated $688 million for the announced rail line in the south-west and major bus/rail interchange, and $487 million for regional bus networks. New bus contractual arrangements redress earlier geographic disadvantage that arose from differences in service levels, fares and concessions on Government and private bus services. From September 2005, the availability of the Pensioner Excursion Ticket was extended to include outer metropolitan private bus services, as well as the CityRail network and Government bus and ferry services.
Action 2.2 Enhance the Parramatta rail link	●	Major work is underway to complete the Epping to Chatswood rail line by 2008. This will increase the capacity of the CityRail network and provide direct rail access for the first time to the growing North Ryde/ Macquarie Park area. The Chatswood transport interchange is also being redeveloped. The Parramatta transport interchange was opened in February 2006. Further major initiatives to prepare the rail system for growth are included in the Rail Clearways Program.

✓ Implemented ◐ Being implemented ● Accommodated in new strategies ● Revised approach

Action or response	Status	Comment
		The new North–West–CBD–South–West rail link, will link Rouse Hill and Castle Hill in the North–west, the global economic corridor centres from Macquarie and Chatswood to North Sydney and the Sydney CBD, and Leppington and Campbelltown/Macarthur in the South–West. The South–West rail link is due to be built by 2012 while the North–West and Harbour rail links are due to be built by 2017.
Action 2.3 Consider fast-tracked public transport for the Hoxton Park (Liverpool) to Parramatta corridor via Bonnyrigg	✓	Liverpool–Parramatta Transitway opened February 2003 and was fully completed by 2004.
Action 2.4 Plan for public transport in north-western Sydney	◐ ●	Facilitated by the Government's response to the Parry Inquiry and further developed in the context of the Metropolitan Strategy. The new bus contracts provide for bus service delivery levels to be built around demographic trends, patronage generators, and the availability of other transport services. Operators are required to develop detailed service plans after consultation. The Ministry of Transport will be more actively engaged in reviewing service planning. Work on the North–West Transitway has also commenced. This, and the newly announced North–West–CBD–South–West rail link, and Unsworth bus reforms, will significantly enhance public transport in developing areas.
Action 2.5 Improve bus services in western Sydney	◐ ●	
Action 2.6 Provide public transport to new suburbs	●	
Action 2.7 Complete construction of the New Southern Railway	✓	Completed in May 2000 (known as the Airport rail link).
Action 2.8 Extend the Eastern Suburbs rail line	●	The Bondi Junction turnback was completed in May 2006 providing increased capacity on the Illawarra line (as part of the Rail Clearways Program).
Action 2.9 Construct the Homebush Bay rail loop	✓	Completed in 1998 (known as Sydney Olympic Park).
Action 2.10 Integrate light rail	◐	Inner West extension to Lilyfield completed in August 2000.

✓ Implemented ◐ Being implemented ● Accommodated in new strategies ● Revised approach

Action or response	Status	Comment
Action 2.11 Fund road-based public transport	◐ ●	Facilitated by the Government's response to the Parry Inquiry and Unsworth Review and further developed in the context of the Metropolitan Strategy. A new funding model for bus services has been implemented as part of new bus contract arrangements covering Government and private operators. The Government has also approved an additional allocation of $90 million over three years (2005–06 to 2007–08) for bus priority measures to support the Unsworth bus reforms.
Action 2.12 Implement the M2 public transport management plan	✓	Bus-only lanes operate on over half the length of the M2. The Epping station interchange was upgraded in 2000 and two commuter car parks built along the M2.
Action 2.13 Implement the M5-East sub-regional air quality plan	◐	Since 2003 $0.5 million has been set aside per year over a period of five years to fund identified air quality improvement measures. To date improvements that have been funded include solid fuel heater buyback, smoky vehicle enforcement, travel demand management and community education.
Action 2.14 Implement an extensive bus priority scheme	◐	Ongoing commitments. Strategic planning for all Sydney bus services is progressing through the Unsworth bus reform process. State Transit Authority/Ministry of Transport are also providing better buses, improved cross-regional services and other reforms under the new bus contractual arrangements. The RTA's Strategic Bus Corridors project includes the installation of Public Transport Information and Priority System (PTIPS), bus lane enforcement cameras and physical bus priority measures.
Action 2.15 Improve bus services to the Eastern Suburbs	◐ ●	
Action 2.16 Upgrade the Warringah Peninsula bus system	◐ ●	
Action 2.17 Better integrate ticketing, especially in Greater Western Sydney	◐ ●	New bus contractual arrangements provide for fare harmonisation between Government and private operators across Sydney, including more consistent ticketing products and concession arrangements. Public transport fare reform was introduced in January 2005 including a single fare scale for all buses regardless of operator, and extension of the Pensioner Excursion Ticket to private bus users. Tcard has been trialled for school students on private buses in 2005, with a wider staged rollout for all travel on rail, light rail, monorail, bus and ferry services anticipated to commence from 2007.

✓ Implemented ◐ Being implemented ● Accommodated in new strategies ● Revised approach

Action or response	Status	Comment
Action 2.18 Improve transport information services	✓	A staffed call centre commenced in 1999 followed by an automated phone line (131500 Infoline) and the 131500 website. These cover all public transport services. The RTA's roadside variable message signs provide drivers with up-to-date information on traffic flows and incidents to facilitate smooth flows, avoid delays and minimise congestion. A number of passenger projects focussing on technology and training will be undertaken by Railcorp during 2006-07 to ensure clear and effective communication with passengers on trains and at stations.
Action 2.19 Develop a metropolitan parking policy	◐ ●	Under development in the context of the Metropolitan Strategy.
Action 2.20 Promote teleworking in government and the business sector	✓	The NSW Government provides guidance to employers on home-based work arrangements such as telecommuting, and a number of NSW agencies like DEC allow employees to telework from home. The RTA operates telecentres for staff at Penrith, Parramatta and West Gosford, and also provides assistance and advice on teleworking, including via its website, to business and government.
Action 2.21 Develop a settlement strategy for the Central Coast	◐ ●	To be built on in the context of the Metropolitan Strategy and Regional Strategies currently being developed under the leadership of the Department of Planning. The Ministry of Transport is also providing better buses, improved cross-regional services and other reforms under the new bus contract arrangements.
Action 2.22 Develop a long-term strategy for improving transport in the Illawarra	◐ ●	
Action 2.23 Prepare a Newcastle–Sydney Transport Corridor Strategy and Plan of Management	✓	Ongoing commitment. Works include upgrades of sections of the F3 Freeway and Pacific Highway and major intersections, and construction of cycleways.
Action 2.24 Prepare a Penrith to Orange Corridor integrated road and rail strategy	✓	Ongoing commitment. Package of road upgrades is continuing.

✓ Implemented ◐ Being implemented ● Accommodated in new strategies ● Revised approach

Action or response	Status	Comment
Action 2.25 Improve government support for safer and more convenient bicycle use, including cycleways, bicycle facilities and user support programs, and a bicycles and public transport strategy.	✓	Ongoing commitment. The Government has issued *Planning Guidelines for Walking and Cycling* and *NSW Bicycle Guidelines* to assist councils, communities and the development industry to improve planning and facilities for cycling (and walking). The RTA, working with local councils, has constructed over 2100 km of on-road dedicated cycle lanes and 1100 km of off-road shared pathways for cyclists and pedestrians across NSW. The RTA also promotes bicycle use and safe cycling by sponsorship of bike events, and has published cycleway maps for Sydney, the Illawarra, Central Coast and Newcastle regions.
Action 2.26 Facilitate walking as a mode of transport	✓	Ongoing commitment. The Government has issued *Planning Guidelines for Walking and Cycling* and *NSW Bicycle Guidelines* to assist councils, communities and the development industry to improve planning and facilities for cycling (and walking). Implementation of the guidelines is a key action in the Metropolitan Strategy. Through Pedestrian Access and Mobility Plans and financial assistance, the RTA helps local councils to develop integrated pedestrian-public transport networks and to implement local area traffic management schemes and traffic calming devices.
Action 2.27 Continue to promote school and community education programs	✓	Ongoing commitment. Department of Planning piloted TravelSmart at Woy Woy and Ermington in 2004, which aims to increase use of sustainable travel modes and reduce car dependency.
2002 Update response 2.1 Maintain the program for investment in public transport infrastructure and service improvements to support the urban growth in the Greater Metropolitan Region.	●	Facilitated by the findings of the Parry Inquiry and Unsworth Review and further developed in the context of the Metropolitan Strategy. In December 2004 the Government outlined an estimated $7.8 billion of infrastructure including roads, rail, bus networks, and educational and health services to be developed with the staged release of land for new homes in Sydney's north-west and south-west. The $1-billion Rail Clearways Program and newly announced $8-billion North-West–CBD–South-West rail line will also improve public transport in urban growth areas.

✓ Implemented ◐ Being implemented ● Accommodated in new strategies ● Revised approach

Action or response	Status	Comment
2002 Update response 2.2 The RTA, in consultation with relevant agencies, will review the application of the 'full-cost' and 'user-pays' approach to road pricing analysis, incorporating environmental externalities. This review is expected to be completed by April 2004.	◐	The RTA consulted with DEC, Department of Planning and Austroads ARRB Transport Research in reviewing its cost-benefit analysis of roads and related project proposals. In addition to road user costs and benefits (e.g. travel time savings, safety, vehicle operating costs), environmental externalities such as air pollution, greenhouse emissions and noise are taken into account. Methods and principles for valuing environmental externalities are included in the RTA Economic Analysis Manual version 2 (July 1999). Economic parameter values are presented in the April 2004 update of the manual. Studies on valuing externalities are continuing and further results and updates will be released via future issues of the manual.
2002 Update response 2.3 Treasury and transport agencies will advise Government on options to achieve viable funding for public transport improvements.	◐ ●	Facilitated by the findings of the Parry Inquiry and further developed in the context of the Metropolitan Strategy.
2002 Update response 2.4 The EPA will investigate further opportunities to incorporate the benefits of public transport in the remaining two years of the *Our Environment – It's a Living Thing* education program.	✓	The promotion of walking for short trips rather than driving was included in the *Our environment – It's a living thing* campaign in 2003.
2002 Update response 2.5 Active transport will be considered a key priority by the Premier's Physical Activity Task Force in the development of a new whole-of-government plan to promote physical activity in NSW between the years 2002 and 2007.	●	A Premier's Council for Active Living has been established instead. Its strategies include promoting active transport.
Objective 3: Make cars, trucks and buses cleaner		
Action 3.1 Advocate tighter national emission standards for new cars	✓	Ongoing commitment. Tighter national emission standards for petrol and diesel vehicles were adopted from 2002–03 with further standards to come into effect in 2005–06 and 2008–10.
Action 3.2 Augment the Smoky Vehicle Enforcement Program	✓	Ongoing commitment. Program commenced in 1999. DEC's Environment Line receives about 400 reports of smoky vehicles per month and over 1000 Penalty Infringement Notices are issued each year.

✓ Implemented ◐ Being implemented ● Accommodated in new strategies ● Revised approach

Action or response	Status	Comment
Action 3.3 Implement an inspection and maintenance program for in-service vehicles	●	The high cost of the introduction of a mandatory inspection and maintenance program would be difficult to justify, as the benefits would be extremely marginal given changes to vehicle and fuel standards under Action 3.1.
Action 3.4 Reduce petrol volatility in summer	✓	Regulated for the Greater Metropolitan Region from the 2004–05 summer at a limit of 62 kilopascals (the lowest of any Australian urban air shed).
Action 3.5 Investigate merits of reducing sulfur content in petrol	✓	New national fuel standards which incorporate reduced sulfur content in both petrol and diesel came into effect on 1 January 2002, with further reductions in sulfur in diesel required from 2006 and in petrol from 2008.
Action 3.6 Advocate tighter national emission standards for heavy-duty diesel vehicles	✓	Ongoing commitment. Emission standards for diesel vehicles were adopted from 2002–03, with further standards to apply from 2007–08.
Action 3.7 Develop a diesel national environment protection measure (NEPM)	✓	Diesel NEPM introduced in June 2001.
Action 3.8 Design an inspection and maintenance program for diesels	✓	Implementation of the Diesel NEPM includes the maintenance-focused Clean Fleet Program, training for maintenance personnel and a number of emission testing projects.
Action 3.9 Ensure cutting-edge emission technology for the State bus fleet	◐ ●	State Transit currently operates more than 400 CNG-fuelled buses. A bus replacement program will commence in 2006–07 with 255 new CNG-fuelled buses and 250 Euro 5 diesel buses to be purchased over 5 years. New bus contractual arrangements require both Government and private bus operators to meet mandatory standards for emissions (Euro 3 or equivalent), Clean Fleet accreditation and fleet renewal requirements.
Action 3.10 Support research to identify effective emission control strategies	✓	Ongoing commitment. Pursued through partnerships with local councils (e.g. trial of biodiesel in council vehicles by Camden and Newcastle councils).
Action 3.11 Participate in the Western Sydney Natural Gas Vehicle Project	✓	Completed. The RTA was involved in making contributions to Liverpool Council to assist in the conversion of its fleet to natural gas. Final payment was made in 2001–02.

✓ Implemented ◐ Being implemented ● Accommodated in new strategies ● Revised approach

Action or response	Status	Comment
Action 3.12 Develop a cleaner transport fuels and technology strategy	◐	Ongoing commitment. Being progressed as measures in the NSW Cleaner Vehicles Action Plan announced by the Premier in 2001 and additional measures announced in 2004. As part of the *Cleaner NSW Government Fleet Policy*, government agency fleet managers are now required to use 10% ethanol blended petrol, biodiesel or other alternative fuels such as CNG or LPG in all government-owned vehicles where practicable and cost-effective. A State Biofuels Strategy is also being developed to encourage the development of a sustainable biofuels industry in NSW.
2002 Update response 3.1 In early 2003 the findings of the State Transit bus testing program, as well as the results of the development of the audited maintenance program for diesel vehicle fleets, will be used to assess the need for, and nature of, additional measures for implementation in NSW to reduce diesel emissions.	✓	Addressed by the RTA's test and repair program for diesels (Action 3.8) and programs for diesel vehicles being developed under the NSW Cleaner Vehicles Action Plan (Action 3.12).
2002 Update response 3.2 Stamp duty incentives to promote the early uptake of vehicles meeting more stringent emission standards (such as Euro 3 and Euro 4) are being developed as part of the Government's Cleaner Vehicles Package.	●	Remains under active consideration by the Government.
2002 Update response 3.3 The NSW Government will continue efforts to secure establishment of a robust national regime for enforcement of fuel quality standards.	✓	Ongoing commitment.
Objective 4: Promote cleaner business		
Action 4.1 Implement revised Clean Air Regulation 1997	✓	Implemented in 1997 and reviewed in 2004–05, with the proposals of the review incorporated by amendment into the Protection of the Environment Operations (Clean Air) Regulation 2002.
Action 4.2 Implement load-based licensing (LBL)	✓	Scheme commenced 1 July 1999 and was reviewed in 2003, with LBL fees increasing from 1 July 2004. The Regulation covering LBL is currently being reviewed.
Action 4.3 Establish a Cleaner Industry Unit in the EPA	✓	Commenced operations in 1998 with a focus on education and training.

✓ Implemented ◐ Being implemented ● Accommodated in new strategies ● Revised approach

Action or response	Status	Comment
Action 4.4 Implement the Protection of the Environment Operations legislation	✓	*Protection of the Environment Operations Act 1997* commenced 1 July 1999.
Action 4.5 Develop a framework to control NO_x emissions in the Greater Metropolitan Region (GMR)	●	DEC has is developing a strategy to manage emissions of NO_x and VOCs from EPA-licensed sources within three regions – the Sydney, Hunter and Illawarra air sheds – rather than for the entire GMR (but noting the close links between the Illawarra and Sydney regions). This approach would replace the commitment in *Action for Air* to achieve a long-term cap on NO_x emissions at 1998 licensed levels for the Greater Metropolitan Region, and is likely to achieve cleaner air at a lower cost.
Action 4.6 Enhance leak-detection and repair programs at petrochemical facilities	✓	Leak detection completed on extensions to some existing premises has shown substantial reductions in VOCs via new technologies. Further reduction in fugitive emissions occurs through licence conditions.
Action 4.7 Negotiate reductions in the emissions of ROCs from major industry sources through licence conditions	✓	Ongoing commitment. Effected through the LBL scheme and pollution reduction programs.
Action 4.8 Implement staged code of practice for commercial printing premises	◐	DEC originally set a process in train to develop a code of practice for large commercial printers in NSW. The Commonwealth Department of Environment and Heritage (DEH) then began to develop a national code of practice and DEC decided to support that process. Victoria is the only state that licenses these large printers, and did not endorse the Draft National Code of Practice in view of the special needs of their licensing system. DEH therefore abandoned the national process and undertook to develop guidelines for the industry that would be placed on DEH's website. This is still in progress. In the meantime, DEC's Business Partnerships Section has been working on a cleaner production project with the Printing Industry Association targeting the medium to large companies who print packaging materials.

✓ Implemented ◐ Being implemented ● Accommodated in new strategies ● Revised approach

Action or response	Status	Comment
Action 4.9 Improve housekeeping practices in auto repair shops and surface-coating premises	✓	A Solutions to Pollution booklet for auto-repairers was released in 1998, and training material developed for automotive teachers at TAFE. DEC and Insurance Australia Group have formed an industry partnership to promote cleaner production among NRMA's network of preferred smash repairers. Funding was provided to local councils in 2003 and 2004 to develop guidelines and checklists for council officers assessing spray painting and smash repair activities, and educational fact sheets for operators of these businesses.
Action 4.10 Install petrol-vapour recovery units at rail loading gantries	✓	Installed at the only rail loading gantry in Sydney.
2002 Update response 4.1 The NSW Government is proposing an offset scheme to improve air quality in the greater metropolitan area. A concept paper on green development offsets was released for consultation in May 2002. Comments received will be taken into consideration when developing a framework for how offsets can work in NSW, and the air offset pilot scheme itself. The offset scheme is likely to focus on NO_x, fine particles and ozone-forming chemicals such as reactive organic compounds.	●	Following the release in May 2002 of NSW Government's concept paper on green development offsets, DEC has been piloting pollution offsets to improve water quality in stressed waterways. DEC will continue to investigate the potential for using air offsets to address NO_x and other air emissions within the context of the 2007 review.
2002 Update response 4.2 Electricity accounts for around 37% of Australia's greenhouse gas emissions. From 1 January 2003, the NSW Government will enforce greenhouse gas emission reduction benchmarks on NSW electricity retailers. The new compulsory scheme will involve reducing emissions and penalties for those retailers that do not meet their target reductions.	✓	Implemented 1 January 2003. Benchmark participants (i.e. retail suppliers, customers supplied directly from the National Electricity Market, generators supplying customers directly, large consumers who elect to participate) are required to meet mandatory targets for abating greenhouse gas emissions from electricity production and use for the period 2003 to 2012. A penalty of $10.50 per tonne CO_2 (equiv.) applies to emissions above the benchmark. Participants can offset their excess emissions by surrendering abatement certificates bought from low emission generators and other accredited certificate providers. The former Premier announced on 11 June 2005 the NSW Government would set a target of a reduction in carbon emissions to year 2000 levels by 2025, and a 60% reduction by 2050. These targets were reaffirmed in the

✓ Implemented ◐ Being implemented ● Accommodated in new strategies ● Revised approach

Action or response	Status	Comment
		NSW Greenhouse Plan released in November 2005. The Premier announced the extension of the Greenhouse Gas Abatement Scheme to 2020 and beyond, until such time as a national emissions trading schemd is in place.
Objective 5: Promote cleaner homes		
Action 5.1 Ensure compliance with the Clean Air (Domestic Solid Fuel Heater) Regulations	✓	All new heaters in NSW must be certified and labelled confirming that they comply with emission limits set by Standards Australia. NSW and other jurisdictions are currently developing a better certification scheme for new woodheaters.
Action 5.2 Develop a Code of Practice for the installation of heaters	✓	DEC released the environmental guideline, *Selecting, Installing and Operating Domestic Solid Fuel Heaters* in 1999. This guideline is currently being reviewed.
Action 5.3 Conduct a community education program on using woodheaters	✓	DEC conducted the Woodsmoke Reduction Program over the winters of 2002–2004, providing financial assistance to regional councils for their education and enforcement programs for the clean use of woodheaters. Educational material on how to minimise the impact of woodsmoke on winter air quality is also available via DEC's woodsmoke website and a resource kit for local councils.
Action 5.4 Continue voluntary 'Don't light tonight unless your heater's right' campaign	✓	Conducted each winter until 2002, after which it was largely replaced by the Woodsmoke Reduction Program.
Action 5.5 Implement the Energy Smart Homes program	✓ ●	Launched in 1997, and taken up by 60 councils approving 80% of NSW residential development applications. Has been superseded by BASIX.
2002 Update response 5.1 The Environmental Trust will assess the effectiveness of the financial incentives in encouraging cleaner forms of home heating and whether there is merit and capacity to extend this strategy to other areas.	✓	Taverner Research independently evaluated the Woodsmoke Reduction Program in 2002–03, following which funding under the program was extended in its third year (2004) to 14 regional councils and one group of councils (Hunter Inc.).

✓ Implemented ◐ Being implemented ● Accommodated in new strategies ● Revised approach

Action or response	Status	Comment
Objective 6: Manage the impact of open burning		
Action 6.1 Release a users' guide to open burning restrictions (March 1998)	✓	Released across DEC regional offices, Rural Fire Service (RFS) offices and local councils in 1998. Updated in 2003 to reflect changes in the Control of Burning Regulation and Rural Fires Act and Regulation.
Action 6.2 Develop smoke management guidelines for open burning (June 1998)	●	While there is no stand-alone document on smoke management for open burning, the issue of smoke management relating to hazard reduction burning was covered in the interdepartmental work leading up to the Bush Fire Environment Code (managed by the NSW RFS and available on its website). This material is included in Section 5.5. of the Code – Standards relating to the effects of smoke.
Action 6.3 Educate the community on open burning restrictions	✓	A resource kit including a copy of *Environmental Guidelines: Regulation of Open Burning in NSW* was released in 1998 through State Government agencies and local councils, and was updated in 2003.
2002 Update response 6.1 In relation to streamlining the approval process for hazard reduction burning, the EPA and Rural Fire Service (RFS) are investigating measures to simplify the process for exempting such burns from the No Burn Notice restrictions.	✓	Developed by DEC and the RFS following the 2001–02 bushfires.
Objective 7: Monitor, report on and review air quality		
Action 7.1 Provide internet access to air quality data by mid-1998	✓	Twice daily Regional Pollution Index reports for three regions in Sydney, two in the Lower Hunter and four in the Illawarra have been available on DEC's website since 1998. Previous-day data is also available, as well as a graph by region of the Pollution Index for each day of each month back to 1994, and quarterly reports of air quality monitoring data.

✓ Implemented ◐ Being implemented ● Accommodated in new strategies ● Revised approach

Action or response	Status	Comment
Action 7.2 Set up air quality modelling interest/advisory group	✓	DEC (and its jurisdictional counterparts) work with a Peer Review Committee to ensure that its air quality monitoring network is properly designed to meet the requirements of the Air NEPM. DEC has also collaborated with CSIRO and the Bureau of Meteorology to develop a numerical air quality forecasting system.
Action 7.3 Report on results of the air toxics study	✓	The pilot study report was released publicly in 1998. The results of the subsequent, broader Ambient Air Quality Research Project, were released in 2002. Toxics identified as presenting potential problems were benzene, 1,3-butadiene and polycyclic aromatic hydrocarbons.
Action 7.4 Reconvene key technical committees with industry groups	●	The need for this committee was overtaken with the Australian Government assuming responsibility for fuel quality. Meetings are held with industry on an 'as needs' basis (e.g. to discuss arrangements for the supply of low volatility petrol).
Action 7.5 Metropolitan Strategy Committee to review environmental matters	●	Committee was superseded by the establishment of other interagency consultation forums (e.g. Action for Air Senior Officers Group).
Action 7.6 Convene a public forum to report regularly to Government	✓	Three-yearly Clean Air Forums have been held on 23 November 2001 and 17 November 2004.
2002 Update response 7.1 The EPA will identify the future and ongoing requirements for future air quality monitoring in NSW, for consideration by Government in 2002.	✓	Determined as part of the Air NEPM Monitoring Plan in 2001 and again as part of the review supporting a submission to Treasury in 2002 for enhanced funding.
2002 Update response 7.2 Implementation of *Action for Air* will continue to be overseen by a Senior Officers Group, chaired by DEC.	✓	Ongoing process.
2002 Update response 7.3 This report, *Action for Air: An Update*, and the *Forum Proceedings* will be released publicly and made available on the DEC website.	✓	Released in early 2003.

✓ Implemented ◐ Being implemented ● Accommodated in new strategies ● Revised approach

Appendix II: Community feedback on air quality

DEC held a series of workshops in the lead-up to the 2004 Clean Air Forum to canvass stakeholders' views on strategies for responding to future challenges in air quality management. Stakeholders had further opportunity to raise issues at the Clean Air Forum itself.

Consultation with major industry, which is licensed by DEC, took place in 2004 and early 2005 as part of consultation on proposed amendments to the Protection of the Environment Operations (Clean Air) Regulation 2002 to replace the existing Clean Air Plant and Equipment Regulation 1997 ('CAPER').

Issues raised at stakeholder workshops, CAPER consultation and 2004 Clean Air Forum

Stakeholders raised a wide range of measures for strengthening air quality management into the future. Responses have been grouped together by sector as follows:

Land-use and transport planning

- Improved planning process, through better research (particularly health impacts), rigorous and quantitative economic analysis, priority setting and measurable outcomes
- Neighbourhood design that reduces short trips by car by facilitating walking, cycling and public transport use
- Land-use controls and centres development in areas of high public transport accessibility
- Developer contributions to fund public transport, especially in greenfield areas, prior to land release
- Improved and integrated public transport, including increased capacity, more frequent services, and better network linkages and interchange facilities
- Road pricing signals and incentives, especially in peak periods, to discourage private car use
- Education and behavioural change

Motor vehicles and fuels

- Economic incentives to encourage cleaner vehicles and fuels and early compliance with emission standards, together with hypothecation of taxes to fund public transport
- Taxation reforms to remove perverse incentives for private vehicle use
- Promotion of alternative and cleaner fuels, including by providing supply-side financial incentives
- In-service vehicle emission reductions, through targeted inspection and maintenance programs for older and modified vehicles and retrofitting of after-treatment technologies
- Cleaner government fleets (vehicles and fuels) at state and local levels (i.e. leading by example)
- Emission standards for all vehicles, including off-road diesels
- Education and consumer awareness
- Filtration of road tunnels

Industry

- Locate complementary industries in close proximity, e.g. supplier and end-user of materials. More integrated industry – dedicated industrial zones
- Encourage industry to use more rail transport, through more flexibility of rail services, to reduce road transport emissions.
- Use a balance of economic incentives/ disincentives to encourage reduction in emissions. Financial incentives to move to lower limits sooner, e.g. reduction in licence fees
- Clear directions for industry in terms of upgrade requirements. Encourage improvement of older equipment even if it does not achieve 'best practice'.
- Better understanding and communication of industrial impacts as compared to other sources to better understand emissions vs impact relationship

- Develop improved emissions inventory (all sources)
- Improve ambient air monitoring network by government
- Provide a whole-of-government policy on global (greenhouse) vs local (ozone) air contaminants. Which takes priority or how can they be balanced?
- Use predictive management to deal with acute high pollution days. Look at predictability and possible actions such as free public transport to encourage leaving the car at home and industry not to undertake some activities.

Smaller commercial and domestic sector

- Regulation, drawing on international experience where appropriate
- Economic incentives
- Education and consumer awareness
- Information sharing within and between industries
- Funding and partnerships between industry and state and local governments
- Technology improvements, supported by research and development funding
- Environmental ratings, labelling and accreditation schemes for products and services
- Urban planning and integration

Participants in the stakeholder workshops

Government organisations

- Department of Commerce (NSW)
- Department of Energy, Utilities and Sustainability (NSW)
- Department of Environment and Conservation NSW
- Department of Environment and Heritage (Commonwealth)
- Department of Infrastructure, Planning and Natural Resources (NSW)
- Department of Transport and Regional Services (Commonwealth)
- Local Government and Shires Association of NSW
- NSW Greenhouse Office
- NSW Health
- NSW Ministry of Transport
- NSW Treasury
- Rail Corporation of NSW
- Roads and Traffic Authority of NSW
- Southern Sydney Regional Organisation of Councils
- State Transit Authority

Industry

- Abbott Consulting Group
- Alcoa Australia
- Australian Cotton Ginners Association
- Australian Environment Business Network
- Australian Home Heating Association
- Australian Liquefied Petroleum Gas Association
- Australian Trucking Association
- Australian Wood Panels Association
- Biodiesel Association of Australia
- Bluescope Steel
- Bus & Coach Industrial Association (NSW)
- Caterpillar Australia Pty Ltd
- Composites Institute of Australia
- Delta Electricity
- Focus Press Pty Ltd
- Galvanisers Association of Australia
- Insurance Australia Group
- Licotec Pty Ltd
- NSW Road Transport Association
- Orica
- Outboard Engine Distributors Association
- Outdoor Power Equipment Association
- Plastics and Chemicals Industry Association
- Printing Industries Association of Australia
- Renewable Fuels Australia
- Service Station Association Ltd
- Shell Australia Ltd
- Truck Industry Council
- Turnkey Environmental Systems
- Visy

Community groups

- Action for Public Transport
- Bicycle NSW
- EPA Board
- Friends of the Earth
- Groups Against Polluting Stacks
- Lane Cove Tunnel Action Group
- NRMA Motoring and Services
- Pedestrian Council of Australia
- Total Environment Centre

Science and academia

- Clean Air Society of Australia and New Zealand
- Graduate School of the Environment, Macquarie University
- Institute of Sustainable Futures, University of Technology, Sydney
- Warren Centre for Advanced Engineering, University of Sydney
- The Institute of Transport Studies, University of Sydney

A list of participants at the 2004 Clean Air Forum can be found in *Action for Air: Proceedings of the NSW Clean Air Forum 2004* available on the DEC website at www.environment.nsw.gov.au/air/quality.htm

Action FOR AIR

The NSW

Government's

25-Year

Air Quality

Management Plan

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Foreword

The New South Wales Government has made a significant commitment to develop and implement a comprehensive long-term plan to protect and improve air quality across NSW. We have also recognised the challenge of putting in place *Action for Air* —a 25 year plan which tackles the widest range of emissions specifically affecting the Greater Metropolitan Region of Sydney, the Illawarra and the Lower Hunter.

The Government undertook extensive public consultation through a series of Green Papers on developing the Air Quality Management Plan (AQMP) and the Smog Action Plan (SAP) during 1996-97. We received valuable information and input from all sectors of the community: business and industry, community groups, and local and State Government. This has led us to a more integrated approach by bringing forward *Action for Air* to tackle both photochemical smog and brown haze in one plan. It is a plan that commits all of government and also requires that we each contribute individually.

Everyone in NSW has a right to breathe clean air and to be protected from the adverse effects of air pollution. However, protecting air quality is a complex matter for which there is no one simple solution. *Action for Air* tackles our most significant and growing air quality issue: the increasing use of motor vehicles in the urban area. Our plan, for the first time, sets targets for reducing the use of vehicles and supports these targets with requirements for long-term transport and freight movement plans, which will give us more and better alternatives to increasing the use of vehicles.

The Government has also made a significant contribution to better public transport, which will improve both air quality and the growing congestion on our roads. At the same time, *Action for Air* continues to push for cleaner cars, trucks and buses. The plan also promotes a continued emphasis on cleaner business and improved management of pollution sources within our homes and from outdoor activities such as open burning.

Most importantly, we have set tough air quality goals within a framework that is publicly accountable and provides improved access to information. With regular reporting on the status of air quality, and on the effectiveness of our long-term strategies, we will be able to adapt our programs as we gain new information and new technologies over the next 25 years.

Our plan, *Action for Air,* will make a difference as long as we all contribute to it. We all need to do our fair share to ensure that we have clean air in NSW well into the future.

BOB CARR
Premier of NSW

Contents

Introduction

The air we breathe

We have reached a critical point for air quality in NSW. The good news is that the air we breathe is substantially cleaner than it was 15 years ago, mostly through controls on industry, on motor vehicles and the fuels they use, and on backyard burning. But there is another side to the story.

Unless we shift air quality management into a higher gear, we are in danger of losing the gains we have already made; or, worse still, experiencing higher pollution levels than in the past.

As the population of Sydney grows, the number of cars and trucks on the road also increases. The number of trips we take and the length of those trips are rising too, as we use our vehicles more intensively than ever before. This seemingly unstoppable growth of vehicle use not only congests our roads: it is the most significant source of many of the pollutants that damage our air quality.

In the past, air quality management in NSW has focused mostly on the technological side of the equation—making vehicles and industrial technology cleaner. We will certainly need to continue to make gains through cleaner technology and cleaner production. But to protect our air quality well into the future, we must also approach the problem from another side of the equation: how we use our motor vehicles.

Changing behaviours can often be harder than changing technology. The whole community will need to make positive choices about improving air quality to protect both our health and our economy.

Getting the priorities right

Recognising the need for a comprehensive plan to make sure the air we breathe is clean, the NSW Government has combined scientific, health, urban planning and economic expertise with feedback from the community, industry and government to produce this plan. It is an ambitious initiative, seeking for the first time to develop a plan for air quality for the long-term, over a 25-year period. Everybody is being asked to take responsibility—government, the community and industry—because integrated solutions are the ones that will work in the long-term.

Setting an air quality plan with goals, objectives and actions over 25 years is very ambitious but it is necessary. It is not a coincidence that NSW is now realising air quality gains from air pollution programs that were put in place in the mid 1980s. *Action for Air* will provide us with the next set of gains; and be adapted as new information comes to light and the technological landscape shifts. Its release marks a crucial phase of the Government's total air quality management strategy, concentrating on the Greater Metropolitan Area—Sydney, Newcastle and Wollongong—which contains about 70% of the State's population.

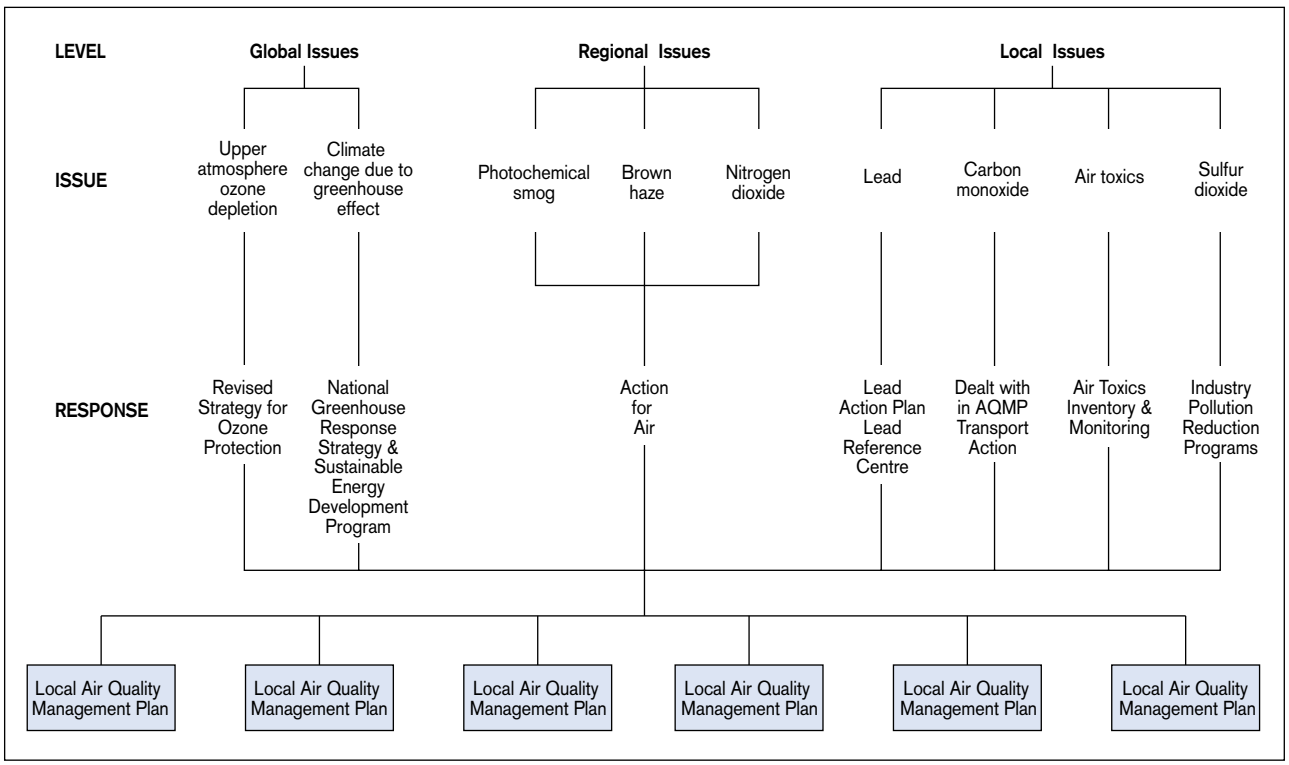
The plan supports the Government's overall air quality agenda, which includes local, regional and global issues. *Action for Air* focuses on regional air pollution—a comprehensive attack on photochemical smog and fine particle pollution. The regional approach taken here draws strong links to local and global issues, especially the Government's high priority campaigns to reduce greenhouse gas emissions and promote sustainable energy sources.

The plan is broad. It recognises that every action counts in tackling air pollution. It puts in place actions that will reduce emissions from motor vehicles as well as industrial and commercial sources and from everyday household activities. Figure 1 highlights the overall air quality framework.

Achieving air quality goals

Crucial to the plan are the ambient air quality goals being adopted by NSW, pending the final decisions on air quality standards at a national level. These are for ozone, nitrogen dioxide and particles, which relate to photochemical smog and brown haze. Additional standards for carbon monoxide, sulfur dioxide and lead will be included following the conclusion of the national process.

Figure 1. Structure of the Air Quality Management Plan



Reducing emissions from motor vehicles is the highest priority if we are to meet the goals in the long term. The Government has set in place a multi-pronged approach to do this. Improving transport choices and encouraging people to take fewer and shorter trips by individual motor vehicles are key objectives. This will rely heavily on developing a progressive transport plan, which is linked to the regions' five-year urban infrastructure management plan. Providing improved public transport and encouraging cycling and walking, as well as integrating the planning of freight movement, are also essential objectives to achieve clean air.

But these are not the only objectives. Promoting cleaner cars, trucks and buses through cleaner fuels and alternative technologies, for example, are among the other priorities found in the *Action for Air* plan. The plan takes a multi-layered approach. It includes seven key objectives for total air quality management, and puts in place a comprehensive slate of strategies to meet these objectives:

1. Integrate air quality goals and urban transport planning

- integrate transport and urban infrastructure planning
- improve management of freight transport

2. Provide more and better transport choices

- provide better public transport
- promote cycling and walking
- change travel behaviour through education

3. Make cars, trucks and buses cleaner

- reduce car emissions
- reduce diesel emissions
- promote cleaner fuels

4. Promote cleaner business

- improve regulation of industrial emissions
- promote a cost-effective approach for small business

5. Promote cleaner homes

- improve operation of wood heaters
- promote energy efficiency in the home

6. Manage the impact of open burning

- develop smoke management guidelines
- inform people of open burning restrictions

7 Monitor, report on and review air quality

- improve access to air quality data
- ensure an effective public review process
- report regularly on the state of air quality in NSW.

Some actions to support these strategies are already under way, some will be started in the near future, others are still to be devised during the 25-year timeframe.

How will the community be involved?

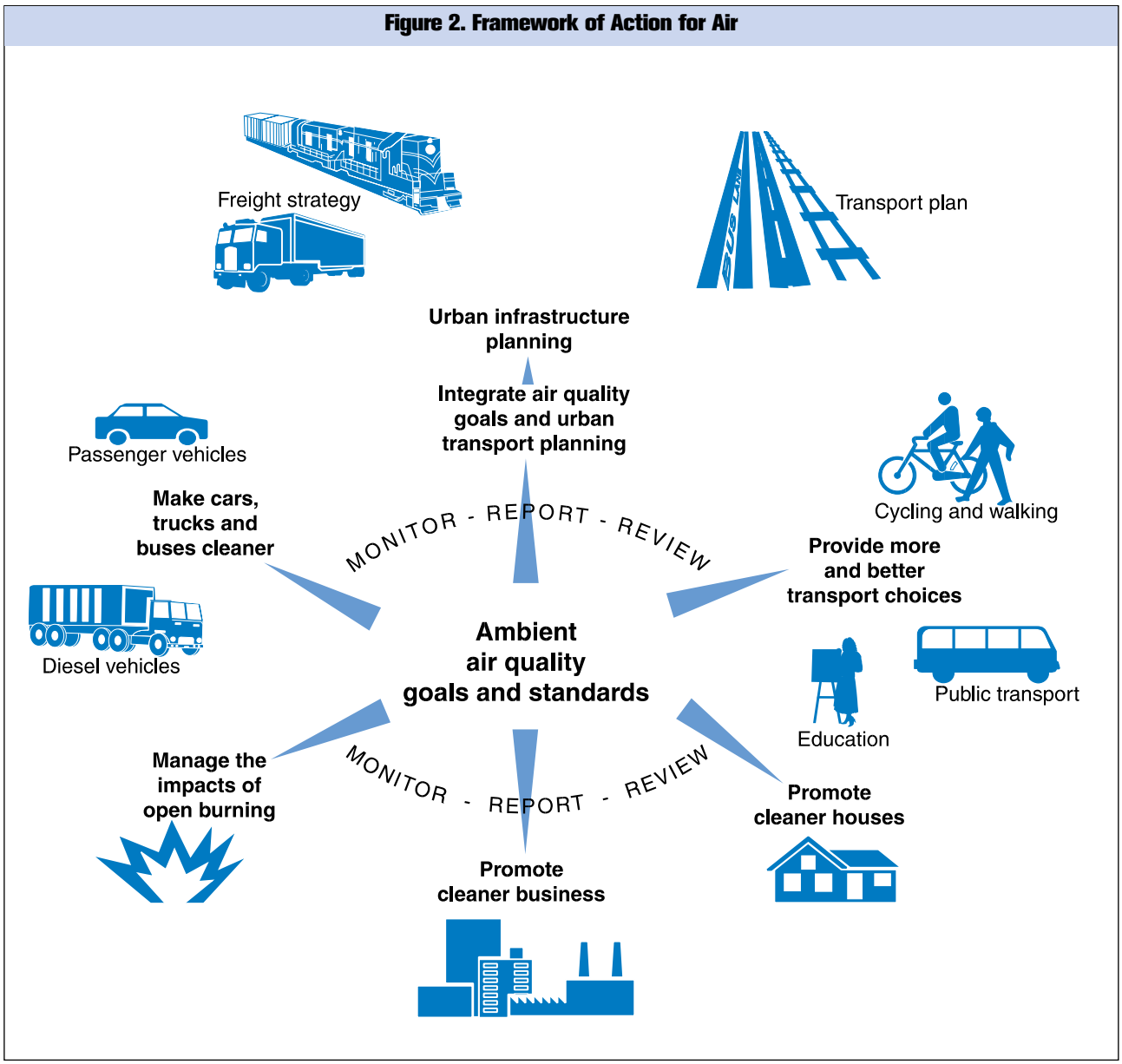
Consultation with the community on air quality issues is a high priority for the Government. Recent NSW-wide studies indicate an ongoing public concern about air quality and show that many people rank it as the highest environmental priority for the State.

Action for Air has numerous mechanisms to encourage further community input in the future, including:

- enhanced access to daily and quarterly air quality reporting data through the Internet
- a public Air Quality Forum to monitor air quality trends and strategies, and report back to Government
- an Air Quality Modelling Advisory Group as a forum for external input into priorities for future modelling
- the Public Transport Advisory Council, ensuring community input into public transport planning.

Whether you are an individual or a community organisation, the Government is calling for your involvement in its air quality improvement program and will work to keep you well informed about the quality of the air in NSW.

Figure 2. Framework of Action for Air



1 The issues in brief

What's the problem?

Action for Air focuses primarily on regional air pollution in the Greater Metropolitan Region (GMR) of NSW, which is home to about 70% of the State's population and encompasses the major metropolitan centres of Sydney, Newcastle and Wollongong. Sydney, in particular, can experience poor air quality under certain weather conditions because of its size and topography.

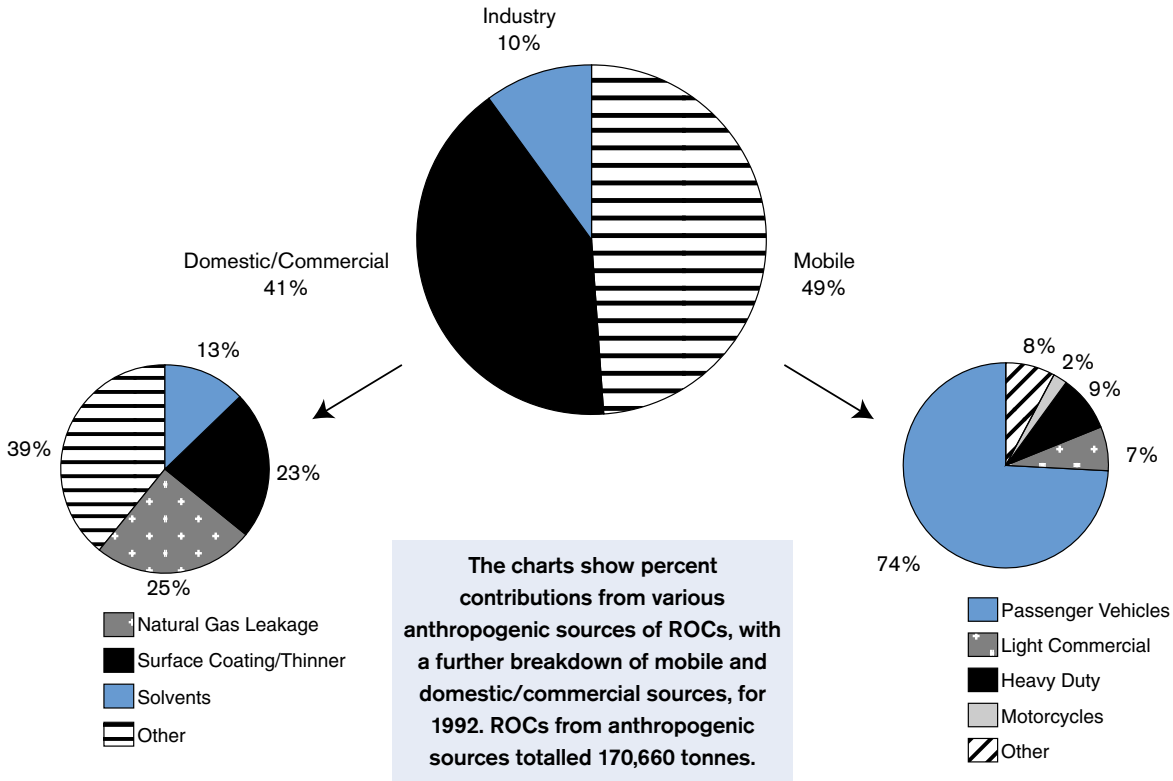
Research shows that air quality problems in any of these three metropolitan centres can affect air quality in the others, so we need to consider them together rather than separately. At the same time, many of the actions implemented in *Action for Air* will also improve air quality in rural areas—e.g. improved standards applying to motor vehicles and wood heaters.

The two regional pollution problems of prime concern within the GMR are photochemical smog and particle pollution. This section deals with the major pollutants that cause smog and particle pollution—**ground level ozone**, **nitrogen dioxide** and **total particulate matter**. It explains where they come from and their effects on human health, drawing on the available body of health related research from Australia and overseas. (The sources of pollutants and their air quality impact are outlined in more detail in EPA publications such as the *Metropolitan Air Quality Study—Outcomes and Implications for Managing Air Quality*).

Photochemical smog

Photochemical smog is a complex mixture of chemicals, which is sometimes visible as white haze. In Sydney, the Lower Hunter and Illawarra, its most significant components are the pollutants ground-level ozone and nitrogen dioxide. Ozone is the main concern in the warmer summer months,

Figure 3. Annual emissions, Sydney Region: Reactive organic compounds (ROCs)



The charts show percent contributions from various anthropogenic sources of ROCs, with a further breakdown of mobile and domestic/commercial sources, for 1992. ROCs from anthropogenic sources totalled 170,660 tonnes.

and nitrogen dioxide in winter. These pollutants are formed in the atmosphere when two classes of compounds—reactive organic compounds **(ROCs)** and oxides of nitrogen **(NO_x)**—react under the influence of sunlight.

ROCs and NO_x are emitted by various human activities as well as from natural sources, including vegetation, soil and the ocean. Some nitrogen dioxide is also emitted directly from combustion processes.

Sources

The major sources of **ROCs** include:

- unburnt petrol and diesel from motor vehicle tailpipes
- evaporative losses from motor vehicles and petrochemical industries
- loss of solvents used in commercial and domestic activities
- natural emissions from vegetation

The major sources of NO_x are combustion processes including:

- motor vehicles (passenger and heavy duty vehicles)
- industry—e.g. the power industry

Effects on human health

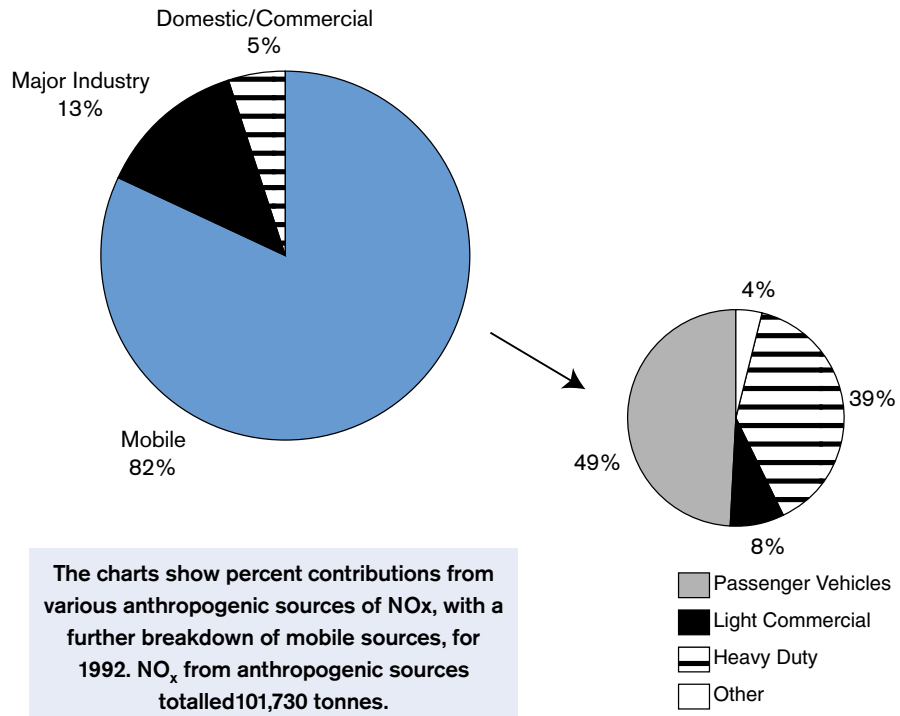
Ground level ozone

The health effects of ground level ozone, the major component of smog, have been widely studied. Even at very low levels, this ozone can:

- cause acute respiratory problems
- aggravate asthma
- cause temporary decreases in lung function in healthy adults
- lead to hospital admissions and emergency room visits
- impair the body's immune system

The effects of ozone vary with concentration,

Figure 4. Annual emissions, Sydney Region: Oxides of nitrogen (NO_x)



The charts show percent contributions from various anthropogenic sources of NOx, with a further breakdown of mobile sources, for 1992. NO_x from anthropogenic sources totalled101,730 tonnes.

length of exposure and level of activity during exposure. Short-term acute effects, including reduced airflow to the lungs and inflammatory changes in the small airways and respiratory systems, have been detected in the laboratory when adults are exposed for 6.6 hours to an ozone concentration of 0.08 parts per million (ppm). There is clear evidence that substantial acute effects occur with one hour's exposure if the concentration is 0.25 ppm or higher.

Nitrogen dioxide

Nitrogen dioxide is a major precursor to ozone as well as being a pollutant in its own right. Health studies of nitrogen dioxide show that it:

- can damage the respiratory system
- is associated with increased respiratory infections in children, especially asthmatics
- may increase the effects of allergens
- is associated with hospital admissions for asthma
- is associated with hospital admissions for heart disease
- may possibly be linked to mortality.

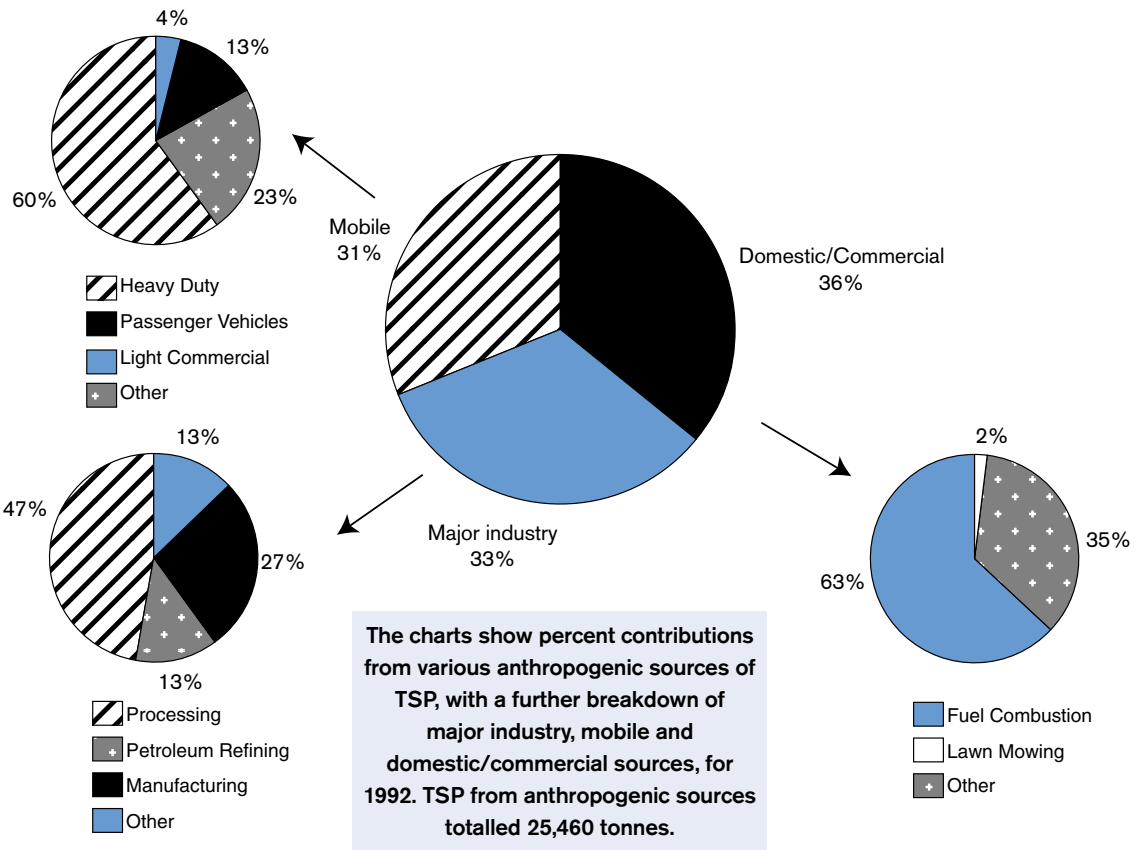
Negative respiratory health effects from exposure to nitrogen dioxide can occur at levels as low as 0.20 ppm. A Sydney-based health study, Health and Air Research Program (HARP), indicated that small increases in one-hour maximum levels of nitrogen dioxide produced an 11% increase in daily asthma admissions; and a similar study in Paris showed an 8% increase.

Particle pollution

Particle pollution can sometimes be seen in the metropolitan area as brown haze, usually during the cooler months of the year. This occurs most commonly in the late afternoon or the early morning—under cold, still conditions when surface temperature inversions are developing or breaking down.

Airborne particles (sometimes called particulate matter) are formed by the accumulation of substances into small, discrete entities in the atmosphere. They are typically less than 50

Figure 5. Annual emissions, Sydney Region: Total suspended particulates



The charts show percent contributions from various anthropogenic sources of TSP, with a further breakdown of major industry, mobile and domestic/commercial sources, for 1992. TSP from anthropogenic sources totalled 25,460 tonnes.

micrometers (μm) in size and can be as small as 0.1μm.

Fine particles—less than 10μm—can be transported some distance from their source, affecting air quality on a regional scale. Because they are small enough to be inhaled into the lungs, they can affect human health. Coarser particles remain in the air for relatively short periods before being deposited, sometimes soiling or damaging materials.

Total suspended particulates (TSP) refers to both fine and coarse particles together.

Sources

Particles originate from a wide range of human activities and natural sources, including motor vehicles, industrial processes, bushfires, hazard reduction burning, pollens, fungi and sea spray. The relative importance of sources varies according to time, season and locality.

The major sources of fine particles include:

- motor vehicles (particularly diesels)
- domestic solid fuel heaters, particularly wood burners (major source of particles during winter: 34% of TSP in Sydney on a winter weekday, 50% on a winter weekend)
- industry (also a major source of coarse particles in the GMR)
- open burning associated with agriculture, forestry management and hazard reduction (significant source of particles across NSW)

Effects on human health

Fine particles are measured in two categories:

- PM_{10}—particles 10μm or less in diameter, small enough to be inhaled into the respiratory system.
- $PM_{2.5}$—particles 2.5μm or less in diameter, small enough to be inhaled deep into the lungs.

Our living environment is filled with particles of all shapes and sizes. Under normal conditions,

Table 1. Regional Ambient Air Quality

Pollutant	Averaging time	Previous NSW goal	*Action for Air* interim goal	Long-term reporting goal
Ozone (O_3)	1 hour 4 hour	0.10 ppm 0.08 ppm	0.10 ppm 0.08 ppm	0.08 ppm* 0.06 ppm*
Nitrogen dioxide (NO_2)	1 hour Annual	0.16 ppm 0.05 ppm	0.125 ppm 0.03 ppm**	0.105* —
Particulate matter < 10 μm (PM_{10})	24 Hours Annual	150 μg/m³ 50 μg/m³	50 μg/m³	— 30 μg/m³
Particulate matter < 2.5 μm ($PM_{2.5}$)	24 Hours	— —	Standard being developed. Insufficient data at this stage	Standard being developed. Insufficient data at this stage
	Annual	—	Standard being developed. Insufficient data at this stage	Standard being developed. Insufficient data at this stage
Total suspended particulates (TSP)	Annual	90 μg/m³	90 μg/m³	

* WHO goal
** Consistent with WHO goal of 0.021 - 0.026ppm

people in good health are able to deal with most particles without adverse effect. However, particles of the size of PM_{10} can be inhaled into the lower airways and are closely associated with health effects. Recent research has focused on $PM_{2.5}$ which can penetrate deep into the lungs and which, some studies suggest, are most closely associated with health effects. An important emerging issue from the most recent health studies is that there is no obvious threshold level of fine particles below which there are no effects on health.

Health studies of fine particles have shown that they can:

- increase mortality from cardiovascular and respiratory diseases
- increase hospital admissions for chronic obstructive pulmonary disease and heart disease
- reduce lung function in children with asthma
- increase respiratory symptoms in school children.

What are our air quality goals?

The starting point for any air quality management plan is to adopt air quality goals or acceptable standards for pollutants of concern. The NSW Government is committed to health based ambient air quality goals. State and Federal Governments have also made the important collaborative decision to develop national air quality standards as National Environment Protection Measures (NEPMs) and expect to finalise these in 1998.

NSW is playing an active role in developing these national standards and is committed to adopting them when they are finalised. Pending that decision, NSW has established its own interim goals to guide the development of control strategies and for reporting purposes.

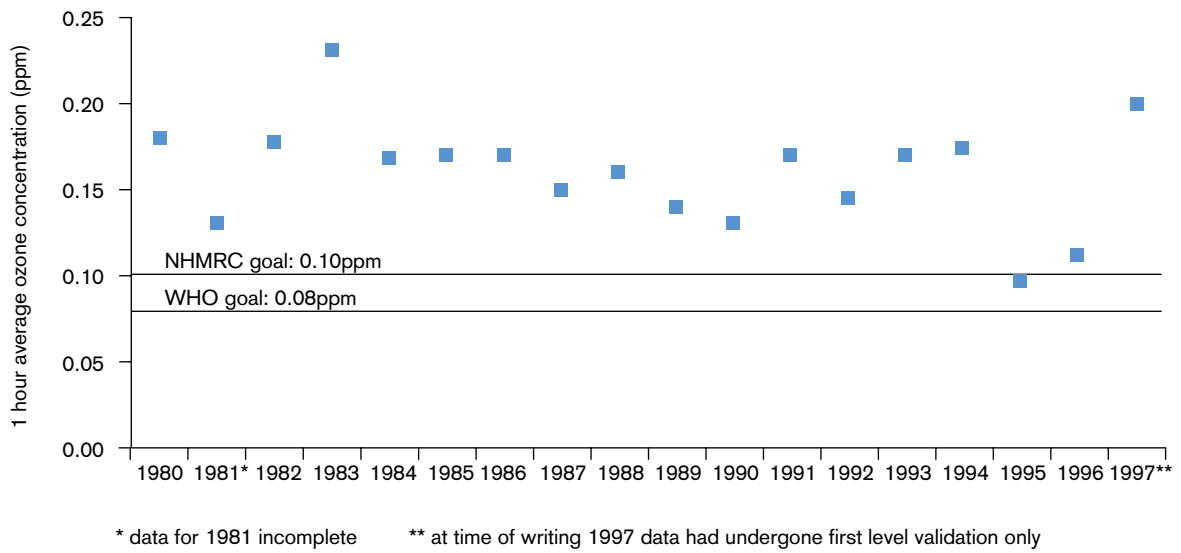
In setting these levels, NSW has examined the local and overseas health research relating to the adverse health effects from high levels of photochemical smog, nitrogen dioxide and fine particles. We have also been involved in the national discussions to set appropriate national standards through the air NEPM.

Table 1 outlines the air quality goals that form the basis of this action plan.

Over the 25 years of the *Action for Air* plan, there will undoubtedly be further health research undertaken and a better understanding of health effects established. In order to build a comprehensive picture of air quality in the region, the Government intends to report against a range of health-related goals. The plan therefore commits the EPA to provide information on air quality at different levels to ensure comparative data is available for the long-term.

This approach will ensure that public health in NSW is protected over the long term.

Figure 6. Annual maxima of 1-hour average ozone concentrations, greater metropolitan area



* data for 1981 incomplete ** at time of writing 1997 data had undergone first level validation only

Photochemical smog

Ground-level ozone

■ Ambient goals

The NSW goal for ground-level ozone is based on the national ozone goals set by the NHMRC in 1995. These are 0.10 part per million (ppm) (averaged over one hour) and 0.08 ppm (averaged over four hours).

The World Health Organization (WHO) ozone goals of 0.08 ppm (averaged over one hour) and 0.06 ppm (averaged over 4 hours) will be set as a long-term goal for reporting on air quality in NSW. The EPA will be required to report against the WHO standard as well as the interim goal for ozone.

The long-term objective is ambitious. It is, however, important to set a goal for progressive long-term reductions in ozone.

■ Trends in ground-level ozone

It can be difficult to establish trends in ozone levels because ozone formation depends on meteorological conditions. In a cloudy summer such as in 1996, ozone goals may not be exceeded. On the other hand, unusually hot sunny weather in November 1997 caused unexpected high peak levels of ozone.

There has been little change in peak levels of ozone over the last decade, according to annual one-hour average maxima (see Figure 6).

Concentrations of ozone at EPA sites in the Sydney region over the last decade have exceeded the NHMRC goal (0.10 ppm) on up to 15 days in a given year. They have exceeded the long-term WHO goal (0.08 ppm) on up to 31 days in a given year.

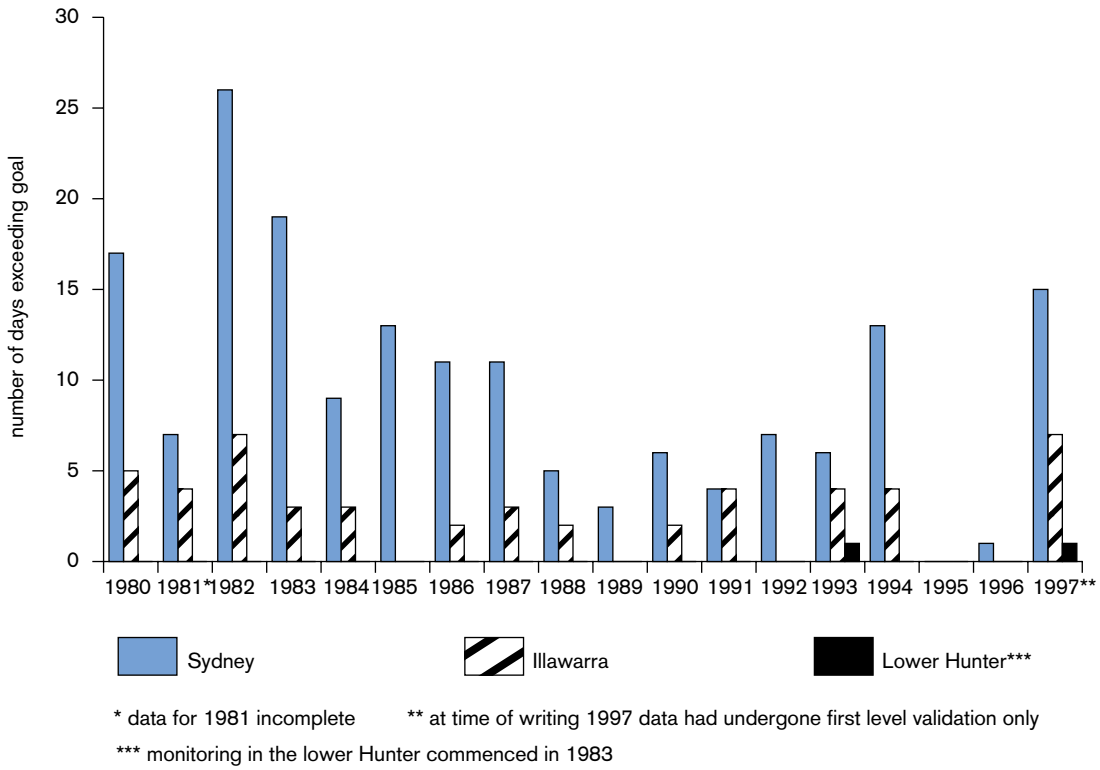
Nitrogen dioxide

■ Ambient goals

Until 1998 NSW has used a goal for nitrogen dioxide of 0.16 ppm (one-hour average) and 0.05 ppm (annual average).

To ensure an adequate safety margin to protect the very young and those with respiratory disease, NSW will use 0.125 ppm (one-hour average) and 0.03 ppm (annual average) as its interim goals for

Figure 7. Days exceeding the NHMRC 1-hour ozone goal at EPA sites in the Sydney, Illawarra and lower Hunter regions



* data for 1981 incomplete ** at time of writing 1997 data had undergone first level validation only

*** monitoring in the lower Hunter commenced in 1983

nitrogen dioxide. It will also adopt the WHO one-hour standard as a long-term reporting goal.

■ Trends in nitrogen dioxide levels

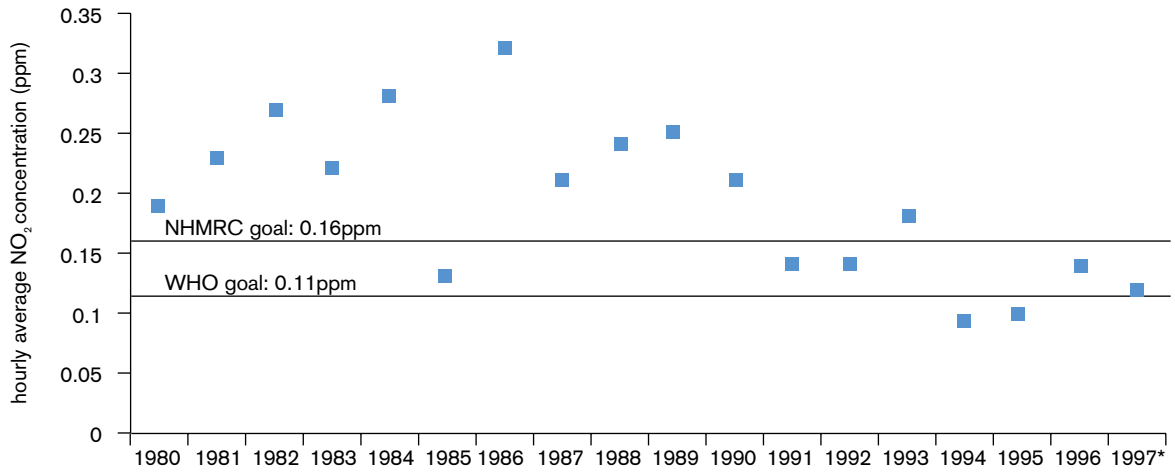
The frequency of nitrogen dioxide events in the Sydney region is highly variable (Figure 9). During the past six years, the NHMRC goal (0.16 ppm) has been exceeded on only one day. Over the last decade, it has been exceeded on up to 16 days per year. The more stringent WHO goal (0.11 ppm) has been exceeded more frequently.

Fine particles

Ambient goals

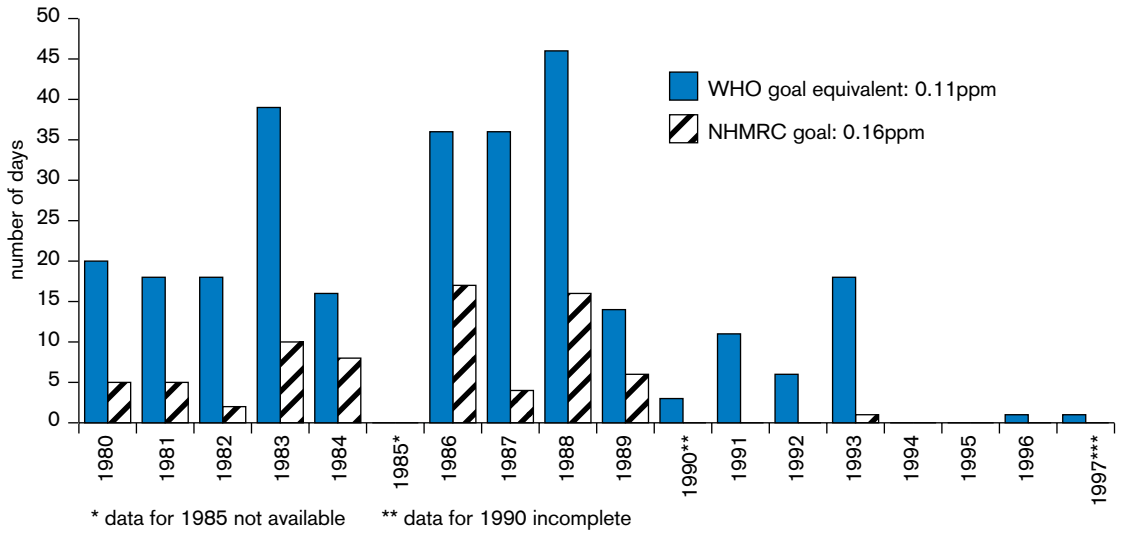
Current health advice is that there is no established threshold for fine particles below which there are no health effects. Setting a standard for fine particles therefore presents a dilemma. WHO does not have specific goals for fine particles because of this. Instead it issues a summary table of health effects to guide authorities.

Figure 8. Annual maxima of 1-hour average nitrogen dioxide concentrations, greater metropolitan area



* at time of writing 1997 data had undergone first level validation only

Figure 9. Days exceeding NHMRC and WHO nitrogen dioxide goals at EPA sites in the Sydney region



* data for 1985 not available ** data for 1990 incomplete

*** at time of writing 1997 data had undergone first level validation only

Historically, NSW has applied the US EPA PM_{10} goal of 150 µg/m³ 24-hour average in the absence of available Australian information.

Because of rising health concerns from particles, NSW will adopt a 24-hour average goal of 50µg/m³ for PM_{10} (24 hour average) as the interim goal. A new annual average standard of 30 µg/m³ will also be referenced as a long-term reporting goal.

Fine particles as small as of $PM_{2.5}$, which are capable of being absorbed deep into the lung, are of primary concern in terms of health effects. The NSW Government is committed to the development of a $PM_{2.5}$ standard but further research is necessary to achieve this. NSW will set a $PM_{2.5}$ goal as soon as sufficient information is available.

The NSW EPA currently uses an hourly visibility goal which equates to approximately 9 km under normal conditions. It will be maintained as an interim goal.

NSW will also maintain its current goal for reporting total suspended particulates (TSP) of 90µg/m³ annual average.

Trends in fine particle levels

Over the last seven years, annual average concentrations of PM_{10} in the Sydney region have generally remained below the proposed interim NSW goal of 30 µg/m³; however, annual averages for individual sites can exceed this goal (figure 11). Levels in the lower Hunter and Illawarra regions are very similar to those measured in Sydney.

Figure 11. Annual average PM_{10} at EPA monitoring sites in the Sydney region, 1988-96

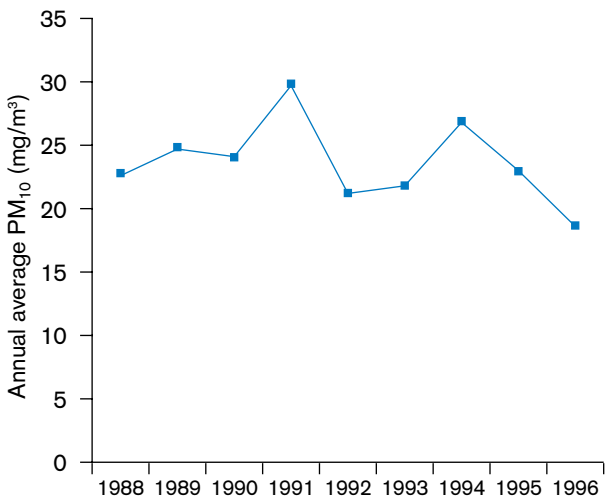
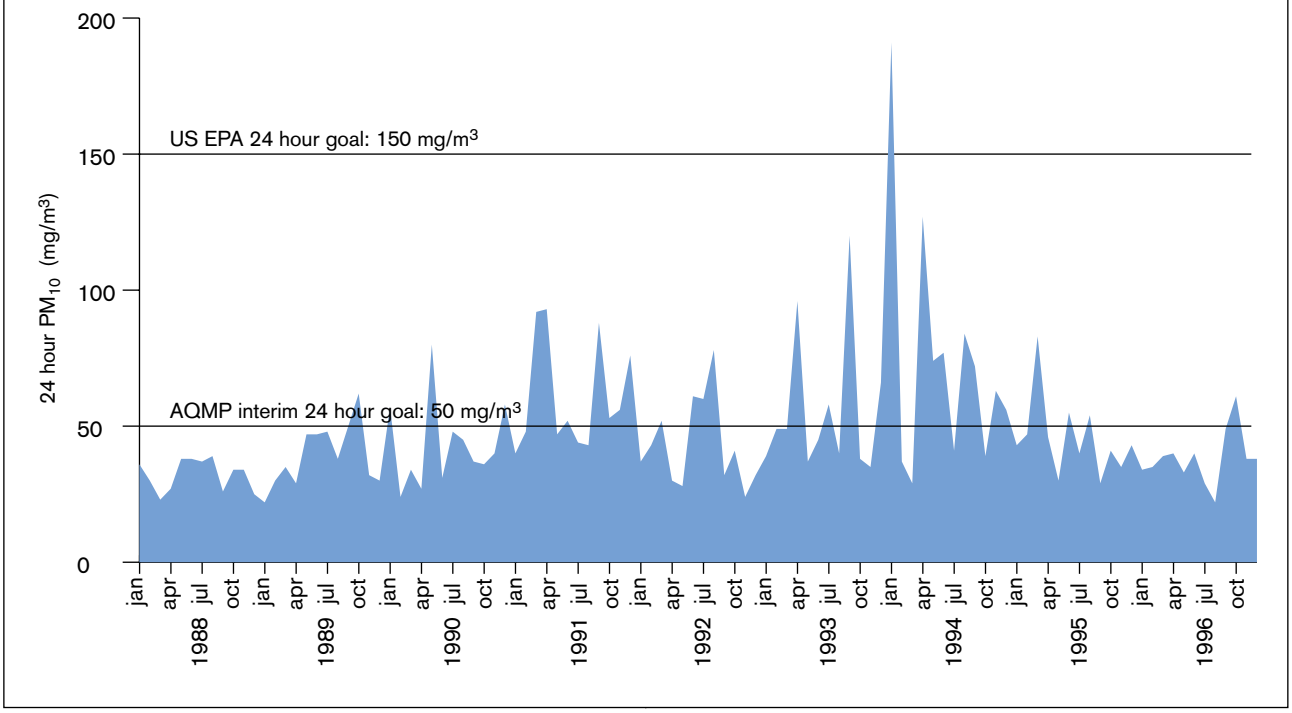


Figure 10. Monthly maxima of 24-hour PM_{10} concentrations at EPA sites in the Sydney region



2 What is the Action Plan?

Overview

Isolated pockets of action will not achieve our air quality goals over the next 25 years; the key to protecting air quality is to launch a concerted and sustained effort across all spheres of government, industry and the community.

Action for Air aims for a fundamental change in air quality management in NSW by sketching the big picture and identifying everyone's place within it, so that government, the community and the business sector understand how they must work together to protect human health and the quality of the environment. The responsibility for keeping the air clean is shared by everyone.

The Action Plan focuses primarily on the greater metropolitan region and contains diverse strategies and actions, approaching the problem on many fronts and linking State and local government, industry and individual actions for an integrated attack on air pollution. Transport initiatives sit alongside actions to reduce industrial and household emissions. Technology initiatives sit alongside education and regulatory initiatives.

The Action Plan's key objectives are described in a brief overview and the strategies and actions that will support these objectives are detailed under seven separate headings. An overview of these is shown in Figure 12.

Summary of objectives

Objective 1. Integrate air quality goals and urban transport planning

Although big air quality gains have been made through new vehicle technologies and fuels, motor vehicles remain a major, and increasing, source of air pollution in the GMR. As well as contributing to smog and particle pollution, they are a source of air toxics and a major contributor to greenhouse gases.

Growth in car use is increasing faster than the growth in population. We are taking more and longer trips both to get to work and for domestic purposes. Emissions from diesel vehicles, both heavy and light commercial vehicles, are becoming an increasing source of air pollutants as they move freight throughout the GMR.

To respond to this, the Action Plan has set an ambitious objective of containing the per capita growth in vehicle kilometres travelled (VKT) and then stopping the growth in total VKT by effectively integrating planning decisions and by improving transport choices.

The Government's objectives include achieving:

- a shift from private cars to public transport, cycling or walking
- smoother flows of traffic and reduced congestion, including for road-based public transport
- reduced need for travel
- reduced length of trips travelled by vehicles
- increased occupancy of cars and public transport carriers
- better planning and managing freight movement across all transport modes.

The Action Plan sets specific targets for reducing per capita VKT. To achieve these targets, the Government has required the development of two new overarching transport initiatives:

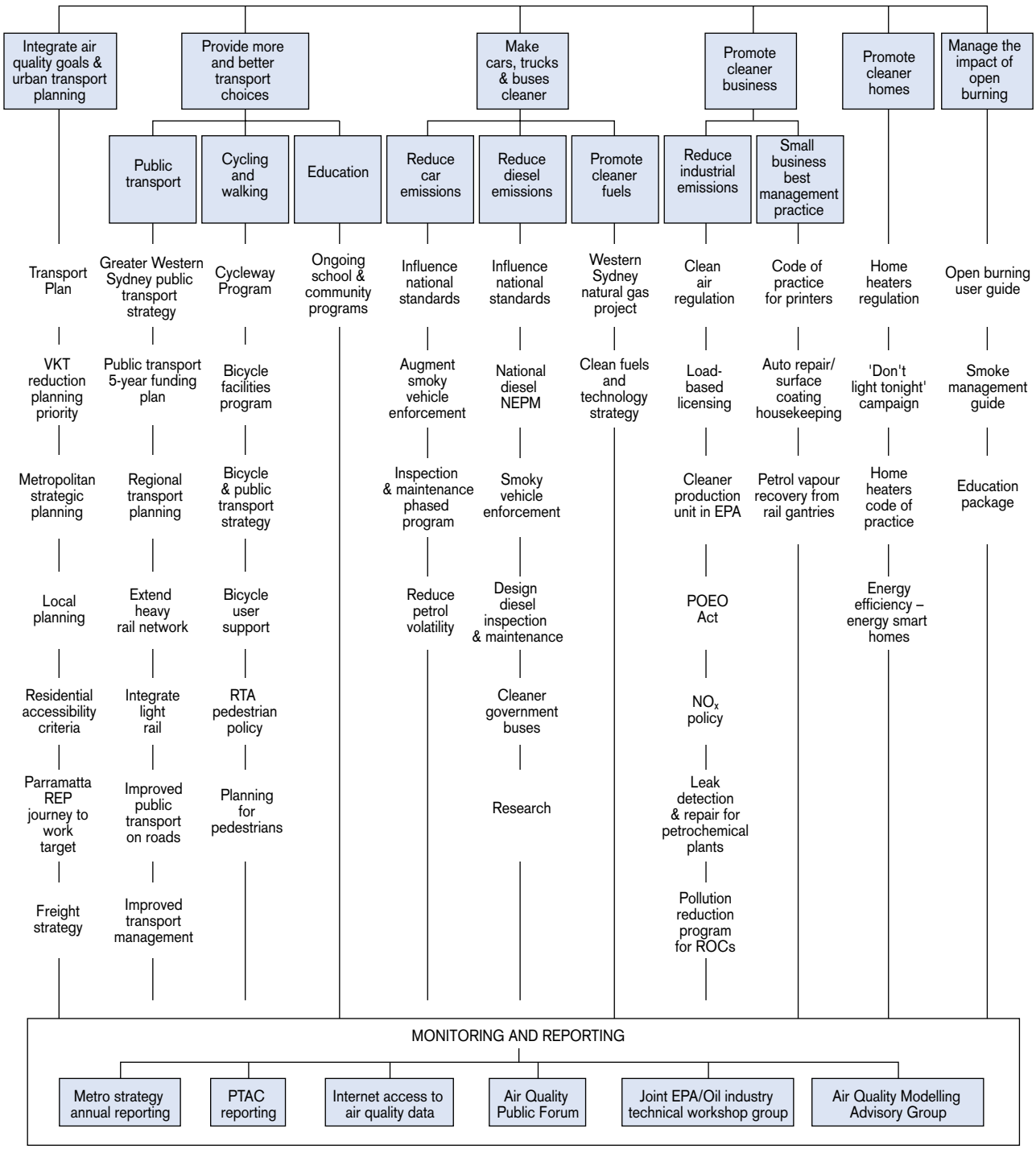
- an integrated transport plan
- an integrated freight management strategy across road, rail and other transport modes.

The VKT target will also be incorporated into the Government's metropolitan and regional planning processes and the five-year rolling Urban Infrastructure Management Plan—which helps to integrate land use and transport planning, and sets the priorities for infrastructure funding approvals.

Objective 2. Provide more and better transport choices

In addition to long-term planning, there is a clear need to provide more and better transport choices, which will encourage reduction in vehicle trips and kilometres travelled by both passenger and commercial vehicles.

Figure 12. Action fo Air: key objectives, strategies and actions



The Action Plan outlines key commitments for improving provision of both fixed rail and road-based public transport. The plan balances construction of new public transport facilities with establishing priority for road-based public transport services and management improvements such as integrated ticketing. Improved opportunities for walking and cycling are integral to the plan, to help reduce harmful emissions and improve people's health.

Objective 3. Make cars, trucks and buses cleaner

We have achieved significant gains in air quality in the GMR by adopting standards and putting in place programs to make motor vehicles cleaner. However, there is still more work to be done. This will be done at a national level for new vehicle standards and at a state level for in-service vehicles.

The Action Plan aims to reduce exhaust and evaporative emissions from both new and in-service cars, trucks and buses by continuing to improve the technology of vehicles and their fuels—including diesel vehicles, which contribute a disproportionately high level of emissions; and encouraging the use of alternative fuel sources (such as natural gas) and their application to private and public fleets. Specifically, the Government has brought forward a comprehensive program to have cars and trucks tested and properly maintained, beginning in 1998 in the Sydney region and expanding to the Illawarra and Hunter by 2004.

Objective 4. Promote cleaner business

Through *Action for Air*, the Government is continuing to put in place a revamped environment protection framework for industry, which combines strong legislation and regulation with economic incentives for change.

Successful measures to reduce industrial emissions of ROCs in the 1980s are being followed with new actions that concentrate on the control of NO_x. For smaller commercial sources, the goal of the Action Plan is to reduce emissions of ROCs in the most cost-effective way and, in the process, help reduce air toxics and workplace exposure to chemicals.

Objective 5. Promote cleaner homes

The domestic sector is a significant contributor to ROCs and fine particle emissions. While there are a number of household sources, including petrol lawn mowers and garden tools, the major domestic source of emissions is the solid-fuel (mainly wood) heater. The first phase of the 25-year plan will reinforce existing regulations to reduce emissions from solid fuel heaters with a new slate of education and management programs.

The home is also a significant consumer of power and a major contributor to regional production of greenhouse gases. The second focus on the domestic front is to improve domestic energy efficiency and encourage the use of alternative, cleaner and sustainable energy sources.

6. Manage the impact of open burning

The effect of the Clean Air (Control of Burning) Regulation introduced in 1995 has been to prohibit backyard burning in the Sydney and Wollongong metropolitan regions. The major smoke management issue for Sydney air quality now relates to bushfire hazard reduction and forestry management burning. There is also some impact from ecological and bush regeneration burns and, in regional centres, the issue extends to agricultural open burning.

Hazard reduction burning practices are necessary to control bushfires, but the impact of prescribed burning on air quality can be greatly reduced if best practice in smoke minimisation is understood and implemented. Also, the public must have ready access to information about restrictions on open burning in their particular locality.

Objective 7. Monitor, report on and review air quality

Because of its 25-year time frame, *Action for Air* is an adaptive plan that will be monitored and evaluated against its own goals and objectives. To ensure greater input from the community, business and government in this monitoring and development process, the plan includes a number of actions to improve access to information on air quality and provide forums for input from the public and from industry on air quality strategies.

These include the provision of Internet access to air quality data, setting up an air quality modelling interest/advisory group, and convening a public forum to report to the Government. The forum is linked to the legislatively based 3-yearly *State of the Environment* report.

3 The Action Plan in detail

Objective 1. Integrate air quality goals and urban transport planning

Objective: To reduce the growth in vehicle kilometres travelled by effectively integrating urban and transport planning and improving transport choices.

It is now well known that the structure of our urban centres influences travel demand and choice of transport. Historically, urban development in Australian cities has been characterised by low density and separation of land uses. The result is a reliance on the private motor vehicle as the principal means of transport.

Related to that, motor vehicles, both cars and trucks, are a significant source of air-polluting emissions.

Population is projected to be 22% higher in 2021 than in 1991 for the Sydney region. Total VKT is projected to grow approximately 35% over the same period, reflecting increasing per capita VKT as a result of increasing trip lengths, people making more trips, and a higher reliance on cars. If the rise in vehicle use continues at the same rate over the next 25 years, many air quality gains already made across the industrial, commercial and domestic sectors may be neutralised (see Figure 13).

For the health of the community, there is clearly a need to break this trend. There are also economic imperatives for change, as air pollution and traffic congestion undermine the attractiveness of Sydney as a tourist and commercial centre. The Australian Transport Council estimates that the cost of Sydney's traffic congestion is already in the vicinity of $2 billion a year.

To reduce vehicle kilometres travelled (VKT), we need to create more compact cities, where:

- fringe expansion is reduced
- housing development near public transport routes is encouraged
- retail, entertainment, community service and other suitable high-use facilities are located in centres that are able to be well served by public transport.

We also need to create long-term transport and freight movement plans that provide the overall

A Snapshot of Motor Vehicle Emissions

ROCs

Almost half—49%—of the ROCs in Sydney and the GMR are produced by transport activity; of this, 70% are emitted by light duty vehicles

In summer, 60% of light duty vehicle emissions comes from evaporation and 40% from the tail-pipe.

NO_x

82% of the NO_x in Sydney are produced by transport activity. Of this, light duty vehicles contribute 48%, heavy duty vehicles 38%. That 38% is disproportionately high given the number of diesel vehicles in the fleet.

Industry is the major source of NO_x in the GMR but motor vehicles still contribute substantially in the Hunter and Illawarra regions.

Particles

24% of total suspended particles (TSP) emissions from human activity in Sydney are produced by motor vehicles. Of this, up to 80% comes from diesel emissions, even though diesel vehicles account for only 15% of vehicle kilometres travelled.

Industry is the major source of TSP outside Sydney.

Greenhouse gases

Transport activity contributes 12% of NSW greenhouse gases.

Not only is the number of vehicles on NSW roads increasing as the population increases, we are also becoming much more dependent on our cars. Between 1981 and 1991, the growth in car use in Sydney greatly exceeded the growth in population.

blueprint for investment in infrastructure and public transport management improvements.

Integrating land use and transport plans, and delivering coordinated services, help to reduce the length of vehicle trips and provide alternatives to private vehicle use. *Action for Air* aims to improve air quality by better and more integrated urban transport and relevant land-use planning.

Strategy A. Integrate urban infrastructure and transport planning

Because it is so wide-ranging, the progress of *Action for Air* will rely on unprecedented integration of State programs across different agendas. This can only happen by setting out the linkages, the steps and the goals clearly for all planning agencies to see and work with.

The creation of the Ministry of Urban Infrastructure Management (1996) and the Urban Management Committee of Cabinet were necessary steps to coordinate across planning, environment and infrastructure providers. The Ministry's role is to develop Urban Infrastructure Management Plans with a five-year outlook.

Equally important has been the recent decision to bring the roads, traffic and transport agencies together in a single portfolio under the same Minister.

Other important steps have been the creation of the Department of Urban Affairs and Planning (DUAP), by combining the Department of Planning, the Office of Housing Policy, Landcom and the City West and Honeysuckle Development Corporation; and the creation of an independently chaired Public Transport Authority, which is advised by a Public Transport Advisory Council made up of users and public interest groups.

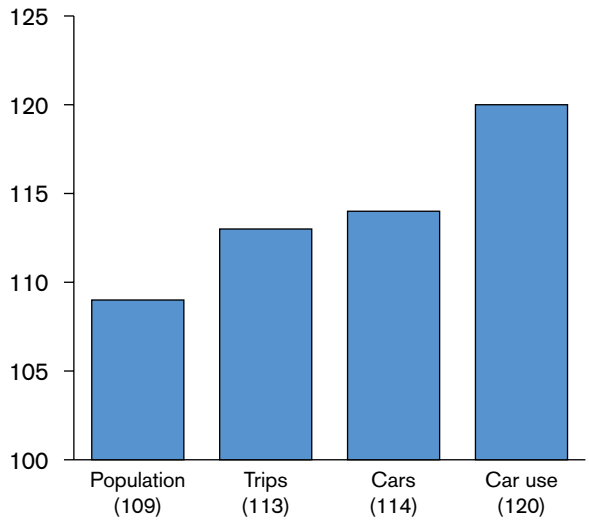
The focal point for future action will be a long-term transport plan for the GMR.

Action 1.1. Develop a transport plan to reduce VKT growth

At the request of the Premier, the Minister for Transport and Roads has directed transport agencies to develop an integrated Transport Plan in conjunction with planning agencies. This plan will:

- set directions for public transport and road developments in conjunction with related land-use issues
- include the Government's goal of stopping the per capita growth of VKT by 2011 and stopping the growth in total VKT by 2021
- include regional and staged sub-targets for the achievement of the VKT target
- build on existing policies, plans and projects across the transport and planning agencies
- involve all relevant government agencies including the RTA, the Department of Transport, the DUAP and the EPA
- involve consultation with key community stakeholders in its framing and development
- be provided to the Government by November 1998.

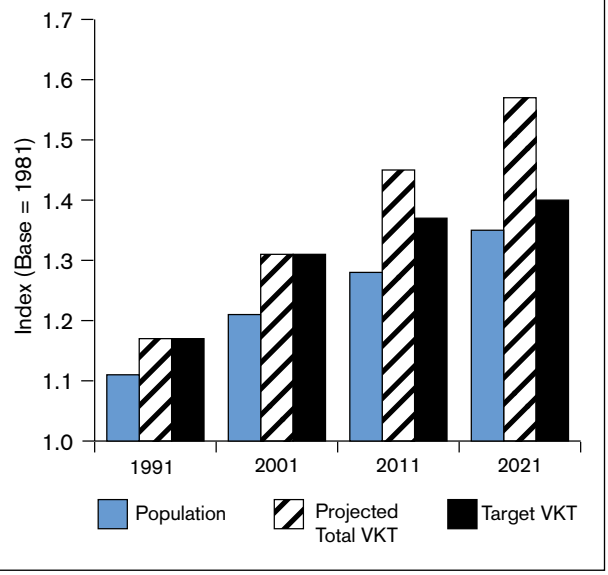
Figure 13. The mobility expansion, Sydney, 1981-91



*Sydney Statistical Division

The graph shows that, while Sydney's population increased by 9% in the 10 years 1981-91, the number of car trips increased by 13%, car ownership by 14% and car use by 20%. That is, people are using more cars, more often. (Data courtesy Department of Transport home interview surveys.)

Figure 14. Projected growth in population and total VKT based on present trends, compared with target VKT



Action 1.2. Make the reduction of VKT a planning priority across government

The Government has committed to a two-phased VKT target:

- to achieve zero growth in per capita VKT by 2011
- to achieve zero growth in total VKT by the year 2021.

This target will be refined through the development of the Transport Plan, as a realistic timeframe can only be set when detailed planning is complete. It is a very challenging goal, which will require determined effort.

The VKT target will require a reduction of around 9% in per capita VKT in the decade 2011–2021—a reversal of the current increasing trend.

It will deliver a major reduction in the overall growth of VKT for the 1991–2021 period. Projected VKT growth will be reduced by around 43%. To achieve this target there will have to be a major shift to public transport. The projected public transport share of trips to work of around 21% will have to increase to a figure approaching a 30% share by 2021. Again this requires a reversal of the current trend—which is away from public transport.

The targets will also be incorporated into the 5-year rolling Urban Infrastructure Management Plan, which sets priorities for infrastructure funding approvals. They will also be reference criteria in major policies, strategies and projects across all transport and planning agencies.

Action 1.3. Integrate transport issues in regional and local planning

The Department of Transport (DOT), the Roads and Traffic authority (RTA) and the Department of Urban Affairs and Planning (DUAP) are working with local councils to improve their decision-making on transport issues through the statutory planning process. Issues being addressed include proposed changes to the development approval process; a review of planning instruments and guidelines to broaden their transport focus; and development of best-practice notes on public transport planning.

The DOT is convening a multi-agency taskforce to promote best practice in planning, design and management of streets and roads to support more effective public transport. The taskforce has developed a framework of transport issues for consideration when preparing development control plans.

The DUAP is pursuing a number of key land-use policies that will contribute to achievement of the VKT targets. In particular:

- urban consolidation policies which provide for a range of housing choices and for higher-density development close to rail and other transport corridors
- 'centres' policies which facilitate multi-purpose trips and reduce demand for car travel by encouraging the concentration of retail, commercial, entertainment and community-service activities into centres that can be well served by public transport.

Action 1.4. Implement accessibility criteria for new residential development

It is important that the location, design and development of new residential areas maximise access to public transport. The DOT in conjunction with the DUAP have developed accessibility criteria for new residential development. This will provide a framework for assessing areas for inclusion in the Metropolitan

Urban Development Program (UDP) or for setting priorities for areas already in the UDP. The criteria will also be used by local government in the design and staging of new residential development areas.

Action 1.5. Set targets for journey to work by public transport at key centres

Parramatta provides a major opportunity to increase the use of public transport for journey to work trips. Through the Parramatta Regional Environmental Plan (REP), the Government has set a target of increasing public transport patronage for journeys to work—from its current 25% to 40-60% as the workforce doubles.

The Government is working with Parramatta City Council to ensure coordinated development of the Parramatta City Centre as a major employment location and service centre for the residents of western Sydney, with greatly improved public transport access. The REP for Parramatta has a range of specific access strategies:

- actively pursuing a high modal split towards public transport
- developing regional public transport corridors to provide efficient access from all catchment areas, with particular priority for the North West, South West, North Shore/Chatswood/Hills Districts and Homebush Bay
- managing road-traffic demand
- developing an integrated access system, including public transport, pedestrian and cycle access within Parramatta Primary Centre, linking all areas important for its growth
- ensuring the city is accessible through the provision of services, information, technology, and built structures.

This integrated approach to the Parramatta REP, including a growth target for public transport in line with growth in the workforce, will be used as a model for planning development of other centres.

Case Study: City West Project

The City West (Ultimo-Pyrmont) area is being redeveloped for high density residential and mixed use, with strong emphasis on providing good access to jobs through public transport, pedestrian and cycling networks. A projected 7,500 new dwellings and jobs for 40,000 people will be provided over the next 20 to 30 years.

Development is based on the assumption of the following proportions of the local workforce travelling to/from work by public transport:

1990	**15%**
2001	**45%**
2011	**55%**
2020	**65%**

Public transport to Ultimo and Pyrmont will be provided by light rail as well as extensions to bus and ferry services; and a comprehensive pedestrian and cycle network has been developed to complement the public transport system. Unrestricted on-street parking is gradually being removed and replaced by more restrictive parking zones intended to reduce motor vehicle use in the area.

Strategy B. Improve management of freight transportation

Clear planning to improve the efficiency of urban freight movements is an urgent priority. We need smarter and more integrated planning for the management of freight transportation by road, rail and other modes to reduce the impact of heavy diesel vehicles in built-up areas.

Action 1.6. Develop and implement an integrated freight strategy

The Government has recognised the need for a wider integrated freight strategy that combines a comprehensive road freight strategy with strategies for other transport modes, including ports and rail. The Minister for Transport and Roads is responsible for developing the integrated strategy by the end of 1998.

Objective 2. Provide more and better transport choices

Objective: To improve transport choices and encourage reduction in vehicle trips and kilometres travelled by both passenger and commercial vehicles.

Contemporary households now have complex travel patterns that extend beyond the conventional trip to work, presenting a major challenge for transport planners and networks. This section deals with the strategies and actions chosen to create more and better alternatives to private car use.

The Government clearly has a major responsibility for action on this issue; however, in the long run the community will determine whether NSW will reverse the current trend in growth of per capita VKT.

The community must decide whether it will change travel behaviour and use alternatives to the single occupant private car wherever suitable choices are available. It will have to consider what disincentives to growing private-car use it is willing to accept: for example, strong pricing policies for parking.

The aim of *Action for Air* is by no means to discourage car use altogether; cars and trucks will continue to have a central and valued role in transporting people and goods in NSW. The challenge for the community is to reduce the negative impact of motor vehicles by reducing the number and length of trips.

The major strategies selected to achieve this goal are:

A. Provide better public transport

B. Promote cycling and walking

C. Change travel behaviour through education.

Strategy A. Provide better public transport

Existing patterns of car use can only be changed if viable public transport options are available. Improvements in public transport—both fixed-rail and road-based—across the distinct regions in the GMR, are a high priority for the Government.

The key elements of *Action for Air* public transport strategy are:

- implementing the Greater Western Sydney Public Transport Strategy
- extending the heavy rail infrastructure
- integrating light rail
- improving public transport on roads
- improving transport management
- upgrading regional transport strategies.

A.1. Greater Western Sydney Public Transport Strategy

The job of reversing the long neglect of public transport in the fast growing region of western Sydney is being coordinated through the Greater Western Sydney Public Transport Strategy, which will dramatically improve public transport services in the area. Key actions from this strategy include:

Action 2.1. Consider funding for public transport

The NSW Government has increased its public transport allocation by over $200 million in the period 1995-97. In the 1998-99 budget, the Government will provide funds for projects for public transport in line with its identified public transport priorities and directions in the Air Quality Management Plan, *Action for Air*.

As part of the 1999-2000 budget process, the Government will consider a five-year funding program for public transport, arising from the integrated transport plan. The focus of the plan will be on areas of greatest need, such as western Sydney.

The development of an integrated public transport plan and consideration of a five-year funding program represent the Government's commitment to promoting growth in public transport usage, and allowing proper medium and longer-term public transport infrastructure planning.

Action 2.2. Enhance the Parramatta rail link

The Government is committed to commencing the enhancement of the Parramatta rail link.

The Government is considering options that will greatly improve rail access to Parramatta and for western Sydney residents. By improving fast and efficient public links from western, south-western and north-western Sydney, such options will greatly reduce dependence on private vehicles in this region.

Options being considered will:

- free up train paths on the main western rail line
- enable more frequent and more punctual services, including express services
- be consistent with reducing travel times and with the objectives of the proposed Parramatta REP.

Action 2.3. Consider fast-tracked public transport for the Hoxton Park to Parramatta corridor

The Government is identifying the most appropriate services for a rapid public transport route on a reserved corridor from Hoxton Park to Parramatta—intended to strengthen Parramatta's development as Sydney's second CBD.

Action 2.4. Plan for public transport in north-west Sydney

The Department of Transport is developing a transport strategy for north-west Sydney, which will provide a comprehensive framework for this growing region.

A dedicated bus land has now been completed on part of the Sunnyholt Road transit corridor, giving priority to road-based transport in the first stage of development of the Rouse Hill release area. The corridor is part of the strategic plan to link Rouse Hill with the proposed Mungerie Park sub-regional centre, Blacktown, Parramatta and other key employment areas. The feasibility of running a light rail service along the corridor to connect with the Blacktown/Riverstone railway line is being considered.

Within two years, work will commence on a new centre at Mungerie Park at Rouse Hill, which will become the anchor for a comprehensive public transport network in the Rouse Hill development.

The Richmond rail line is also being upgraded in 1998, to provide for track amplification. This will enable CityRail to meet the expected increase in demand from population growth in the north-west.

Action 2.5. Improve bus services in western Sydney

Improvements already made to bus services include minibuses, a 24-hour information service and letter-boxing of timetables, but there is strong community demand for further improvements. The Government amended the Passenger Transport Act in 1996 to enhance the quality of services delivered by private bus operators, so that a contract will only be renewed for another five years if a series of best-practice benchmarks are achieved.

The GWS Public Transport Strategy includes many other bus service improvement strategies such as establishing a TransitWay Policy and upgrading the provision of public transport information.

Improvements to the road network to provide for bus priority, interchange upgrades and the development of future cross-regional services will also improve bus services.

Action 2.6. Provide public transport to new suburbs

Public transport will be introduced at the outset of new developments (greenfield areas), to encourage the use of public transport before consumers become car-dependent or house-bound. Criteria for awarding bus contracts in greenfield areas will set mandatory requirements for links to the overall transport network, minimum levels for services, fares and vehicle and driver standards, and the accreditation of operators.

A.2 Extend the heavy rail network

Major heavy rail initiatives under way or in planning (in addition to the Parramatta rail link) include:

Action 2.7. Complete construction on the New Southern Railway

The $600 million New Southern Railway is currently under construction and expected to open by May 2000. It provides a new rail link between Central and the East Hills line, with new stations at Green Square, Mascot, Kingsford Smith Airport's domestic and international terminals, and North Arncliffe (North Arncliffe station has been added to provide for cross-regional transport between Illawarra/south-western Sydney and the developing

Sydney South area. It is expected that about 4600 passengers will use this station daily); and that 13,000 new dwellings will be developed as a result, providing housing for 30,000 residents.

Action 2.8. Extend the Eastern Suburbs rail line

The Government is considering a private sector proposal to extend the rail line from Bondi Junction to Bondi Beach. It will link a high-density residential area directly into the CityRail network and provide a seamless public transport connection to a premier tourism precinct.

Action 2.9. Construct the Homebush Bay rail loop

As part of a comprehensive strategy to make public transport the predominant form of travel to major events at Homebush, a new rail link has been completed. This will be complemented by extensive cross-regional bus services, limited car parking and integrated ticketing for events.

A.3. Integrate light rail

Action 2.10. Integrate light rail

The Government is committed to integrating light rail into the transport network where it is appropriate. A new light rail service between Central Railway and the Fishmarkets at Pyrmont has already opened to the public to service urban renewal in this region. An EIS for extending the route has been completed and a preliminary feasibility study of light rail in the eastern suburbs is under way.

A.4. Improve public transport on roads

Road-based public transport services provide a crucial service and require ongoing improvement to meet demand. Initiatives to reduce car use by improving road-based public transport include:

Action 2.11. Fund road-based public transport

The Public Transport Infrastructure Improvement Program (PTIIP) has allocated $170 million from the RTA budget for the period 1995-96 to 1998-99, to support a greater modal share of road trips by public transport.

Action 2.12. Implement the M2 public transport management plan

The newly-opened M2 includes an exclusive busway from the Epping bus-rail interchange west to Windsor Road. A management plan for the busway will ensure its potential is maximised and commit all relevant agencies to implementing recommendations. The plan provides an effective model for developing buses as a viable form of mass transit on road-based corridors.

Action 2.13. Implement the M5-East sub-regional air quality plan

The M5 East will ease traffic flow between the city and the south-west, removing an estimated 70% of heavy vehicles from residential roads and local suburbs by 2011.

Planning approval for the M5 East has imposed stringent environmental conditions on the development. The RTA will be required to meet rigorous local ambient air quality standards for the tunnel. Also, the Government has required the RTA, DUAP, the Department of Health and the EPA to work together to identify key contributors to local air pollution and develop appropriate control strategies. This will include consideration of a Transport Plan for the M5 East and surrounding streets.

The RTA will contribute $500,000 a year for five years to fund the implementation of these strategies. The objective of this integrated approach is an overall reduction in air pollution emissions in the locality.

Action 2.14. Implement an extensive bus priority scheme

Under the PTIIP, the Government is progressively developing the Sydney CBD Bus Priority Scheme, the most extensive of its kind in Australia. In addition, bus and transit lanes have been set up on Epping Road, Windsor Road and the Great Western Highway.

Action 2.15. Improve services to the Eastern Suburbs

Approval of the Eastern Distributor was contingent on the implementation of a comprehensive Eastern Distributor bus priority plan for the Eastern Suburbs of Sydney. The benefits will include improved travel times and reliability for the 44 million passenger trips made each year on buses in the east. Faster, more reliable services will encourage more people in this area to travel by bus rather than car.

Action 2.16. Upgrade the Warringah peninsula bus system

A five-year strategy to upgrade the existing bus system on the Warringah peninsula is being developed by the RTA and other agencies. Bus priority on Military Road has been improved and a Bus Rapid Transit System is being developed.

Case Study: The Olympics

Planning for the Olympics provides a unique opportunity to maximise public transport facilities for the future and launch innovative transport management practices. It is intended to be a blueprint for sustainable urban transport networks well beyond 2000.

Car access will be limited mainly to emergency vehicles. Expected mode splits for spectators are:

■ rail	60%
■ regional bus services	20%
■ park and ride	15%
■ cycling and walking	5%

To facilitate public transport access to the Olympic Park, a new railway station and ferry wharf have been constructed. A comprehensive system of bicycle and pedestrian pathways will facilitate travel around the area. Bicycle parking will be provided at all major venues. Four major park and ride facilities, providing up to 16,000 cars with feeder bus services to the venues will be located north, south, east and west of the Park (e.g. Eastern Creek, Macquarie University).

A.5. Improve transport management

To make public transport more attractive to consumers, the following management initiatives will be undertaken:

Action 2.17. Better integrate ticketing, especially in Greater Western Sydney (GWS)

Integrated ticketing is operating to a large extent in the areas serviced by CityRail trains and State Transit buses and ferries. The main challenge now is to integrate the rail ticketing system with private bus operations in western Sydney. The Government has directed transport agencies to provide advice on how to extend integrated ticketing to GWS.

The Premier has also directed DOT to investigate the possibility of making integrated ticketing available to those using public transport on a regular casual basis—for example, to those who leave their car at home one day a week.

DOT has a number of integrated ticketing programs under way, including the 'Bus Plus' trial, which combines into one ticket a point-to-point rail weekly and an equivalent bus weekly. Trials are currently operating in Blacktown, Rooty Hill, Mount Druitt, Campbelltown, Minto, Wyong, Gosford and Woy Woy.

Action 2.18. Improve transport information services

The Public Transport Authority will investigate and advise on the coordination of information relating to all modes of public transport. The goal is to have a fully comprehensive centralised phone information system that covers all public transport modes, all providers and all Sydney regions. As part of the new best practice requirements for the renewal of commercial bus contracts, information benchmarks will be developed to ensure improved timetable and route information.

Action 2.19. Develop a metropolitan parking policy

The availability of parking is a key factor influencing people's transport choices: easily available and relatively cheap parking encourages car use. For a consistent approach to the issue, transport and planning agencies and local government will produce a comprehensive policy to guide the provision, management, licensing and enforcement of parking and parking regulations.

Action 2.20. Promote teleworking in government and the business sector

Teleworking is emerging as a significant and realistic work mode with the potential to reduce travel demand, especially in peak hours. An RTA survey revealed that 5% of the sample teleworked on a regular basis, 10% on an occasional basis and a further 65 % would if given the opportunity.

The Government will investigate options for its own workforce as well as working with the NRMA Clean Air 2000 Taskforce to support effective implementation of teleworking in government and business sectors.

Integrated ticketing will be a key to the successful integration of transport systems. Ticketing for Olympic and other events (e.g. the Royal Easter Show), combining entry and public transport fares, will be actively marketed to encourage bus and train use.

A.6 Implement regional transport planning

Action 2.21. Develop a settlement strategy for the Central Coast

The Central Coast and Illawarra are both major and growing urban areas. A settlement strategy is being developed for the Central Coast by the DUAP and local councils. Integration of land use and transport planning will be a central element.

Action 2.22. Develop a long-term strategy for improving transport in the Illawarra

The Illawarra sub-committee of the Metropolitan Strategy Committee has formed a task force to evaluate options for improving transport in the region. A preliminary analysis of the region's transport infrastructure, planning and coordination needs has been prepared. A draft long-term strategy for improved public transport, reduced reliance on private cars and better integration with residential development will be provided to the Illawarra sub-committee of the Metropolitan Strategy Committee.

Action 2.23. Prepare a Newcastle-Sydney corridor study

The Sydney-Newcastle corridor links the State's major economies and urban areas. Road links in the corridor are under increasing pressure as a result of the growth in commuter traffic between the Central Coast and Sydney. DOT, RTA, State and Regional Development and DUAP are working together and a corridor study is being carried out to develop an integrated package of land use, transport and local employment measures.

Action 2.24. Prepare a Penrith to Orange Corridor integrated road and rail strategy

The Government has established the Penrith to Orange Transport Corridor Task Force to develop an integrated road and rail strategy for the area. The Task Force will report to the Premier.

Strategy B. Provide for cycling and walking

Walking and cycling have important parts to play in reducing car dependency. They perform the vital function of feeding into the public transport network and are key transport modes for people without cars or access to public transport. The significance of walking and cycling is likely to increase as integrated land-use and transport planning policies take effect and more journeys are brought within their scope.

Action 2.25. Improve government support for safer and more convenient bicycle use

Improvements will be on a number of fronts, including increasing the size of the bicycle network available to cyclists; encouraging dual-mode public transport/cycling; providing bicycle access along rail easements; providing better facilities such as parking and lockers; and improving motorists' attitudes towards cyclists. Key programs include:

- the Cycleways Program and Bicycle Facilities Program, run by the RTA and local councils to provide on- and off-road cycleways, State, regional and local bicycle networks, bicycle parking, and local improvements to cycleways. The Government has allocated $5.5 million annually to cycleway programs in NSW of which almost $3 million is in the Sydney region
- the Bicycles and Public Transport Strategy, managed by the DOT in collaboration with the SRA and other transport agencies. The strategy

encourages the use of cycling and public transport as a dual mode.

- the Bicycle User Support Program, run by the RTA in collaboration with NSW Police, education agencies and local government. It focuses on increasing bicycle use and reducing accidents involving bicyclists through training and promotion. Its goals are a threefold increase in bicycle use statewide, and a 5% reduction in accidents, by 2001.

In support of these programs the Government has allocated over $8m of funding through the RTA. In addition, the RTA provides for cyclists in the design of new roadworks and in the maintenance of existing roads, with the additional cost being about $12m per year over and above the specific programs.

Action 2.26. Facilitate walking as a mode of transport

The Government has a number of initiatives under way to facilitate walking. The Shaping Up Streets and Roads Taskforce, comprising government and non-government representatives, has been working with councils to ensure that the needs of pedestrians, public transport users and cyclists are considered in the design of new developments and suburbs.

The RTA is developing a comprehensive pedestrian policy. The initial stage of the project involves a broad community consultation, with workshops currently being held around NSW. The policy will recognise walking as a legitimate form of transport, thereby reinforcing the need to provide safe, convenient and direct routes and facilities for pedestrians.

Strategy C. Change travel behaviour through education

Education and public information strategies play a vital role in achieving change in travel behaviours. Major efforts by government agencies, local councils and community bodies are under way, or in planning, to bring about a shift in community understanding of the health and environmental consequences of individual travel choices. To help people translate this understanding into action, the quality, range and scope of information available on transport alternatives will be substantially upgraded. The potential for teleworking and trip-linking will illustrate travel demand-management philosophies.

Action 2.27. Continue to promote school and community education programs

Several initiatives involving government agencies, local councils and community groups—such as the NRMA Clean Air 2000 Task Force and the Nature Conservation Council—are under way or in planning. They include Airwatch for schools, the City Savers resource kit, Smogbusters, and the annual 'Travel Smart Day' public transport campaign.

Objective 3. Make cars, trucks and buses cleaner

OBJECTIVE: To reduce exhaust and evaporative emissions from new and in-service cars, trucks and buses.

Another key objective of *Action for Air* is to augment the gains already made in air quality through standards and programs to make cars, trucks and buses cleaner. Standards for new vehicles are set by the Commonwealth Government through the Motor Vehicle Standards Act, while in-service vehicles in NSW are currently regulated by the State Government.

The major strategies that will achieve this objective are:

A. Reduce car emissions.

B. Reduce diesel vehicle emissions.

C. Promote cleaner fuels.

Strategy A. Reduce car emissions

Action 3.1. Advocate tighter national emission standards for new cars

A new national vehicle emissions standard was introduced in January 1997 but further action is needed. NSW is chairing the national working

group reviewing Australian Design Rule 37/01 and is supporting new standards equivalent to those adopted in the USA in 1994 or Europe in 1996. If agreed to nationally, these will come into effect from 2003.

The new standards would achieve for each car further major reductions in emissions of carbon monoxide (20%), ROCs (30%) and NO_x (68%), and the resulting improvement in fuel economy would reduce greenhouse gases. It would be a very cost-effective approach for each tonne of pollutants reduced (less than $1000/tonne). The State Government's long-term goal is national implementation of the very stringent California Low Emission Vehicle Standards or their equivalent. The EPA will monitor all quality trends and provide advice over time on the appropriate timing for achieving these standards.

Action 3.2. Augment the Smoky Vehicle Enforcement Program

NSW has had a Smoky Vehicle Enforcement Program since 1974. Under the NSW Clean Air Act it is an offence for a vehicle to emit visible smoke continuously for a period of more than ten seconds. The EPA and RTA have strengthened this program, which is enforced by issuing penalty notices to offending vehicles. Smoky vehicles have been identified as the priority target for the new mandatory testing and repair program outlined below.

Action 3.3. Implement an inspection and maintenance program for in-service vehicles

Although new cars meet stringent emission standards, in-service vehicle emissions are often excessive owing to lack of proper maintenance or the removal, modification or deterioration of emission controls.

An Inspection and Maintenance (I/M) program for passenger and in-service light commercial petrol vehicles will reduce emissions from in-service vehicles by identifying and requiring the repair of high polluting vehicles. It will be supported by a major public information campaign on I/M. NSW will introduce the I/M program beginning in June 1998. It will be extended throughout Sydney, Illawarra and the Hunter in a phased program to 2004.

A fully implemented I/M program will achieve significant reductions in air pollution emissions within the GMR. Estimates are: NO_x—13 tonnes per day; ROCs—16 tonnes per day and CO—342 tonnes per day. Fuel economy will be improved by 2.5% on average, resulting in a corresponding reduction in carbon dioxide emissions; air toxics will also be reduced. Vehicle performance will generally be enhanced through more consistent, regular car maintenance.

The program will be implemented in three phases:

- Phase 1 will target high-polluting vehicles such as modified and smoky vehicles within the Sydney Region and will be operational in mid-1998, by expanding two RTA emissions-testing facilities. There will also be random inspections of high-usage vehicles to assess their overall impact.
- Phase 2 will require testing of passenger and light commercial vehicles in the Sydney region—through a network of 20 privately-operated testing facilities across the region—and will be implemented in 2000. Repairs would be required after the first 12 months of phase 2.
- Phase 3 will extend the testing program for passenger and light commercial vehicles to the lower Hunter and Wollongong in 2004.

Action 3.4. Reduce petrol volatility in summer

Reducing petrol volatility will reduce fuel evaporation and the formation of photochemical smog. Reducing Reid Vapour Pressure (RVP)—the measure for volatility—will lower emissions from vehicles, lawn mowers, fuel storage facilities and service stations.

Because fuel evaporates more readily when it is hot, RVP reductions are only necessary during summer. NSW has negotiated a phased reduction in RVP during the peak ozone period of 15 November to 15 March, to be phased in from 1997-98 to 2003. There is an annual review program to assess the effectiveness of this phased reduction. The new requirements are included in a formal memorandum of understanding with industry. When fully implemented they will reduce emissions of ROCs by about 7000 tonnes each summer and will also reduce air toxics.

Action 3.5. Investigate merits of reducing sulfur content in petrol

Lowering the sulfur content in petrol can increase catalyst efficiency, thereby reducing tailpipe emissions of SO_2, ROCs, NO_x and CO. It may be appropriate to use this strategy at some stage in the future; however, further evaluation of the estimated environmental benefits compared with the economic impacts and feasibility for Australian oil refineries is needed. The feasibility, cost and effectiveness of the strategy will be evaluated by the EPA/Oil Industry Technical Committee for further consideration by Government at a later date.

Strategy B. Reduce diesel vehicle emissions

Emissions from diesel vehicles, especially small commercial vehicles and vans, are a growing source of urban air pollution. Diesel vehicles create a disproportionate share of emissions compared to cars—for example, they produce up to 80% of TSP emissions from motor vehicles in Sydney, even though they account for only 15% of VKT.

Action 3.6. Advocate tighter national emission standards for heavy-duty diesel vehicles

Australia is lagging behind international developments in regulating heavy-duty diesel vehicles. Our current standards are equivalent to 1991 standards in the USA, 1992 standards in Europe and 1993 standards in Japan. NSW is supporting national review, through Australian Design Rule 70/00 (ADR 70), of the more rigorous Euro II standards. If agreed to nationally, these will be phased in from 2000.

Vehicles and fuels operate as a system and must be compatible to achieve improvements in emissions and performance. If Australian diesel emission standards become as stringent as those in the USA and Europe, changes to the composition of diesel fuel will be necessary for control technology to be effective. There is a need to understand the links between diesel fuel production and passenger vehicle fuel. These issues will be considered in the future review of national diesel emission standards (ADR 70) and will be referred to the National Environment Protection Council for consideration.

In the interim, the EPA/Oil Industry Technical Committee will be asked to investigate the feasibility, cost and effectiveness of low-sulfur diesel fuel as an emission control strategy.

Action 3.7. Develop a national diesel environment protection measure

NSW will continue to champion a comprehensive national diesel measure through the National Environment Protection Council. The measure would allow governments to tackle diesel exhaust emissions and fuel quality collectively. It would also provide an opportunity to work with industry to gather a better information profile on the national diesel fleet so that an environmentally sound and cost-effective program can be brought forward.

Action 3.8. Design an inspection and maintenance program for diesels.

Inspection and maintenance programs for diesel trucks and buses are not as advanced as those for cars. There is no readily available short emissions test for diesel vehicles that is both economical and accurate. Further research into diesel vehicle inspection and maintenance programs is under way at a state level to develop the appropriate test.

The Government is committed to implementing a comparable inspection and maintenance program for diesel vehicles. In the meantime diesel vehicles will be subject to the visual Smoky Vehicle Enforcement Program.

Action 3.9. Ensure cutting-edge emission technology for the State bus fleet

The Government gives high priority to ensuring that its own fleets are as clean as is possible. This is being achieved in a number of ways:

- from 1997, specifying that new diesel buses for the State bus fleet meet the very stringent Euro II emission control standards, although these are not required nationally
- purchasing an additional 300 natural-gas-fuelled buses over the next five years to add to the 107 already operating from the Kingsgrove Depot. The State Transit Authority will call for tenders to supply compressed natural gas and the associated infrastructure to bus depots.

Action 3.10. Support research to identify effective emission control strategies

Through a joint research program the EPA, RTA and Sydney Buses are working to identify the most effective ways of reducing emissions from existing buses and other heavy-duty diesel vehicles. Because these vehicles will remain on our roads for many years (the diesel fleet turnover rate in Australia is a slow 30-35 years), the project is very significant. Three key options being evaluated are catalytic converter retrofits, regular maintenance programs and the use of compressed natural gas fuel.

There is plenty of scope for improved emissions from these vehicles. Research results available in 1998 will assist the Government, local councils and other fleet owners to make sound environmental and economic decisions.

Strategy C. Promote cleaner fuels

Action 3.11. Participate in Western Sydney Gas Natural Vehicle Project

This project was initiated by Liverpool City Council with a focus on the Liverpool area, but there is opportunity to expand the scope to the wider Western Sydney Region.

In partnership with Liverpool Council, NRMA Clean Air 2000, Planet Ark and the Australian Natural Gas Vehicles Council, the NSW Government will promote the benefits of a regional compressed natural gas infrastructure. A priority will be to encourage fleet operators to use natural gas, especially for diesel vehicles and possibly taxis. The Government will work closely with the project, providing seed funding, technical assistance and advice.

Action 3.12. Develop a cleaner transport fuels and technology strategy

The Premier's Department will work with government agencies, private sector interests such as AGL, the Australasian Natural Gas Vehicles Council and the NRMA, universities and the CSIRO to draw together many existing and emerging initiatives into a strategic framework on adoption of cleaner fuels and technologies. This will include integration of options for the use of alternative fuels in government and private-sector fleets. There is much evidence to suggest that significant opportunities exist for environmental, social and economic gains in this area. This strategy will be developed by July 1998.

The Government has already supported Waverley Council in its conversion of two of its trucks to compressed natural gas. This a pilot project which emerged from the Southern Sydney Regional Organisation of Councils Greenhouse Strategy and is supported by the private sector and all levels of Government.

Objective 4. Promote cleaner business

Objective: To improve the regulation of industrial emissions that contribute to air pollution.

The Government is committed to finding new and more effective ways of reducing industrial emissions without imposing unnecessary economic costs on industry. It has begun to put in place a revamped environment protection framework for the industrial sector, combining strong legislation and regulation with economic incentives for change.

Because reduction strategies introduced in the 1980s have been successful in controlling ROCs emissions from large industrial sources, new programs will concentrate more heavily on the control of NO_x. Both traditional and innovative regulatory tools will be used to achieve maximum emissions reduction.

For smaller commercial sources, the broad goal is to reduce emissions of ROCs in the most cost-effective way. The actions supporting this goal will also reduce air toxics and workplace exposure to toxic chemicals.

Strategy A. Reduce industrial emissions

Industrial emissions are a relatively small proportion of total emissions of ROCs, NO_x and particles in the Sydney region. In 1992, large industry contributed 11% of ROCs, 14% of NO_x and 33% of particles .

Industry accounts for a much larger proportion of NO_x emissions in the GMR, however—mainly through the contribution of power stations on the fringe of the region.

There is potential for significant growth of NO_x emissions from new industry over the next 25 years, which could substantially increase formation of smog or cause exceedences of the nitrogen dioxide goal. New industrial sources in western Sydney are of particular concern: although small in terms of total NO_x, they are relatively concentrated and could feed into the photochemical smog reaction at a stage where they cause rapid production of ozone. The concentration of ozone formed in the emission plume from a large industrial source could be significantly higher than in the surrounding area for up to 15 kilometres downwind of the source.

Consequently, the strategy to reduce emissions from heavy industry makes the control of NO_x a top priority.

Action 4.1. Implement revised Clean Air Regulation 1997

As an immediate action, the Government has implemented the revised Clean Air (Plant and Equipment) Regulation 1997, setting never-to-be-exceeded emission concentration limits for air pollutants. Limits for new premises are, in most cases, based on NHMRC limits. In order to create further improvements, the EPA will implement a new performance-based licensing system (load based licensing) beginning in 1998.

Action 4.2. Implement load-based licensing

The introduction of load-based licensing (LBL) will see a shift from uniform emission concentration standards as the main pollution control tool (as in the current Clear Air (Plant and Equipment) Regulation) to a focus on the total mass of pollutants discharged into the environment. Licence-specific limits will be retained to ensure air quality in local areas is protected. Licence fees will be used to provide powerful financial incentives for licensees to achieve discharges below the required minimum performance. LBL will also form the platform for trading schemes to cap and reduce total emissions.

The Government brought forward necessary legislative amendments to implement LBL, which were passed by Parliament in December 1997. The draft Regulation and Regulatory Impact Statement are scheduled to be released for public consultation in February 1998, with phased implementation to begin in mid 1998.

Action 4.3. Establish a Cleaner Industry Unit in the EPA

A new unit within the EPA will develop partnerships with industry to promote cleaner production. It will encourage industry to put in place environmental management systems to control its own environmental performance and will bring forward a State Cleaner Production Strategy, developed in consultation with industry.

Action 4.4. Implement the Protection of the Environment Operations legislation

The Clean Air Act passed more than 30 years ago has been revised and incorporated into the *Protection of the Environment Operations Act 1997*. The new legislation will provide stronger tools for the EPA and local councils in dealing with cumulative industrial emissions. It will commence in July 1998.

Action 4.5. Develop a framework to control NOx emissions in the GMR

Future industrial growth, such as an expansion of cogeneration (a positive greenhouse initiative), has the potential to increase NO_x emissions in the Sydney region—thus generating a conflict with regional air quality goals for ozone.

Action to control industrial emissions is best approached through a framework that allows industry and the EPA to work together to find the most appropriate and cost-effective controls for each situation. An innovative framework to control NO_x emissions in the Sydney region will allow set parameters for licence negotiations with power generation (including cogeneration) plants, petroleum refineries, metal processing plants, chemical manufacturers and other scheduled premises with NO_x emissions.

The new policy will take into account:

- benefits to the National Greenhouse Strategy and the NSW economy of new technology and fuels, especially cogeneration

- a commitment to achieve NO_x reductions with the least cost to industry and maximum flexibility
- a commitment to transparent and predictable regulatory processes
- the complexity of the air chemistry involved in the production of ozone and nitrogen dioxide, which makes it extremely difficult to specify appropriate levels of NO_x for any airshed.

The EPA will implement its NO_x policy for the GMR by capping total emissions and setting up a scheme for trading within the cap. The scheme will be scoped and developed during 1998 for implementation, commencing in the 1999-2000 financial year. Its aim will be to limit and progressively reduce emissions to achieve a long-term cap on emissions at 1998 licensed levels.

Until LBL and the full trading scheme are operational, the EPA has put in place an interim approach for both replacement and greenfield proposals. In all cases, this will include: the Clean Air Regulation and the safety-net requirement that new plant (replacement or greenfield) should not be allowed to cause extra exceedences of the interim air quality goals for nitrogen dioxide and ozone in local or adjacent areas.

For replacement proposals, a minimum requirement of no net increase in NO_x emissions from the individual site, and an economic impact analysis of the cost of available control technologies for new plant, will apply. With a view to encouraging emission reductions, the EPA will record any reduction in annual NO_x emissions for possible future credit when the trading scheme is finalised.

For greenfield sites, the EPA will seek emission limits consistent with best available control technology, dependent on an economic impact analysis of the cost of achieving these limits.

Action 4.6. Enhance leak-detection and repair programs at petrochemical facilities

Fugitive emissions, caused by equipment leaks from pump and compressor seals, valves, flanges and other equipment connections, are a significant source of ROCs emissions from petrochemical facilities (such as petroleum refineries and chemical plants). Emissions can be reduced by an active inspection and maintenance program.

A program to reduce emissions from petrochemical facilities will apply to plants run by ICI, Ampol, Shell and Montell. In some cases, existing pollution-control licence conditions already require fugitive emissions control; the program will ensure a comprehensive coverage of all plants. It will be implemented as part of the licensing process, with appropriate conditions negotiated for each plant prior to review of its licence.

The environmental benefits include an estimated reduction in ROCs of up to 2,600 tonnes per year in the GMR. There will also be reductions in fugitive emissions of air toxics such as benzene, toluene and xylene. Workplace exposure to such chemicals will be reduced and odour may also be reduced.

Industry is progressively installing low-emission valves and seals. It may be feasible to move to zero-emission leakless valves and seals over time, but the cost is currently prohibitive. However, future development will be monitored.

Action 4.7. Negotiate reductions in ROCs emissions from major industry sources through licence conditions

There are feasible ways to further reduce ROCs emissions from industrial sources and these will become a focus for licensing review processes with plants in relevant industrial areas. Appropriate reduction strategies will be negotiated on a plant-by-plant basis.

The range of actions to be explored includes:

- improved storage tank operations for fuel and chemical storage and distribution
- improved wastewater treatment in petroleum refineries
- technical process modifications, add-on controls and improvements to existing control equipment for chemical manufacturing plants
- improved transfer efficiency and use of waterborne coatings to reduce ROCs emissions from can and coil-coating industries and other fabricated metals manufacturers.

Strategy B. Develop cost-effective approaches for small business

The broad goal for small commercial premises that produce regional pollutants is to reduce emissions of ROCs compounds in the most cost-effective way. The supporting actions will also reduce air toxics and workplace exposure to toxic chemicals.

Action 4.8. Implement staged code of practice for commercial printing premises

The EPA, the Printing Association of Australia, the Australia Flexographic Technical Association and local government are working together to develop a code of practice and a complementary industry education campaign to reduce ROCs emissions from printing activities.

They will focus on the adoption of low ROCs or ROCs-free coatings in the flexographic and gravure printing industry, for premises emitting 35 tonnes or more of ROCs a year. The code of practice will be implemented in three stages:

- Phase 1 (2000): Improved housekeeping measures. Flexographic printing presses will have chambered doctor blades, anilox rollers and ink trays fitted; there will be some conversion of gravure presses to run water-based inks; some laminating machines will be converted to allow use of high-solids adhesives; and the drier components on presses will be upgraded.
- Phase 2 (2003): Installation of incineration devices for laminating/coating operations and flexographic presses and some conversion to water-based adhesives.
- Phase 3 (2006): Installation of control equipment on rotogravure presses, solvent recovery for laminating/coating machines and changeover to an extrusion laminator.

When fully implemented, the code has the capacity to produce a reduction of over 2,800 tonnes of ROCs per year, to reduce air toxics and odours, and possibly reduce workplace exposure to chemicals. The costs for the program are medium and the cost-effectiveness rating is good.

Printing industry associations have agreed to inform and educate the industry on the code of practice. Ink manufacturers will be responsible for developing low-ROCs ink alternatives. Local government will monitor implementation of the code.

The education program will be an extension of the successful Small Business Solutions to Pollution Program and the EPA will work with other partners to develop and implement it.

Action 4.9. Improve housekeeping practices in auto repair shops and surface-coating premises

The Small Business Solutions to Pollution program has been effective in supporting a cooperative approach to environmental protection. The EPA is working with local government and industry to extend the program to cover air quality in auto repair shops and surface coating premises. Guidelines and an information campaign to improve practices are being developed for local implementation in 1998.

There are various points in the work process in auto repair shops and surface-coating premises where improved practices can reduce emissions of ROCs. Measures will include the use of high-volume, low-pressure spray guns; avoiding spillage; recycling and reuse of materials; and generally improved housekeeping practices.

This cost-effective program has the capacity to reduce ROCs emissions in the GMR by over 4,000 tonnes a year. There will also be reductions in air toxics, odours, and in workplace exposure to toxic compounds.

Action 4.10. Install petrol-vapour recovery units at rail-loading gantries

Vapour controls can minimise the evaporation of petrol that frequently occurs during its distribution. Installing petrol-vapour recovery units at rail-loading gantries extends the vapour controls currently required by the Clean Air Regulations during the transfer of petrol at service stations in Sydney.

At present, the only operational rail-loading facility is at Parramatta, where fuel is loaded for rail-tanker distribution from both Sydney refineries. Negotiations with industry are under way and it is expected that an activated carbon vapour-recovery unit will be installed on the Parramatta Rail Gantry in 1998.

The reduction in ROCs emissions from this action is expected to be about 310 tonnes per year, with associated benefits possibly including reduced air toxics and odour. Product savings are an additional benefit, as fuel vapour is returned to the system rather than lost to the atmosphere. The cost-effectiveness of the strategy is rated as good.

The EPA will consult further with industry in relation to the extension of vapour recovery units to bulk loading terminals and service stations in Wollongong and Newcastle. Until now, the environmental benefit of this strategy has only been considered in the context of its impact on photochemical pollution. The EPA's current monitoring and inventory work on air toxics will provide additional information to assist in the environmental and economic assessment of the proposal.

Objective 5. Promote cleaner homes

Objective: To maximise home energy efficiency and reduce emissions of fine particles and ROCs from domestic fuel consumption.

In the domestic arena, individuals and households can initiate direct action to improve air quality.

Our homes are a significant contributor to fine particle emissions and ROCs, mainly through solid fuel heaters but also through petrol lawn mowers and garden tools. As a significant consumer of power, the home is also a big contributor to regional production of greenhouse gases and an important site for innovations in energy efficiency.

Action for Air is responding with a package of strategies to reduce fine particles and other emissions from wood heaters, improve energy efficiency and encourage the use of alternative, cleaner and sustainable energy sources in the home.

Strategy A. Reduce Emissions from solid-fuel heaters

Domestic solid fuel heaters (mainly wood heaters) are a significant source of fine-particle pollution in both Sydney and a number of rural regional centres in winter.

They also can produce:

- carbon monoxide (CO) through incomplete combustion of fuel
- ROCs (including benzene, aldehydes, phenols and organic acids), which are responsible for most of the odours produced
- semi-volatile organic compounds such as the polycyclic aromatic hydrocarbons, which need higher temperatures to evaporate. Some of these are known to be toxic or carcinogenic at particular levels and others may be so.

The EPA has examined strategies developed in other countries and used consultative tools to canvass appropriate action for NSW. An independent social research organisation was commissioned to survey community knowledge, attitudes and behaviour relating to wood heaters in 1995. In 1996, the EPA distributed a discussion paper, *Air Pollution from Solid Fuel Heaters,* to all NSW local councils seeking feedback on preferred strategies.

Since 1995, the Government, in collaboration with industry, has put into place a number of strategies to reduce the negative impact of wood heaters, including regulatory action, education programs and requests for voluntary avoidance of wood fires on high-pollution days.

A continuing program of action includes the following:

Action 5.1. Ensure compliance with the Clean Air Regulations 1997

The Government enacted regulations in 1995 to control emissions from new wood heaters and these were renewed in 1997.

Under the Clean Air (Domestic Solid Fuel Heaters) Regulations 1997, all new wood heaters sold in NSW must be certified and labelled to confirm that they comply with emissions standards set by Standards Australia. The EPA estimates that properly certified heaters will reduce emissions by up to 80% over time (the full effect of implementation will not be felt for a number of years).

Action 5.2. Develop a code of practice for installation of heaters

Heaters must be installed properly, as inappropriate installation can greatly increase the negative impact of smoke emissions.

The EPA is working with the key players, including industry and councils, to facilitate the development of a comprehensive industry code of practice—covering all aspects of the installation of domestic solid fuel heaters—scheduled to be available in early 1998.

The industry code will be made available to local councils, domestic solid fuel heater retailers, consumer bodies and relevant licensing and training authorities. It will provide useful information and education material.

Action 5.3. Conduct a community education program on using wood heaters

Armidale City Council and the EPA began a pilot education campaign in 1996, focusing on the correct operation of wood heaters and the use of seasoned wood to reduce emissions. The pilot provided a successful model and the EPA extended the program as part of the 1997 winter campaign to reduce brown haze pollution in Sydney and regional centres (including Wollongong, Newcastle, Dubbo, Orange, Lithgow, Oberon and Queanbeyan).

The EPA will continue to work with local councils, the industry association, retailers and the media on a regular community education program addressing these issues in Sydney and other relevant regional centres.

Action 5.4. Continue voluntary 'Don't Light Tonight' campaign

The environmental and health impacts of wood heaters, especially those that do not meet the new emissions standards, are most severe on cold and still nights when smoke emissions are poorly dispersed. Reducing wood smoke emissions on such nights is a clear priority and there is strong community support for direct, voluntary action of this kind.

The EPA began the voluntary pilot 'Don't Light Tonight' public information campaign in 1997 in Sydney, targeting open fires and old, uncertified solid fuel heaters – conveying the information through radio and television weather forecasts. Preliminary indications are that Sydney residents responded positively. The program is now to be continued beyond its pilot phase.

The EPA will continue to work with the industry association and local government to assess the benefits of taking further action including:

- guidelines for wood suppliers to ensure wood for sale is properly seasoned, hard wood
- possible regulatory action by local councils to fix smoky house chimneys
- incentives for owners of old wood heaters to upgrade to certified wood heaters, or to gas or electricity, as an alternative fuel source. Armidale Council is investigating interest-free home loans for this purpose.

Strategy B. Improve energy-efficiency of homes

Energy efficiency in homes is an important element in the overall push for energy efficiency. Our broad environmental objectives are to reduce the emission of pollutants, minimise the burning of fossil fuels, encourage the use of energy from renewable sources and reduce greenhouse gas emissions.

Local government has a major role in promoting energy efficiency through its planning and development responsibilities, and some councils have been very active on this front. It is also a high priority for the NSW Government, involving a number of agencies but largely driven by the Sustainable Energy Development Authority (SEDA). The Department of Energy is responsible for programs with a regulatory focus, including appliance energy labelling and Minimum Energy Performance Standards (MEPS) for refrigerators and electric storage water heaters (from 1999). A national framework for dealing with energy labelling and MEPS has been developed.

Action 5.5. Implement the 'Energy Smart Homes' program

SEDA is working through partnerships with local government and the building industry on

implementing its Energy Smart Homes program—designed to reduce the imported energy requirements of new and existing homes for heating, cooling and ventilation. The program will make use of education and public information initiatives, demonstration projects and land-use planning. The overall strategy will be supported by a $6 million allocation from SEDA over the next three years as well as by contributions from local government.

The targeted outcomes of the Energy Smart Homes program are:

- 60% of new homes granted building applications between mid-1997 and 2002 will have a 'minimum energy performance' rating;
- 90% of new homes and 70% of major retrofits requiring a building application will have at least an 'improved energy performance' rating.

The program is being developed in stages and has a number of elements:

- Energy Smart councils
  SEDA aims to work with local councils to assist them to reduce their own energy consumption and promote energy-efficient practices in the building sector and broader community. This includes adopting an energy-efficient housing policy: promoting energy conservation to their residents, making their own premises more energy-efficient and considering the purchase of some portion of their electricity through a SEDA-accredited Green Power Scheme.
- Energy Smart homes policy for councils
  This initiative aims to introduce an 'energy efficiency' housing policy into 50 local governments covering 80% of new homes and home alterations in NSW. It requires councils to do everything that is cost-effective for saving greenhouse gases. These may include improvements to the building envelope, and savings from hot water through more energy-efficient systems and showerheads (saving up to 30% of greenhouse gases from the domestic sector).
- Energy Smart home builders
  Land developers, home designers and home builders taking part in this scheme must design and build houses to comply with SEDA's minimum requirements for energy efficiency. This includes the supply of energy-efficient fittings and appliances with a packaged home. Partners in the scheme include:
  - land developers who divide up land so as to optimise solar access for future houses
  - home designers using passive solar principles that reduce the need for mechanical heating, cooling and lighting
  - home builders including specifications of the Energy Smart Designers program, such as wall and ceiling insulation.

Other SEDA residential programs will include Energy Smart Homes Make-Over—a retrofit program promoting insulation, efficient windows, daylighting systems and other energy savers.

Objective 6. Manage the impact of open burning

Objective: To implement effective smoke management programs, recognising the importance of hazard reduction burning in controlling bushfires.

Major reductions in pollution from open burning activities have been achieved during the last decade, particularly in the metropolitan area. The effect of the Clean Air (Control of Burning) Regulation introduced in 1995 has been to prohibit backyard burning in the Sydney and Wollongong metropolitan regions.

The major open burning issue for Sydney air quality now relates to bushfire hazard reduction and forestry management burning. There is also some impact from ecological and bush regeneration burns; and, in regional centres, the problem extends to agricultural open burning. Smoke from these activities can create both nuisance and health effects and, in certain weather conditions, contribute to brown haze. However, they are vital activities in preventing uncontrolled bushfires.

Strategy A. Manage the impact of open burning

The *Rural Fires Act 1997* put in place recommendations responding to the NSW Bushfire Inquiry of 1994. The Act creates a more cohesive and integrated fire-fighting

structure in rural areas and incorporates an enhanced environmental focus. Ecological sustainability is identified as a guiding principle for key bodies, including the NSW Rural Fire Service. The Act also provides for bushfire risk-management plans and operational plans being able to restrict the use of fire in environmentally sensitive areas.

Future actions to minimise the impact of open burning include:

Action 6.1. Release a users' guide to open burning restrictions (March 1998)

A users' guide to open burning restrictions will ensure those responsible for hazard reduction and other open burning fully understand the relevant statutory requirements relating to clean air as well as open burning management.

The EPA and the Department of Rural Fire Services (RFS) are developing clear guidelines to provide a plain-English description of all relevant provisions and implications of the Clean Air and Rural Fires acts. The guidelines will be finalised in early 1988 and made available to all relevant fire control officers in local councils, the RFS, the NSW Fire Brigade, State Forests and the National Parks and Wildlife Service (NPWS), and will also be integrated into future training courses.

Action 6.2. Develop smoke management guidelines for open burning (June 1998)

Smoke management guidelines will help to implement best practice in the management of fires.

Hazard reduction burning must be undertaken to allow maximum control of bushfires. Good forest management, native plant regeneration or agricultural work can also require open burning. But the impact of prescribed burning on air quality can be greatly reduced if best practice in smoke minimisation is understood and implemented. Factors such as fuel moisture content, wind speed and direction, and overall weather conditions can affect the amount of smoke emitted. Smoke-sensitive areas such as schools, retirement villages and hospitals need to be identified and strategies must be put into place to reduce the impact of smoke on these areas. Where appropriate, alternative management options, such as the removal and disposal of hazardous materials by other means, should be considered.

Smoke management guidelines, setting out best practice, are being developed by the NPWS in consultation with the Department of Rural Fire Services, State Forests and the EPA for release in early 1998. They will be submitted to the Bush Fire Coordination Committee for approval and will be integrated into bushfire risk management and prescribed burning training programs over the following two years.

Action 6.3. Educate the community on open burning restrictions

It is important that the community is aware of the wide-ranging restrictions on open burning and the use of incinerators, and has ready access to clear information on how these restrictions apply in particular locations. Because the controls vary across the State, it is often quite difficult for members of the public to sort out the requirements for their particular locality. The EPA Pollution Line receives regular requests for advice on this issue as do local councils and the fire services.

The EPA will work with local councils, the Department of Bush Fire Services, the Fire Brigades and NPWS to produce a clear community information package for distribution through local councils, Bush Fire Brigade depots, fire stations and Pollution Line. These will be available in early 1998.

Objective 7. Monitor, report on and review air quality

Objective: To provide for the ongoing monitoring and future development of the NSW Air Quality Management Plan, based on new scientific, economic and social information, wide collaboration and open consultation.

Action for Air is a long-term plan based on the best information and resources available in 1997. Because of its 25-year time frame, it is an adaptive plan that will be monitored and evaluated against its own goals. Each new stage of research and planning will take into account the cumulative impact of the strategies of the previous phase.

The final key objective of *Action for Air* is to provide for ongoing monitoring and development of

the Regional Action Plan based on scientific, economic and social information, wide collaboration, and open and full consultation.

The major strategies for achieving this are:

- improving access to air quality monitoring data and modelling results
- ensuring an effective and regular review process for the plan is in place
- reporting regularly on the state of air quality in NSW.

Monitor, report, review

It is the cumulative effect of actions over many areas by government, industry and the community that will maintain and improve our air quality in the future. As a community, we need open and accessible ways of monitoring this cumulative process.

The NSW Government already monitors and reports on air quality in the GMR and assists local government in some regional areas to establish local monitoring programs. The community has daily access to this information through television and newspaper weather reports. In addition, the EPA publishes quarterly reports on air quality. There is considerable community, local government and academic interest in this information.

Action 7.1. Provide Internet access to air quality data by mid-1998

The EPA will upgrade community access to data on air quality by providing Internet access to daily and quarterly reports by mid-1998.

Action 7.2. Set up an air quality modelling interest/advisory group

The Metropolitan Air Quality Study (MAQS) has developed the capacity for sophisticated modelling of long-term air quality trends, including the predicted impact of policy interventions. The Government will open this process to greater industry, community and scientific participation.

The EPA will set up an air quality modelling interest/advisory group with representatives from community interest groups, universities, CSIRO, industry and government. The group will provide a forum to identify priorities for future modelling work.

Action 7.3. Report on results of the air toxics study

The Government has provided the EPA with $500,000 to investigate the levels of air toxics in the GMR. This will build on the pilot air toxics study of the Sydney airshed in 1996, and provide a sound basis for assessing the need for specific actions to protect the community from unsafe levels of these toxics.

The EPA will report on the results of its pilot study in early 1998 and on its more comprehensive monitoring data when completed.

Action 7.4. Reconvene key technical committees with industry groups

The joint EPA/Industry Technical Committees will be reconvened to undertake further work. This will include investigating innovative responses to unresolved issues, especially pollution from heavy vehicles, and fuel quality issues.

Action 7.5. Metropolitan Strategy Committee to review environmental matters

The Metropolitan Strategy Committee, a whole-of-government body that coordinates integrated land use, transport and environment planning, will annually review environmental considerations including the achievement of air quality goals. This will provide an important link between urban planning and environmental planning.

Action 7.6. Convene a public forum to report regularly to Government

The NSW State of the Environment Reports must be produced and tabled in parliament every 3 years.

State of the Environment reporting provides an ideal opportunity for public review of the status of our air quality and the effectiveness of air quality strategies. It is an ideal context for identifying emerging issues, new technologies and possible solutions. The EPA will convene a broadly based forum within six months of the publication of each *NSW State of the Environment* report to encourage public input on air quality trends and strategies. The forum's report to the Government will help guide future development of the Action Plan.

4 How were the strategies selected?

The strategies in the Regional Action Plan were selected on the basis of feasibility, community acceptance, and both environmental and economic effectiveness.

Modelling

The photochemical smog strategies were modelled for environmental and economic impact over the 25-year timeframe set for *Action for Air*.

The Metropolitan Air Quality Study (MAQS) provided the tools for the environmental impact modelling, with scenarios ranging from 'No New Initiatives' to the ultimate 'Beyond State of the Art' in control and management. Modelling allows for the projection of the peak levels of ozone that might occur under worst-case conditions but does not allow for projection of the number of possible exceedences in any one year.

No new initiatives

This scenario provides for no new strategies but assumes existing control programs will continue until 2021. It reveals that gains in air quality will continue using this approach and peak ozone levels will continue to be reduced—although they will not achieve NSW interim or long-term goals. Ongoing reduction of peak ozone levels in this scenario comes through the phasing-in of strategies already agreed upon, particularly relating to new motor vehicle standards such as ADR 37/01.

Beyond state-of-the-art

This scenario incorporates an exhaustive array of state-of-the-art initiatives and an 18% reduction in the total projected VKT in 2021. Many of these strategies are not available for current implementation in NSW—e.g. the development of ultra-low emission vehicles (foreshadowed in California) or extensively reformulated motor fuel. The modelling reveals this level of control may be necessary to ensure the current NHMRC ozone goal is not exceeded by 2021. Even this extensive suite of strategies may not ensure that there are no exceedences of the Government's long-term ozone goal by 2021. Progressive monitoring of the effectiveness of strategies will be needed if compliance with the long-term goal is to be achieved.

AQMP package

This scenario estimates the impact of all the smog-management strategies outlined in *Action for Air*. The strategies will ensure substantial improvement in air quality by 2021, but the model indicates the Government's short-term and long-term ozone goals may still be exceeded on occasion under worst-case conditions. Therefore, ongoing review of the effectiveness of the strategies will be essential.

The strategies will be re-evaluated regularly in the light of new air quality data, trends and technological advances, allowing the Government to augment strategies as needed.

Economic impact analysis

The EPA has undertaken cost-effectiveness analysis of the various strategies, focusing on the cost of reducing the smog precursors NO_x, ROCs and CO. Many of the strategies will also bring about reductions in fine particle emissions, air toxics and greenhouse gases.

Information was gathered from a range of sources. First, the EPA commissioned Peter Ramsey and Associates to collect data on industrial control costs and effectiveness. The resulting report, *Air Pollution Prevention and Control Option Costs* (June 1996) identified a number of cost-effective options for smog-reduction strategies. Some of these were identified as likely to achieve cost savings for industry through cleaner production.

To gain direct local information, joint EPA/Industry Technical Committees were set up across a number of areas: petroleum, natural gas, power generation, surface coatings and adhesives, chemical manufacturing, dry cleaning, printing, bitumen and aerosols. The committees developed local cost data and cost-effectiveness analyses of proposed strategies. Industry, particularly the petroleum industry, made considerable helpful data available; other cost data were gathered from State

and national industry associations. Overseas cost data were collected for comparative purposes and used in some contexts where local data were not available.

The results of this costing analysis for key strategies are summarised in *Appendix 3*.

5 From global to local – achievements to date

Although *Action for Air* focuses on air quality at the regional level, the Government recognises that local, regional and global air-quality issues are interconnected, and is committed to action at the global and local levels as well.

Air quality in NSW is improving as a result of existing strategies to control emissions. This section explores the range of initiatives that have already been put in place to alleviate global, regional and local air quality problems.

Global issues

Background

Ozone is present in both the lower and upper atmospheres. In the upper atmosphere (more than 10km above the Earth) ozone plays an essential role in protecting plant and animal life from the harmful effects of ultraviolet radiation.

The *NSW State of the Environment* Reports present information on the depletion of ozone over Australia, and its potential health implications. Scientists have calculated that ozone depletion would result in a 5-10% increase in UV-B radiation in Sydney between 1990 and 2000.

Climate change is the other major problem at the global level. The presence of greenhouse gases in the atmosphere has an insulating effect which leads to warming of the Earth's surface: greenhouse gases such as carbon dioxide, methane and nitrous oxides trap part of the heat being radiated from the Earth back into space. While the 'greenhouse effect' occurs naturally and is essential for sustaining life on Earth, scientists now generally believe that the accumulation in the atmosphere of increased amounts of greenhouse gases produced by human activities—particularly by burning fossil fuels—is intensifying global warming.

Response

Climatic change and greenhouse gases are being tackled through a broad NSW State strategy—set in the context of the National Greenhouse Strategy—which is the key institutional driver for the development of renewable energy sources, research and development policy, and improved energy efficiency in the community.

The effort is spearheaded by the NSW Sustainable Energy Development Authority (SEDA), established in 1996 to reduce the level of greenhouse gas emissions in NSW by investing in the commercialisation and use of sustainable energy technologies. The NSW strategy also includes proactive legislative reform of the electricity industry, as well as programs to control clearing of native vegetation. Because the transport sector is a major generator of greenhouse gas emissions in NSW, further benefits will flow from implementing *Action for Air*.

The relationship between greenhouse gas abatement and air quality strategies is complex. Although reducing fossil fuel emissions will improve overall air quality, some strategies may put pressure on local and regional air quality. For example, cogeneration results in lower overall greenhouse-gas emissions by improving the efficiency of energy use—but it inevitably creates NO_x. The need for reducing greenhouse gas emissions will have to be balanced with the need to improve regional and local air quality.

Implementation of the NSW Ozone Protection Regulation 1997 has brought NSW in line with national policies on ozone protection and control of hydrochlorofluorocarbons.

Regional issues

Background

The major regional air pollutants in the GMR and their effects on human health have already been discussed (see 'What's The Problem?' p. 9).

Response

An important achievement in regional air quality management is the Metropolitan Air Quality Study (MAQS), which set up a crucial airshed modelling and air quality monitoring system for Sydney, the Illawarra and the Lower Hunter, and generates

important scientific information on smog formation and transportation.

The Health and Air Research Program 1995 examined the health effects of major pollutants in parts of the GMR and provided a key rationale for the development of further strategies to address photochemical and fine-particle air pollution.

Two NSW Government green papers on air quality management were released for public consultation in May 1996. Responses to these significantly shaped the strategies contained in *Action for Air*. Appendix 1 provides details on the responses to the documents.

New, never-to-be-exceeded air quality emission standards for industry and controls on motor vehicles were implemented in revamped Clean Air Regulations in August 1997.

Regulatory and education strategies to reduce fine-particle/brown haze pollution were initiated in 1996 and 1997, including regulations to require new wood heaters to be certified to the Australian Standard and beginning a voluntary 'Don't Light Tonight' alert on high pollution days.

Innovative education programs on air quality have included:

- the successful Small Business and Environmental Solutions to Pollution Program run cooperatively by the EPA, local councils and small business
- the innovative 'Air Watch Breathe Easy' Air Quality Monitoring Program for schools and community groups
- State participation in the National Smogbusters Program.

NSW has actively participated in the following national initiatives on air quality:

- development of the National Environment Protection Measure (NEPM) for air quality, covering ozone, sulfur dioxide, nitrogen dioxide, lead, carbon monoxide and fine particles
- development of the NEPM for a National Pollution Inventory
- the National Inquiry into Urban Air Quality
- national forums to set standards to reduce emissions from motor vehicles.

Local issues

Background

The major air pollutants at the local level are lead, air toxics, carbon monoxide and sulfur dioxide.

Lead is a toxic metal than can damage human health when inhaled or ingested. Recent overseas research indicates a strong correlation between blood lead concentrations in children under four, and lead concentrations in the air. Lead is known to cause learning disabilities and to retard mental development in children.

The main sources of lead in air are cars using leaded petrol, and base-metal works. Concentrations are now well below NHMRC guidelines, even in the Sydney CBD. Occasional exceedences occur in Port Kembla and northern Lake Macquarie.

The Government has signalled lead as a priority issue.

Air toxics are airborne pollutants that can cause cancer or otherwise harm health and the environment. They can be naturally-occurring or of human origin. Nearly 200 hazardous air pollutants have been identified by the US EPA, including benzene, dioxins, cadmium, organochlorides, halogenated ethylenes and PCBs.

Although overseas goals do exist for a few air toxics, there is generally neither good information nor any standard process in Australia for setting goals.

Air toxics have been identified as a priority issue by the NSW Government and nationally.

Carbon monoxide is an asphyxiant that reduces the oxygen-carrying capacity of the blood, placing additional strain on the heart as it increases its output to compensate.

Monitoring of results from the regional network show that the NHMRC goal has not been exceeded except at the monitoring station in the centre of the Sydney CBD. This station is purposely set up to monitor peak concentrations rather than the general exposure of the population. Concentrations at this site are declining.

Sulfur dioxide can irritate the respiratory system, contributing to diseases such as chronic bronchitis. Ambient sulfur dioxide in NSW results

largely from combustion of fossil fuels and smelting of mineral ores containing sulfur. Major sources are power stations, oil refineries and base-metal processing plants.

Exceedence of sulfur dioxide goals is associated with relatively few industrial premises and with power generation from coal. Regional concentration measures by the MAQS network show few instances of any established health goals being exceeded. NSW is fortunate that its fossil fuels are relatively low in sulfur.

Response

In 1996, a Lead Reference Centre was established to coordinate a whole-of-government response to managing all lead hazards, including lead-related air quality programs. There has been a dramatic improvement in the level of lead in our air, and this needs to continue.

Following a pilot study of selected air toxics in Sydney in 1996, the Government has allocated $500,000 to establish an ongoing air toxics monitoring program to quantify the toxic organic compounds present in the ambient air and develop an inventory of emissions from stationary and diffuse air-pollutant sources.

Integrated programs

The development by local councils in NSW of Local Air Quality Management Plans (LAQMPs) contributes positively to global, regional and local air quality. In 1994, the Sydney Regional Organisation of Councils published a manual on local air quality management (*Innovative Ways of Working Together*), to guide local councils on developing their own LAQMPs. A significant number of councils have begun to develop an LAQMP and others are committed to developing one.

Partnerships with industry and community groups are growing—e.g. the NRMA Clean Air 2000 Task Force. In June 1995, the NRMA launched a Clean Air 2000 campaign designed to reduce air pollution and traffic congestion in the GMR by the year 2000. The campaign's core activities are community education and efforts to mobilise key players. Clean Air 2000 is an important complement to *Action for Air*.

Appendixes

Appendix 1. Community feedback on air quality

Summary of main issues covered by responses to the green papers

The 70 submissions canvassed a wide range of issues with the following issues or recommended actions being mentioned most often:

Issue	No. of mentions
Carry out more extensive cost/benefit analysis	17
Introduce financial incentives to encourage environmental improvements	16
Coordinate all levels of government, industry, community	15
Increase public education	15
Establish performance measures for implemented strategies	12
Increase the provision of public transport	11
Employ more extensive long-term urban planning	11
Clearly define proposed action	10
Ensure whole-of-government approach	9
Green papers contain inadequate public transport options	9
Ensure enforcement of legislation	9
Promote national approach	9
AQMP uncertain until verification of Metropolitan Air Quality Study results	8
Green papers adequately cover air quality causes, effects, responses	8
Ensure strategies foster economic/social equity	8
Reduce motor vehicle emissions	8
Employ more extensive transport planning	8
Ensure strategies avoid financial impost on industry, agriculture	7
Increase use of rail freight	7
Set ecologically sustainable development, not health, goals	7
Increase traffic management	7
Encourage decentralisation	6
Promote energy efficient building design	6
Introduce fuel levy to subsidise environmental improvements	6
Introduce vehicle inspection/maintenance program	6
Foster motor vehicle/VKT reduction	6
Utilise new technology	6
Green papers do not assign ownership of proposed actions	6
Support local air quality managemnt plan process	6

List of respondents to the AQMP and SAP green papers

Government agencies

- Department of State and Regional Development
- Department of Urban Affairs and Planning
- Environment Protection Agency (now Environment Australia)
- NSW Treasury
- State Rail Authority

Local government

- Botany Bay City Council
- Camden Council
- Dungog Shire Council
- Fairfield City Council
- Ku-ring-gai Municipal Council
- Newcastle City Council
- Penrith City Council
- South Sydney City
- Southern Sydney Regional Organisation of Councils
- Sutherland Shire Council
- Sydney Regional Organisations of Councils
- Western Sydney Regional Organisation of Councils
- Wollongong City Council

Industry

- AGL Gas Co (NSW)
- Ampol
- Australian Chemical Specialties Manufacturers Association
- Australian Institute of Company Directors
- Australian Institute of Petroleum Ltd
- BHP
- BP Aust Ltd
- Catco Australia Pty Ltd
- Exhaust Systems Professional Association
- Macquarie Generation
- NSW Farmers Association
- NSW Minerals Council
- Pacific Power
- PPM Pty Ltd
- Shell Company of Australia Ltd
- State Chamber of Commerce (NSW)
- Telecommuting Australia Pty Ltd
- Waste Contractors and Recyclers Association of NSW
- Environment/community groups
- Bicycle New South Wales
- Clean Air Society of Australia and New Zealand
- NRMA Clean Air 2000
- Total Environment Centre
- Willoughby Environmental Protection Association

Individuals

- Mr A Batton, Moss Vale
- Mr G Borell, Petersham
- Mr R Burgess, Cronulla
- Mr S Clough, Hunters Hill
- Ms B Delaney, Greystanes
- Mr G Duff, Connells Point
- Mr J Fulford, Mittagong
- Ms H Gillett, Mt Warrigal
- Ms J Haim, Greystanes
- Mr W Hawtin, Rozelle
- Mr E Jefferay, Point Clare
- Mr I Jeisman, Yandina, Qld
- Mr M Kachka, Baulkham Hills
- Assoc Prof P Laird, University of Wollongong
- Mr P Lawson, Marsfield
- Ms K McDonnell, Hornsby Heights
- Mr P McKee, Northbridge
- Mr T Mohr, West Ryde
- Mr C Morgan, Chiswick
- Mr P Morison, Double Bay
- Mr P Motbey, Granville
- Mr M Oliver, Collaroy
- Mr D Owers, Dudley
- Mr R Pevely, Alfords Point
- Mr J Platt, Figtree
- Ms M Sinclair, St Marys
- Mr G Walker, Ingleburn
- Anonymous (2)

Appendix 2. Local councils committed to a local air quality management plan

The following councils have indicated that they are committed to a local air quality management plan:

- Bankstown
- Baulkham Hills
- Blacktown
- Botany Bay
- Camden/Campbelltown/Wollondilly
- Canterbury
- Fairfield
- Holroyd
- Kogarah
- Liverpool
- Marrickville
- Mosman
- North Sydney
- Parramatta
- Randwick
- Rockdale
- South Sydney
- Sutherland Shire
- Waverley
- Wollongong

Appendix 3. Estimated cost, effectiveness and cost-effectiveness of Action for Air smog action strategies

Strategy (possible implementation date)	Financial impacts	Average annual emission reductions (tonnes per year)	Cost-effectiveness ($ per tonne reduced)
National strategies			
New passenger vehicle emission standards (2003)	$250-$650 per vehicle	75,200 tonnes (ROC, NO_x & 1/7CO)	$460-$1,600
New heavy duty truck emission standards (2003)	$1,300-$10,000 per truck	1,800 tonnes (ROC, NO_x & 1/7CO)	$440-$3,500
State strategies			
Inspection & maintenance program (1998-2000)	$20-$25 per inspection (excluding repairs and fuel savings)	18,800-26,500 tonnes (ROC, NO_x & 1/7CO)	$1,800-$5,100
Lower fuel volatility (1998-2001)	Less than $0.002 per litre (excluding fuel savings)	5,800-8,300 tonnes (ROC, NO_x & 1/7CO)	$190-$320
Major industry ROC controls (1998-2003)	$50-$100,000 per refinery/petrochemical facility (less product savings)	2,600 tonnes ROC	$85-$160
Commercial premises ROC controls			
Printing (1998-2006)	N/A	1,200-2,800 tonnes ROC	$1,100-$2,300
Auto repair (1997-2002)	Net savings	315 tonnes ROC	Net savings
Install petrol vapour recovery units at rail loading gantries (1999)	$1.5m per gantry	310 tonnes ROC	$820

Notes: ROC = reactive organic compounds. NO_x = oxides of nitrogen CO = Carbon monoxide. The above strategies would be implemented at different times. For example an inspection and maintenance program in Sydney may be operational by 1998 whereas further new passenger vehicle emission standards may not be in effect until 2003.

APPENDIX 3: EMISSION SOURCES IN THE SYDNEY BASIN

Background

When air quality became an issue in the 1950s and the 1960s, the focus was primarily on the chimneys of its inner-city power stations, gasworks, oil refineries, chemical works and factories which emitted smoke, acid gases and particles into the air. The wide-spread use of coal and oil to fire the industrial furnaces and boilers of the day were a major problem. The Clean Air Act of 1961 assisted in the clean-up of the worst of these sources of visible point-source pollution.

As Sydney grew in the 1970s, attention shifted to other pollutants, including carbon monoxide, lead and photochemical smog and its precursors - volatile organic compounds (VOCs) and oxides of nitrogen (NO_x). The increasing car population (and cars with limited emission controls) was identified as a major source of these pollutants and in the early 1970s, initial steps were taken to regulate car emissions through the Clean Air Act and Motor Vehicle Regulations.

The worsening of the air quality in the 1970s as a result of rapid urban expansion and growth in vehicle ownership, led to the first of two major Air Quality Research Programs, the Sydney Oxidant Study, in the late 1970s. This drew together the skills and resources of the then State Pollution Control Commission (SPCC), CSIRO, Macquarie University and Sydney University to examine the problem and to recommend solutions. This study led directly to a number of actions, including:

- tighter controls on industry
- banning of backyard burning in urban areas
- the introduction of unleaded petrol in parallel with tighter emission standards providing exhaust catalyst technology on motor vehicles for the first time.

In addition to the initiatives above, the 1980s also saw the emergence of developments outside of Sydney in the Hunter (aluminium smelters, power stations and open cut coal mining). However, the closure of city power stations and the gradual movement of industry off-shore meant that the focus for Sydney was control of motor vehicle pollution and this remained a focus for subsequent years.

In the 1990s, community concern about the air quality impacts of the projected population growth led to two Air Quality Summits in 1991 and 1992 and the development of a Coordinated Action Plan on Air Quality that included the Metropolitan Air Quality Study (MAQS), an Integrated Transport Strategy (ITS) and the Metropolitan Strategy Review (MSR).

The MAQS was undertaken by the then EPA and was a major commitment by Government ($10 million over 3 years for scientific and health studies). This study led to the development of the Government's 25 year plan for Air Quality Management - *Action for Air,* launched in 1998 and addressed at two Clean Air Forums since (November 2001 and November 2004).

Action for Air has led to a number of significant initiatives including:

- Cleaner fuels including lower volatility petrol in Sydney
- Improved regulation of industrial emissions
- Tighter emission controls on motor vehicles (national legislation)
- Clean Air Program of initiatives.

More recently air toxics such as benzene and dioxin and particle pollution have been subject to additional attention, the latter on the basis of significant health studies both here and overseas. The results of DEC monitoring of air toxics in the GMR broadly found that ambient

levels of most air toxics were low and well below current international standards and benchmarks. The introduction of a 1% limit on benzene in petrol from 2006 will further reduce ambient levels of benzene.

Inventory Estimates

The various inventories have improved since the early estimates of emission source strengths. It is difficult to directly compare the various total emissions as techniques and coverage has changed and improved as our knowledge improves.

Some of the earliest comprehensive inventory data for Sydney was published by the Australian Environment Council and shows the following (figures in brackets are the % contribution to the total):

Summary of emission estimates – Sydney 1976 & 1985

Source	VOC (10^3 tonnes/yr)		NO_X (10^3 tonnes/yr)		CO (10^3 tonnes/yr)	
	1976 [1]	1985 [2]	1976 [1]	1985 [2]	1976 [1]	1985 [2]
Motor Vehicles	96.3 (48%)	78.5 (45%)	45.0 (75%)	59.4 (80%)	651 (89%)	633.1 (87%)
Other Mobile	5.2 (3%)	4.8 (3%)	3.6 (6%)	3.7 (5%)	27.0 (4%)	23.7 (3%)
Waste Combustion	1.2 (0.7%)	2.8 (2%)	2.0 (3%)	0.3 (neg)	27.6 (4%)	11.9 (2%)
Fuel Combustion	0.7 (0.3%)	13.3 (8%)	6.7 (11%)	6.4 (9%)	4.9 (0.7%)	41.0 (6%)
Petroleum/Solvent	86.7 (43%)	65.9 (38%)	2.9 (5%)	2.9 (4%)	0.3 (0.1%)	0.2 (neg)
Miscellaneous	9.5 (5%)	7.3 (4%)	0.2 (0.3%)	2.0 (3%)	16.9 (2%)	18.4 (3%)
TOTAL	**199.6**	**172.6**	**60.4**	**74.7**	**727.7**	**728.3**

Source: [1]Air emission inventory (1976) for the Australian capital cities, Australian Environment Council Report No. 2 (published 1981)

[2]Air Emission inventories (1985) for the Australian capital cities, Australian Environment Council Report No. 22, published 1988

When this is broken down into the categories used in later inventories (eg MAQS in the 1990s), we get the following relative contributions:

Relative contribution of inventory sources – Sydney 1976 & 1985

Source	VOCs (%)		NO_X (%)		CO (%)	
	1976	1985	1976	1985	1976	1985
Industry	11	11	14	11	<1	<1
Mobile Sources	51	47	81	85	93	90
Domestic/Commercial	38	41	5	4	7	10

In terms of the major sources, motor vehicles were found to be the dominant source of precursors to photochemical smog (VOCs and NO_x) at this time. This led to the development of the Unleaded Petrol Program and related vehicle emission standard changes and ultimately to the progressive introduction of more stringent emission standards that we have today.

With the advent of the Metropolitan Air Quality study (MAQS), the inventory was improved and the Table below shows the contribution by sector of volatile organic compounds (VOCs) and oxides of nitrogen (NOx), and particle emissions for the Sydney Region in 1992 and 2002. The relative contribution from motor vehicles of each pollutant fell over this period, and is expected to decline further over the next 10–15 years. Nevertheless, mobile sources remain the major source of air pollution in Sydney.

	VOCs (10^3 tonnes/yr)		NO_x (10^3 tonnes/yr)		Particles (10^3 tonnes/yr)	
	1992	**2002**	**1992**	**2002**	**1992**	**2002**
Industry	16.8 (10%)	19.5 (14%)	13.4 (13%)	15.6 (18%)	8.3 (33%)	9.7 (40%)
Mobile Sources	83.8 (49%)	59.6 (44%)	83.5 (82%)	67.8 (76%)	7.9 (31%)	4.7 (19%)
Commercial/domestic	70.0 (41%)	56.8 (42%)	4.8 (5%)	5.2 (6%)	9.2 (36%)	10.0 (41%)

Table: Comparison of 1992 and 2002 Sydney Region emissions by source

Between 2002 and 2020, it has been forecast that VOC emissions from motor vehicles will fall by 46%, NO_x by 67%, CO by 75% and particles by 40%.

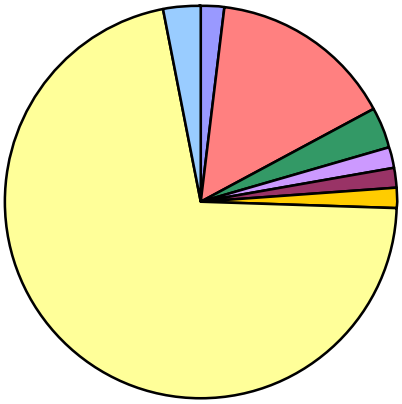
The DEC is completing a new, more comprehensive emissions inventory, full results of which are to be released shortly. This will give detailed and up to date information on the contribution of the various emissions sources for both Sydney and the Greater Metropolitan Region (GMR). The figures below, based on the new inventory results, show the proportionate contributions to NOx, VOCs and PM_{10} emissions of various source sectors in the Sydney region.

From this most recent work, motor vehicles remain the most significant source of precursor pollutants for ozone in Sydney, and are responsible for about 71% of NO_x and 38% of anthropogenic VOC emissions. Commercial-domestic sources, including aerosols, solvents and industrial surface coatings, are estimated to contribute 42% of anthropogenic VOCs. Major industry contributes about 15% of NO_x and 11% of anthropogenic VOCs in the Sydney region.

The major sources of anthropogenic particle emissions in the Sydney Region are industry (36%); the commercial and domestic sectors (35%); and motor vehicles (12%). Domestic wood heating makes up a significant proportion of commercial / domestic emissions and diesel vehicles are the major contributor to motor vehicle emissions.

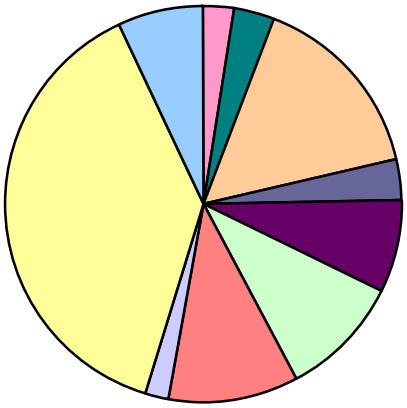
Anthropogenic sources of NO_x, VOC and PM_{10} emissions, Sydney 2003

NO_x



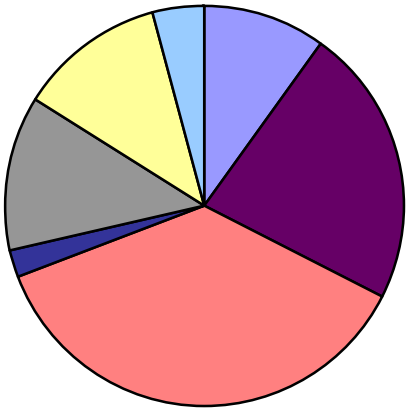
- Commercial Businesses (Non EPA Licensed): 2.0%
- Industrial Premises (EPA Licensed): 15.1%
- Aeroplanes: 3.5%
- Commercial Ships: 1.7%
- Industrial Premises - Off-Road Vehicle Exhaust Emissions: 1.6%
- Railways: 1.7%
- Motor Vehicles: 71.1%
- Other Sources: 3.2%

VOC



- Automotive Fuel Retailing: 2.6%
- Smash Repairing: 3.2%
- Domestic-Commercial Aerosols & Solvents: 15.6%
- Domestic Lawn Mowing: 3.2%
- Domestic Solid Fuel Heating: 7.5%
- Commercial-Domestic-Industrial Surface Coatings: 10.1%
- Industrial Premises (EPA Licensed): 10.6%
- Recreational Boating: 1.7%
- Motor Vehicles: 38.4%
- Other Sources: 7.0%

PM_{10}



- Commercial Businesses (Non EPA Licensed): 9.9%
- Domestic Solid Fuel Heating: 22.6%
- Industrial Premises (EPA Licensed): 36.7%
- Commercial Businesses - Off-Road Vehicle Wheel-Generated Dust: 2.2%
- Industrial Premises - Off-Road Vehicle Wheel-Generated Dust:12.6%
- Motor Vehicles: 11.9%
- Other Sources: 4.1%

Source: DEC data 2006

Principal Sources of Other pollutants monitored under Ambient Air Quality NEPM

Motor vehicles are the dominant source of carbon monoxide (concentrations of which have fallen below national standards) and also of nitrogen dioxide. Total man made emissions of sulfur dioxide during the 2003 calendar year in the GMR have been estimated to be approximately 301,700 tonnes per annum. Coal fired electricity generation, aluminium production, iron and steel production and petroleum refining contribute approximately 96.5% of the total.

In contrast, total man made emissions of sulfur dioxide during the 2003 calendar year in the Sydney region have been estimated to be approximately 13,800 tonnes per annum, which is relatively minor at approximately 4.6% of the GMR total. Maximum hourly ambient concentrations in the Sydney region were less than 25% of the AAQ NEPM standard of 0.20 ppm. Higher concentrations are observed in the Illawarra and lower Hunter regions as a result of industrial emissions.

Changes to fuel formulation have brought marked reductions in the concentrations of lead in the atmosphere. Annual averages in the Sydney region are now less than 20% of the AAQ NEPM standard of 0.5 $\mu g/m^3$. With a complete ban on lead in petrol now in force, the primary source of lead in air at the regional scale has been eliminated. Using current methodology, ambient concentrations of lead were frequently below detection limits and therefore routine monitoring of lead ceased in December 2004.

APPENDIX 4 NSW AIR QUALITY LAWS AND REGULATIONS, 1951–2005

The table below presents a brief history of key pollution legislation, regulation and actions in NSW from the commencement of air quality measurements in 1951 to 2005.

NSW AIR QUALITY LAWS AND REGULATIONS: 1951–2005	
DATE	**ACHIEVEMENT/MILESTONE**
1951	Australia's first ambient air quality measurements – dustfall in Sydney and Newcastle. • Dust in Pyrmont averaged 18g/m^2/month. Measurement now is 2g/m^2/month.
1961	Clean Air Act commences. • Milestone legislation to control industrial air pollution, administered by the Department of Public Health.
1964	Clean Air Regulation introduced. • Specified emission standards for many key air pollutants, eg, smoke, solid particulate matter, soot, sulfur trioxide and sulfuric acid mist, sulfur dioxide, fluorides and hydrofluoric acid, chlorine and hydrogen chloride, hydrogen sulphide, nitrogen oxides, metals (lead, antimony, arsenic, cadmium and mercury). • Particle standard for industry set at 400mg/m^3. • Concepts of scheduled and non-scheduled premises utilised.
1967	First prosecution under the Clean Air Act. • Brick company for emissions of black smoke, prosecuted by the Air Pollution Control Branch and the Department of Public Health.
1970	State Pollution Control Commission (SPCC) Act commences. • Constituted the SPCC to oversee, investigate and resolve environmental issues.
1972	Clean Air Regulation amended. • Particle standard for scheduled industry tightened to 250mg/m^3. • New limits for some other pollutants.
1974	Staff of Department of Environment, Health's Air Pollution Control Branch, among others, combined, with relevant legislation, under a strengthened SPCC.
1974	Introduction of industry monitoring of air quality.
1974	Clean Air Act and Regulation amended. • Smoke from diesel vehicles limited to less than ten seconds. • Tampering with motor vehicle anti-pollution devices prohibited.
1975	Clean Air Act amended. • Penalties to industry increased from $400 to $10,000. • Power to grant or refuse licence to operate. • Non-industrial sources acknowledged, eg, motor vehicles and backyard burning.
1975	Daily public air quality reports commence.
1975 to 1977	Sydney Oxidant Study • Major study of photochemical smog (ozone) in Sydney by SPCC, CSIRO and universities.
1977	Ministerial Order prohibiting all incinerators and open burning in selected areas of City of Sydney.
1978	Sydney Pollution Index (SPI) commences. • Numerical index based on particle and ozone levels. • Daily media releases.
1981	Clean Air Act and Regulation amended. • Strengthened provisions regarding excessive smoke from motor vehicles and tampering with anti-pollution devices.
1982 to 1986	SPCC studies found that, unlike many other industrialised communities, NSW did not have a problem with acid rain.
1985	Volatile Hydrocarbon Storage and Transfer Regulation introduced. • Vapour return and recovery for petrol distribution and some other operations. • Volatile organic chemicals (VOC) from petrol distribution in Sydney reduced by two thirds.

NSW AIR QUALITY LAWS AND REGULATIONS: 1951–2005	
DATE	**ACHIEVEMENT/MILESTONE**
1986	Unleaded petrol and exhaust catalysts introduced. • NSW decided to "go it alone" but was then joined by the other States. • Ambient lead levels significantly reduced.
1988	Control of Refuse Burning Regulation introduced. • Provided local councils with easy mechanism to restrict backyard burning.
1989	*Environmental Offences and Penalties Act.* • Fines up to $1 million. • Up to seven years gaol.
1989	*Ozone Protection Act.* • Controls or prohibits substances that deplete the stratospheric ozone layer, and articles that contain or use them.
1991	*Protection of the Environment Administration Act commenced.* • Constitutes the Environment Protection Authority (EPA), replacing the SPCC.
1992 to 1994	Metropolitan Air Quality Study (MAQS) • $10 million monitoring study of air quality in the Greater Metropolitan Region of Sydney, the Illawarra and Lower Hunter by the Environment Protection Authority. • Established a detailed emissions inventory to show the sources of photochemical pollution and brown haze. Health and Air Pollution (HARP) Study • By Department of Health in conjunction with MAQS. • Epidemiological studies show link between mortality and hospital admissions, and days of high pollution.
1993	*SPI expanded to Regional Pollution Index (RPI).* • Daily media reports. • Covered more pollutants, over greater time period. • Covered five distinct regions: Illawarra, Lower Hunter, and East, North West and South West Sydney.
1995	Clean Air Regulation amended. • Included specifications for domestic solid fuel heaters.
1997	Clean Air Regulation amended. • Particle emission standard for scheduled industrial sites tightened to 100mg/m^3. • Particle emission standard for non-scheduled sites tightened to 250mg/m^3. • Inclusion of extra metals: beryllium, chromium, cobalt, manganese, nickel, selenium, tin, vanadium. • First Australian regulation limit for dioxins and furans.
1997	Clean Air Regulation separated into four Regulations for: • Domestic Solid Fuel Heaters • Motor Vehicles and Motor Vehicle Fuels • Plant and Equipment • Control of Burning
1997	*Don't Light Tonight unless Your Heater's Right.* • Encouragement for woodheater owners to use alternative heating when weather conditions are not conducive to smoke dispersion. • Announced in media with the RPI. • Since 1998, only five requests have been necessary, the last being on 22 June 2001.
1998	Release of *Action for Air* • All-of-government, 25-year air quality management plan for Greater Metropolitan Region of Sydney, the Illawarra and Lower Hunter. • Key regional pollutants targeted: photochemical smog (ozone) and fine particles. • Key pollution sources: industry, motor vehicles and domestic/commercial.
1998	National Environment Protection Measure for Ambient Air Quality. • All Australian jurisdictions agree to standards and goals for six criteria air pollutants: • Carbon dioxide, nitrogen dioxide, ozone, sulfur dioxide, lead and fine particles (PM_{10}) (a variation is made in 2003 to include an advisory reporting standard for $PM_{2.5}$)

NSW AIR QUALITY LAWS AND REGULATIONS: 1951–2005	
DATE	**ACHIEVEMENT/MILESTONE**
1999	Protection of the Environment Operations (POEO) Act commences. • Consolidates several pieces of environmental legislation including Clean Air Act. • Incorporates "precautionary principle" and "polluter pays". • Introduced Load Based Licensing whereby fees are linked to pollutant load from premises.
2001	First Clean Air Forum – Public review of *Action for Air*. Key topics: • Land use planning and public transport use • Motor vehicle emissions • Industrial, commercial and domestic emissions • Maximising health outcomes
2001	National Environment Protection (Diesel Vehicle Emissions) Measure • Australian jurisdictions agree to a suite of programs to manage emissions from diesel vehicles.
2002	Protection of the Environment Operations (Clean Air) Regulation commences. • All domestic solid fuel heaters sold in NSW must meet Australian Standard emission limits and not be tampered with. • Provisions re smoky vehicles and tampering with anti-pollution devices strengthened with increased on-the-spot fines. • Diesel vehicles that meet Australian Design Rule 80/01 are exempt from requiring vertical exhausts (exemption applies to new models 2007, all new vehicles 2008). • Petrol to meet volatility limits to reduce VOC emissions. • Standards of concentration for emissions from scheduled and non-scheduled premises set.
2002	Air toxics monitoring program • A monitoring program for dioxins, organics, polycyclic aromatic hydrocarbons and heavy metals in NSW was conducted by the EPA from 1996-2001.
2002 to 2004	Woodsmoke Reduction Program (over three winters) in regional NSW. • administered by the Department of Environment and Conservation with $2.725 million from the NSW Environmental Trust. • Total of 18 councils and one group of councils participated in the program of public education, cash incentives to replace older, polluting heaters with cleaner alternatives, and enforcement. • Over 2000 polluting woodheaters scrapped. • 60 tonnes of woodsmoke prevented (equal to 6,600 heavy duty diesel trucks).
2003	Department of Environment and Conservation is formed. • EPA and other environment and conservation agencies are combined.
2004	Second Clean Air Forum – Public review of *Action for Air*. Key topics: • Climate change and air quality • Health impacts of air quality • Sydney's metropolitan strategy – towards sustainability
2004	National Environment Protection (Air Toxics) Measure. • Australian jurisdictions agree to improve information base for 5 ambient air toxics: • benzene, formaldehyde, toluene, xylenes and polycyclic aromatic hydrocarbons.
2004	Petrol Volatility Regulation. • During summer, oil companies required to supply petrol of lower volatility to reduce evaporative emissions of VOCs.
2004	Air Pollution Health Alerts introduced, in conjunction with NSW Health. • Public warnings by Chief Health Officer when air quality predicted to exacerbate conditions like asthma. • Announced with the daily RPI.
2005	Protection of the Environment Operations (Clean Air) Regulation amended. • New standards for industrial emissions. • Particle standard for industry tightened to 50mg/m^3.
2005	<u>Health Costs of Air Pollution in the Greater Sydney Metropolitan Region</u> • Study on the economics of air pollution

NSW AIR QUALITY LAWS AND REGULATIONS: 1951–2005	
DATE	**ACHIEVEMENT/MILESTONE**
2005	*POEO Act amended.* • Strengthening of licensing provisions. • Introduction of green offsets for licence holders. • Councils able to issue Smoke Abatement Notices for excessive smoke from domestic solid fuel heaters, with fines for non-compliance. • Increased penalty structure with clearer distinction between wilful and negligent conduct.

APPENDIX 5:
AIR POLLUTION LEGISLATION AND REGULATION ADMINISTERED BY DEC

In summary the main legislation that deals with air pollution consists of:

- The *Protection of the Environment Operations Act 1997*
- The *Protection of the Environment Operations (Clean Air) Regulation 2002*
- The *Protection of the Environment Operations (General) Regulation 1998*
- The *Protection of the Environment (Control of Burning) Regulation 2000.*

The Protection of the Environment Operations Act

The *Protection of the Environment Operations Act 1997* (POEO Act) is the key piece of environment protection legislation administered by the Department of Environment and Conservation (DEC).

The main POEO tools available to DEC to mitigate air pollution in the Sydney Basin are:

- Licensing
- Pollution Reduction Programs
- Environmental audits
- Load Based Licensing
- Enforcement programs.

Licensing
The POEO Act provides a single licensing arrangement relating to air pollution, water pollution, noise pollution and waste management. DEC is the appropriate regulatory authority for the activities specified in Schedule 1 of the POEO Act (scheduled activities). The DEC licenses these scheduled activities. In most cases, local councils are the regulatory authorities for non-scheduled activities, except activities undertaken by a public authority which DEC regulates or where a public authority has been declared the appropriate regulatory authority (see Part 4.6 *Protection of the Environment Operations (General) Regulation 1998*).

Under the POEO Act, DEC has powers to:

- require licensees to notify DEC of pollution incidents (section 148);
- undertake mandatory or voluntary environmental audits (Chapter 6);
- investigate and conduct legal prosecutions (Chapter 8);
- develop and implement economic measures (eg load based licensing) (Parts 9.3, 9.3A and 9.3B);
- set up a public register (Part 9.5).
-

Licences enable DEC to regulate those activities with significant potential to impact adversely on the environment, and to deal with any site specific environmental issues. The licence can include limits, operational, monitoring and reporting conditions and requirements to undertake and comply with a mandatory environmental audit program and pollution studies, reduction programs and to provide financial assurances. It is an offence to fail to comply with any licence condition.

The licence aims to reduce risks to human health and prevent the degradation of the environment by the use of mechanisms that promote the following:

- pollution prevention and cleaner production;
- the reduction to harmless levels of the discharge of substances likely to cause harm to the environment;
- the reduction in the use of materials and the re-use or recycling of materials;
- the making of progressive environmental improvements, including the reduction of pollution at source; and
- the monitoring and reporting of environmental quality on a regular basis.

Air Offences
In 2005, the POEO Amendment Act implemented recommendations arising from the five year statutory review of the POEO Act. Amendments that could influence air quality in NSW include:

- increased maximum penalties for offences under the POEO Act, including an increase from $1 million to $5 million for corporations that wilfully commit serious pollution offences; and
- introduction of smoke abatement notices to regulate smoke pollution from residential premises.

The consultation process for the POEO Act review, revealed a high level of satisfaction with the framework and philosophy of the Act and agreement from major stakeholders that there was no need for any major change in direction.

Pollution Reduction Programs
A Pollution Reduction Program (PRP) is a program, negotiated and agreed between a licensee and DEC, that requires improvements to works, methods or management practices to bring about environmental improvement. The PRP is attached to an existing licence by way of a licence variation and is therefore legally enforceable.

Environmental Audits
Ensuring industry, government and the community comply with environmental legislation is fundamental to environment protection and the delivery of credible cost-effective regulation. DEC uses compliance audits as a tool to complement its regulatory activities. As well as assessing compliance with existing requirements, DEC reviews industry best practice to encourage improved environmental performance.

DEC also reviews its regulation of individual premises and industry sectors to identify areas where improved regulation will help achieve the desired environmental outcomes. This may include the use of other tools such as education, consultation/negotiation and enforcement.

Protection of the Environment (General) Regulation 1998

National Pollutant Inventory (dealt with in Chapter 3A of the *Protection of the Environment (General) Regulation 1998*
The National Pollutant Inventory (NPI) is an emission reporting and public information system, available on CD ROM and the Internet. It is designed to provide the community, industry and government with data on types and amounts of certain emissions to air, land and water across Australia, and their impact on health and the environment.

The database has aggregated emissions data from industries, households and from mobile sources for selected areas. Contextual information is provided and this gives a description of each substance that must be reported against, its uses, sources and health effects. NPI data is mainly based on emission estimations, hence the data tends to be less rigorous than the pollutant loads reported under LBL. DEC administers the program in New South Wales.

Load Based Licensing (LBL) (dealt with in Chapter 2 of the *Protection of the Environment (General) Regulation*)
While POEO licensing and the Protection of the Environment Operations (Clean Air) Regulation prescribe air emission limits on industry, LBL seeks to manage the cumulative impacts of the pollutant loads by applying the 'polluter pays' principle. LBL provides an economic incentive to industry (licensees) to reduce their annual emissions of air and water pollution in NSW.

The LBL fee is based on the potential for pollutants from a licensee to impact on the environment i.e. the *amount* of pollution, how *harmful* it is and *where* it is emitted. The lower the potential environmental impact of a licensee's emissions, the lower the licence fee.

For each assessable pollutant, the LBL fee is calculated using the following factors:

- *assessable load* – the assessable load is the least of the actual load, the weighted load (where the actual load is discounted to reflect measures employed to reduce the harmfulness of discharges, such as effluent reuse), and the agreed load (a future load reduction committed to under a load reduction agreement with DEC);
- *pollutant weighting* – a factor that reflects the pollutant's potential to damage the environment;
- *critical zone weighting* – a critical zone weighting of between 1 and 7 applies for each assessable pollutant, to reflect sensitive or stressed environments;
- *fee rate threshold* – an emission threshold for each industry type and pollutant, set at a level that can be reasonably achieved with modern technology, the load fee essentially doubles beyond this threshold; and
- the *pollutant fee unit (PFU)* –- the amount of money that must be paid for each unit (kilogram) of pollution discharged.

In 2004, DEC introduced an across the board 45% increase in pollutant weightings for assessable air pollutants because evidence suggested that LBL provided a stronger incentives for reducing water pollutants than for air pollutants. The aim was to provide greater incentive for licensees to reduce the environmental impact of their air emissions.

DEC will continue to look at ways to improve the incentive force of LBL to reduce air and water pollution into the future. The closer pollutant fees are to industry-wide average abatement costs, the more licensees are likely to find it cost effective to invest in pollution abatement equipment, thereby reducing emissions, so as to reduce their LBL fees.

DEC is currently reviewing the *POEO (General) Regulation*. The review will assess:

- whether industries with significant emissions (those which the greatest potential for environmental impacts) are sufficiently covered in LBL; for example whether significant emissions reported via the National Pollutant Inventory (NPI) are adequately captured in the LBL scheme;
- approaches to maintain and increase the incentive force of LBL, for example ways to ensure the incentive provided by load fees is not eroded over time.

<u>Protection of the Environment Operations (Control of Burning) Regulation 2000</u>

The Regulation:

- controls burning in the open or in incinerators in local government areas;
- allows the EPA or local councils to grant approvals for burning in the open or in an incinerator in certain circumstances; and
- prohibits the burning of certain articles (including tyres, paint and solvent containers, and certain treated timbers).

<u>Protection of the Environment Operations (Clean Air) Regulation 2002</u>

In relation to industry emissions, the Regulation:

- sets maximum limits on emissions from activities and equipment;
- provides a framework to review the adequacy of older emission standards that apply to existing industry;
- provides performance requirements for equipment used to control toxic air pollutants and a best-practice emission standard for dioxins and furans for activities where these toxic compounds are likely to be produced;
- imposes operational requirements for afterburners, flares, vapour recovery units and other treatment plant.

The Regulation also deals with the sale of domestic solid fuel heaters and requires the heaters to be certified as complying with emission limits set out in the relevant Australian Standard. In relation to motor vehicles, it deals with:

- the emission of air impurities, including excessive smoke from motor vehicles;
- the compulsory fitting and maintenance of anti-pollution devices, and exemptions from these requirements; and
- the method of transfer of petrol into a vehicle's fuel tank.

Enforcement Programs - Smoky Vehicle Compliance Program (POEO Act and POEO (Clean Air) Regulation Clause 8 – see above)
DEC is responsible for maintaining the Smoky Vehicle Compliance Program. The program focuses on improving vehicle owner compliance with regard to visible emissions from motor vehicles. Vehicle exhaust emissions are major contributors to photochemical smog and particle pollution. The smoke emissions can be odorous and visibly offensive. When a vehicle is emitting excess levels of smoke, it is likely that it is not properly tuned or maintained.

The smoky vehicle regulations have been enforced since the mid-1970s. RTA, local council and Police officers also assist DEC in enforcing the smoky vehicle laws. Up to 1000 reports from the public on smoky vehicles are received by the DEC's Environment Line each month. DEC and other officers who have been trained in smoky vehicle observation and reporting regularly patrol streets and highways in NSW to observe and report smoky vehicles. An enforcement officer (who has undertaken the training and been officially designated to enforce the relevant legislation) may automatically issue the owner of a smoky vehicle used for commercial purposes with a $400 fine.

Commercial vehicles often travel far greater distances each year than privately owned vehicles, and may potentially emit far greater levels of pollution if they have smoky exhausts. They are therefore a particular target for enforcement action under the Smoky Vehicle Compliance Program. The community and DEC expect that commercial vehicle owners will have in place an effective maintenance regime to ensure that all of their vehicles comply with the regulations at all times when they are in use.

An enforcement officer may issue the owner of a smoky vehicle used for private purposes with a warning letter on the first observation. The warning letter requires that the owner have the vehicle repaired within 21 days. If it is not demonstrated that the vehicle has been satisfactorily repaired within 21 days, a $200 fine can be issued to the owner. Subsequent observations by an enforcement officer of the same vehicle smoking will result in a fine.

Defective Vehicle Notices can be issued and court action can be taken against owners of vehicles who fail to repair their vehicles as directed and/or which are observed on a number of occasions.

APPENDIX 6 AIR POLLUTION IN THE SYDNEY BASIN

Sydney's airshed and ozone and particle pollution

The features of Sydney's topography and meteorology influence the build up of pollution across the city and the areas where the highest levels occur.

The topography of Sydney and its surrounds forms a basin-like structure bound by elevated terrain to the north, west and south. In the west of the region is the Hawkesbury basin. This is separated from the rest of the region by the Blacktown ridge (Figure 1).

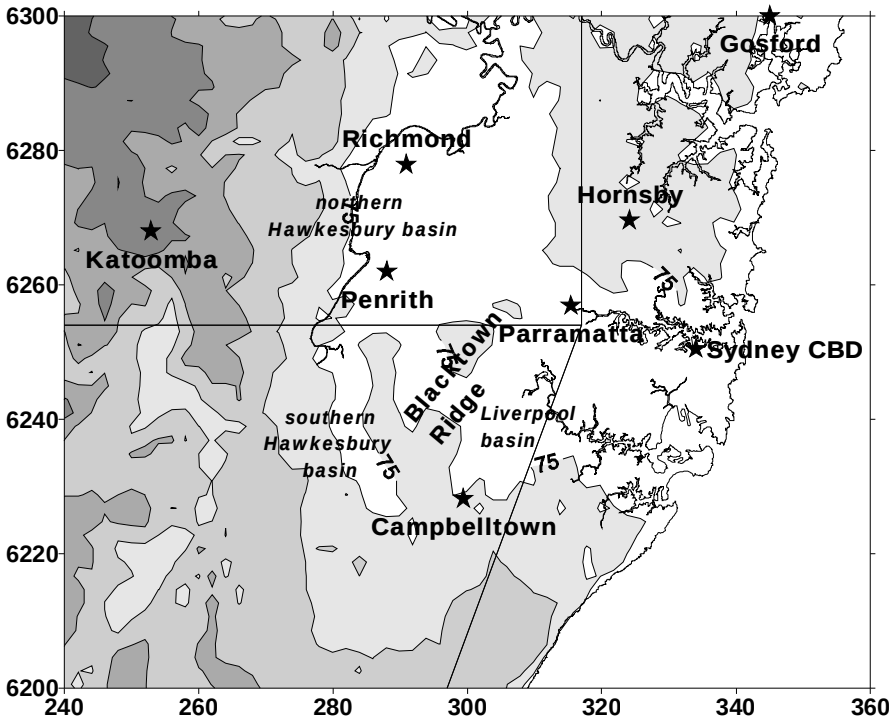


Figure 1: The Sydney Region

Air movement plays an important role in the formation and transportation of ozone in the Sydney region. For air quality purposes it is useful to consider the Sydney region as having three sub-regions – east, north west, and south west. These areas all interact and polluted air moves between them during the course of the day. There is also the potential for air movements between regions so that air is exchanged between Sydney and the Illawarra and Sydney and the Lower Hunter.

One of the key mechanisms which give rise to elevated ozone concentrations in western Sydney is the Sydney sea breeze. In the Sydney basin the sea breeze is generally north-easterly to easterly, and elevated concentrations of ozone within the sea breeze are observed in the north west, west, and south west of the basin.

<u>Ozone</u>

Ozone is a secondary pollutant in that it is not directly emitted from a source but is formed by the reaction between oxides of nitrogen (NOx) and volatile organic compounds (VOCs) in the presence of sunlight. It is of particular concern in the warmer months. How quickly ozone is formed depends largely on the temperature and the ratio of the precursor pollutants (VOC:NOx). Emissions of NOx and VOCs produced by morning peak hour traffic and other sources can be transported offshore. In the presence of sunlight they begin to react to form

ozone and with the arrival of the sea breeze the reacting plume is transported across the Sydney basin arriving in western Sydney mid to late afternoon (Figure 2).

Morning Flows **Afternoon Flows**

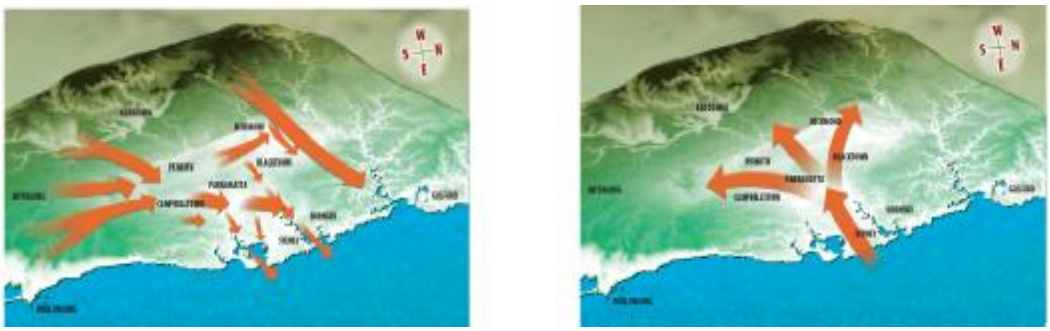


Figure 2: Morning and afternoon air drainage flows in the Sydney Region

Sydney regularly exceeds the current national ozone standards (see Figures 9-12) and tends to have more frequent and longer ozone episodes than other Australian cities. These exceedences arise from emissions within the basin. Bushfires can also generate exceedences with more occurring in bushfire years (for example in 1994 and 2001).

Because ozone is a secondary pollutant formed during daylight hours, the typical summer sea breeze leads to higher concentrations in western Sydney and hence more exceedences of the goal as shown in Figure 3. As the population of western Sydney increases, more people may be exposed to concentrations above the standards.

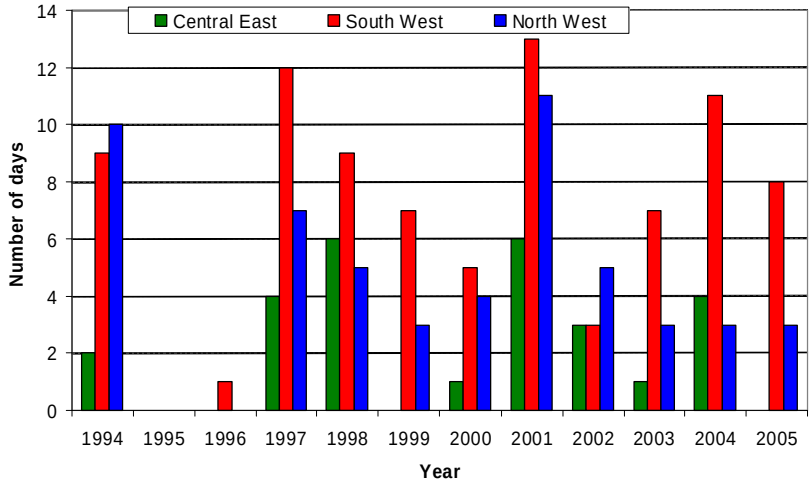


Figure 3: Exceedences of the NEPM one-hour ozone goal for the regions of Sydney

Motor vehicles are the most significant source of the pollutants contributing to the formation of ozone in Sydney. In the Sydney Region in 2003, they made up 38% of total VOCs and 71% of NOx. Other major sources of VOCs include evaporative losses from petrochemical industries and loss of solvents and fuel vapours from motor vehicles and commercial and domestic activities. Industry (e.g. power stations) are another major source of NOx emissions.

Air quality gains are likely due to tighter fuel and vehicle emission standards - with emissions of carbon monoxide, VOCs, NOx and particles all expected to fall significantly by 2020. Notwithstanding, motor vehicles will remain the most significant source of smog precursors in the Sydney Region. There is also a risk that gains from tighter fuel and vehicle emission standards will be eroded by growth in vehicle use and use of heavier vehicles.

Even with predicted gains from current policy, DEC modelling indicates that there will continue to be ozone exceedences in the Sydney Region.

Particles

Particle pollution can sometimes be seen in the metropolitan area as brown haze, usually during the cooler months of the year. This occurs most commonly in the late afternoon or the early morning, under cold, still conditions when surface temperature inversions are developing or breaking down. Particles differ from ozone in that they are predominately a primary pollutant ie they are emitted directly from a range of sources. Most exceedences of the NEPM standard for particles (PM_{10}) occur as a result of extreme events such as bushfires, dust storms and large-scale hazard reduction burning. As a result of the arbitrary nature of events of this type, exceedences can occur anywhere in Sydney (Figure 4).

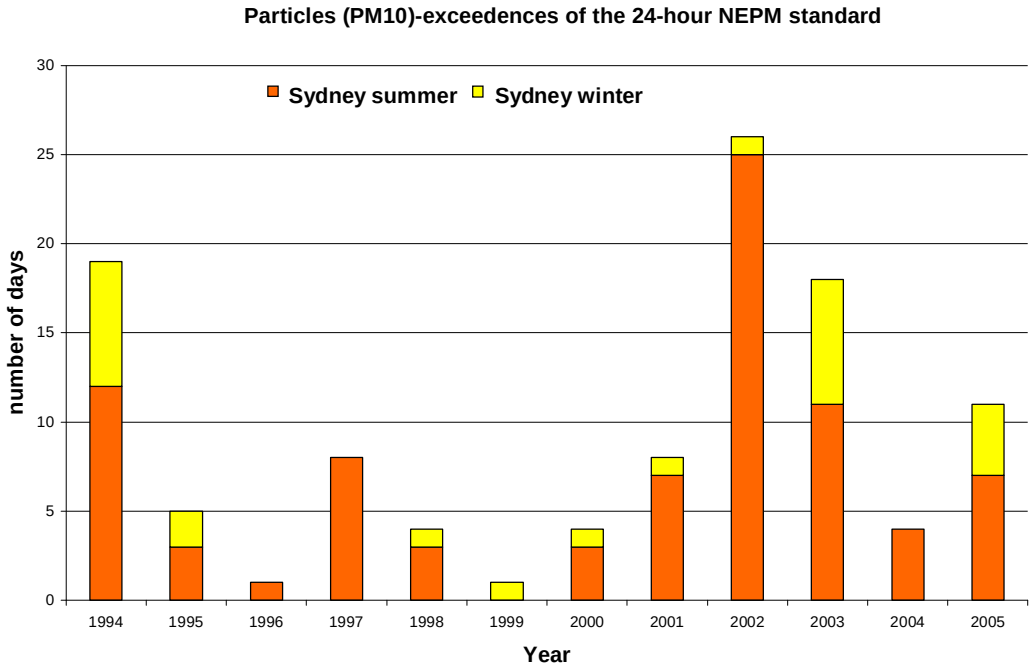


Figure 4: Particles (PM_{10}) - exceedences of the NEPM 24-hour standard

Mobile sources, particularly diesel motor vehicles, contribute just under 20% of particles in Sydney. Other major sources include industry, domestic solid fuel heaters (i.e. wood burners) and open burning (e.g. hazard reduction, bushfires). The national goal for particles (PM_{10}) is generally met in Sydney, except in years with significant fire and dust storms which are often caused by drought.

For $PM_{2.5}$, the finer fractions of particles about which health concerns are increasing, levels in NSW are generally below the national advisory reporting standard for a 24 hour period, but are currently above the annual reporting level. Even when the effects of bushfires and drought are discounted, particles are still a concern.

Air Quality Monitoring Network (AQMN)

The current AQMN has been built up over a number of years and has increased and decreased in size and complexity is response to technology development and changing priorities for monitoring.

A brief description of the major changes in monitoring techniques used in the AQMN over the years is summarised in Attachment 1.

The Role of Air Quality Monitoring in Air Quality Management

The NSW Air Quality Management Strategy has been outlined in the Government's 1998 publication – *Action for Air* and its various updates.

Conceptually, the strategy has four main components:

- Standard setting activities (how clean should our air be)
- Airshed assessments to identify pollutants of concern, to prioritise pollutants of concern and to track progress of initiatives
- Control and management initiatives (National and State) to address the priority pollutants
- Education efforts to inform the community about air quality and to seek input into any strategies to improve it.

Air Quality monitoring plays a critical part in all parts of this strategy, especially in airshed assessments and community awareness and education. However, the data are also used in the other two components of the overall management strategy development.

Generally, ambient air quality monitoring is normally undertaken to provide data for one or more of the following reasons:

- Characterising Regional Air Quality levels and Statutory Reporting – comparing and reporting regional ambient air quality data with ANEPMs or other benchmarks and for SoE reporting.
- Public Awareness – data to support the various Regional Pollution Indices and reports on the web, timely information to the media, pollution forecasts and health alerts and data for exposure assessments.
- Air Quality Trends – data to detect long term trends in air quality and reporting these to the public.
- Effectiveness of existing emission reduction programs – data to determine any measurable impacts in the medium to long term of existing control strategies. This also potentially relates to the assessment of source impacts.
- Emission strategy development – data to support development of new emission reduction strategies to support Action for Air and other programs and also includes inventory evaluation and source apportionment.
- New Source Assessments - this includes using the data to support the application of computer simulation models to development scenarios (including potential new industrial/urban developments).
- Health and other research programs – while research support is not a primary objective of the network, the data can be used to benefit research that feeds back into control programs (eg, health impacts, better model development, describing physical/chemical processes etc.)

Network Development and Current Configuration

Historically, the network has developed and expanded as new scientific findings emerge and new standards established. The Metropolitan Air Quality Study (MAQS) (1992-1995) provided the most recent impetus, focusing on improved understandings of photochemical smog formation.

Prior to MAQS, the network consisted of eight sites in Sydney, located in the eastern and southwest of the basin and including one site in the CBD, with one site in the Illawarra. With MAQS, the network was expanded to include monitoring in the urban growth areas in the west, northwest and southwest of Sydney, which previous scientific investigations had suggested would be subject to higher pollutant levels than those measured in the then existing network. A major aim of MAQS was to, via the strategic placement of sites, obtain scientific information about the meteorology and chemistry influencing the observed pollution episodes. MAQS was also responsible for additional monitoring in the Illawarra and the commencement of monitoring in the lower Hunter.

The introduction of the Ambient Air Quality National Environment Protection Measure (NEPM) in 1998 has provided another focus for the network, driven more by reporting requirements and the concept of understanding the exposure of the population to pollutants. The network nominated for NEPM utilised a sub-set of the existing monitoring sites which best suited the purpose of the NEPM. The NEPM has also been the driver for further monitoring in rural centres.

Today, the AQMN consists of 14 multi-parameter sites in the Sydney region which measure a suite of pollutants on a regional scale. In addition there are three sites located in the Illawarra and three in the lower Hunter. There are four smaller ANEPM campaign sites in rural NSW (Albury, Bathurst, Tamworth and Wagga Wagga), which monitor particles.

Ambient Air Quality Trends

Air quality has progressively improved in Sydney over the past 3 decades due to the successful implementation of many region-wide control programs. These relied on the analysis and interpretation of the ambient air quality data.

Lead & Sulfur Dioxide

In particular, ambient levels of lead and sulfur dioxide are well below national Air Quality Standards.

Lead levels have plunged due to the introduction of Unleaded Petrol (ULP) in 1985 and the subsequent banning of leaded petrol from 2002. Sulfur dioxide levels have been kept low through the availability and use of low sulfur fuels (primarily natural gas) in the Sydney basin.

Figures 5 & 6 below show recent trends in ambient levels of these two pollutants in recent years.

Carbon Monoxide

The ULP program allowed the progressive introduction of more stringent vehicle tailpipe emission standards and the use of catalyst clean-up technology. This has resulted in the progressive reduction of carbon monoxide levels over the last decades (see Figure 7).

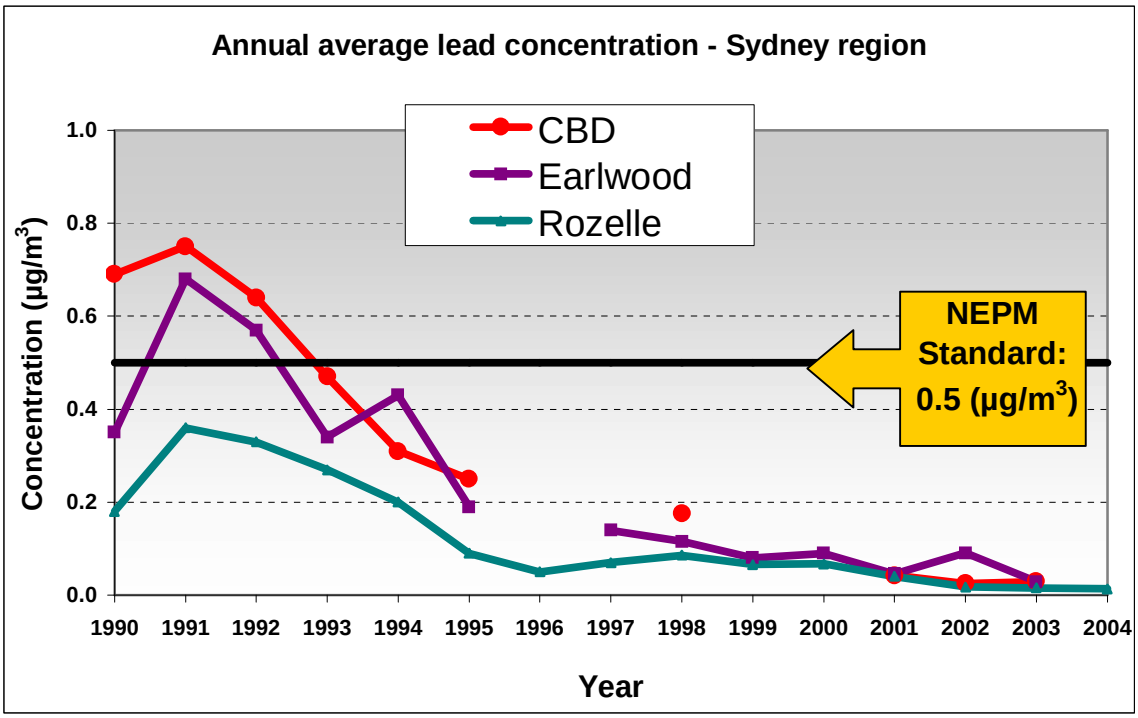


Figure 5: Ambient Lead concentrations in Sydney

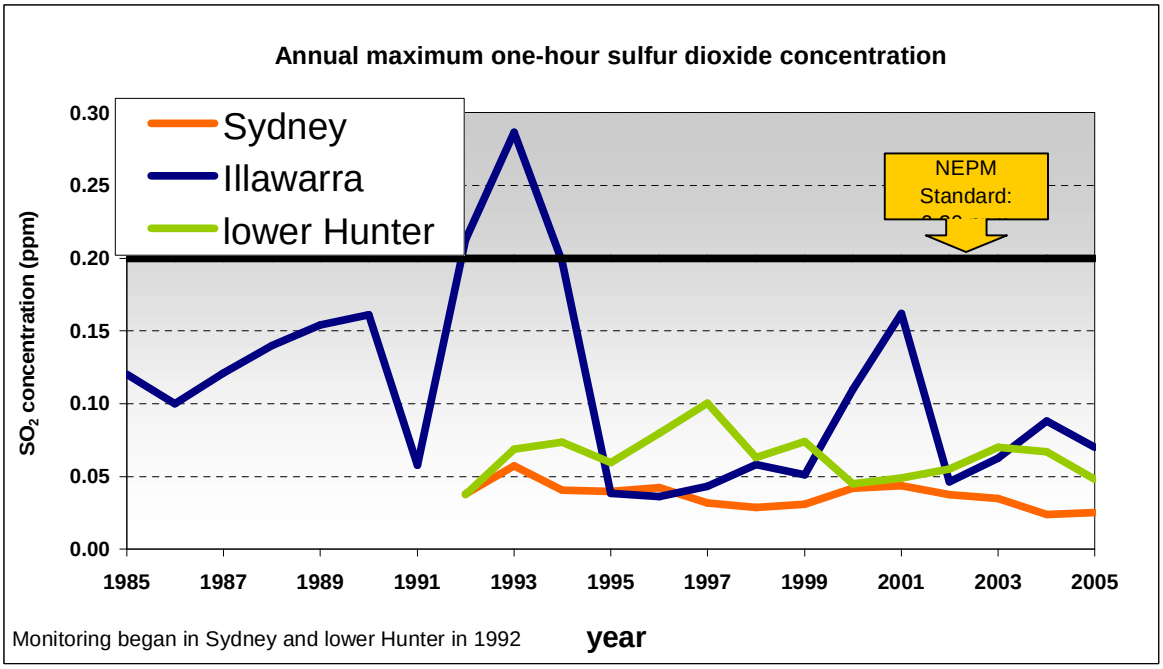


Figure 6: Ambient Sulfur dioxide concentrations in Sydney & the GMR

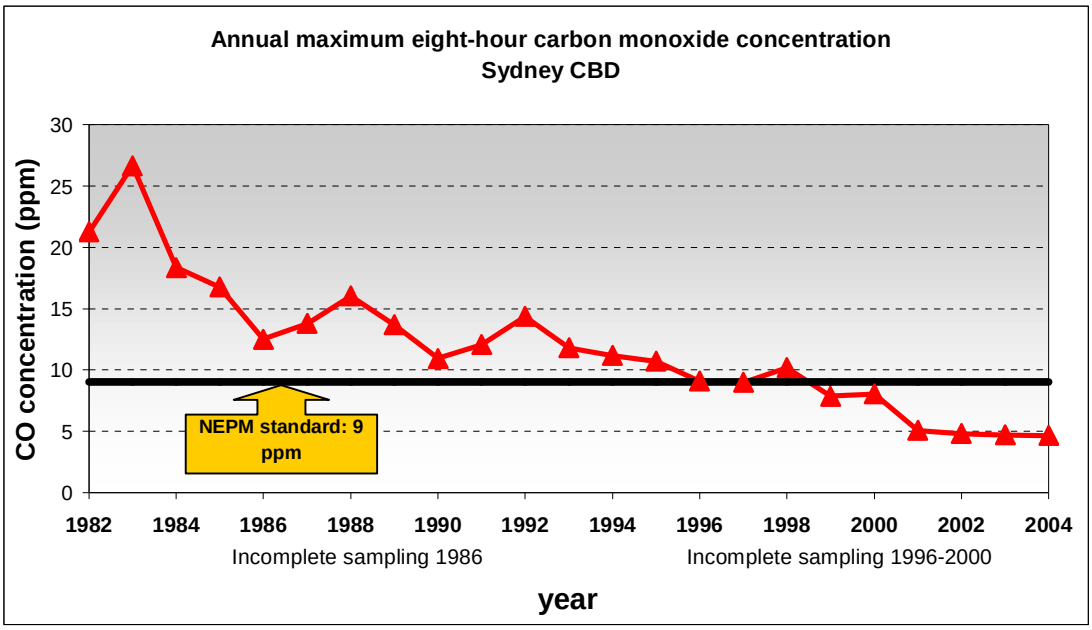


Figure 7: Ambient Carbon Monoxide concentrations in Sydney CBD

Nitrogen dioxide

The levels of Nitrogen dioxide have been reducing as a result of control programs but the reasons for this trend are not totally clear, given the increase in motor vehicle emissions during this period. Investigations are continuing into the reasons for this trend. Figure 8 shows the nitrogen dioxide data set.

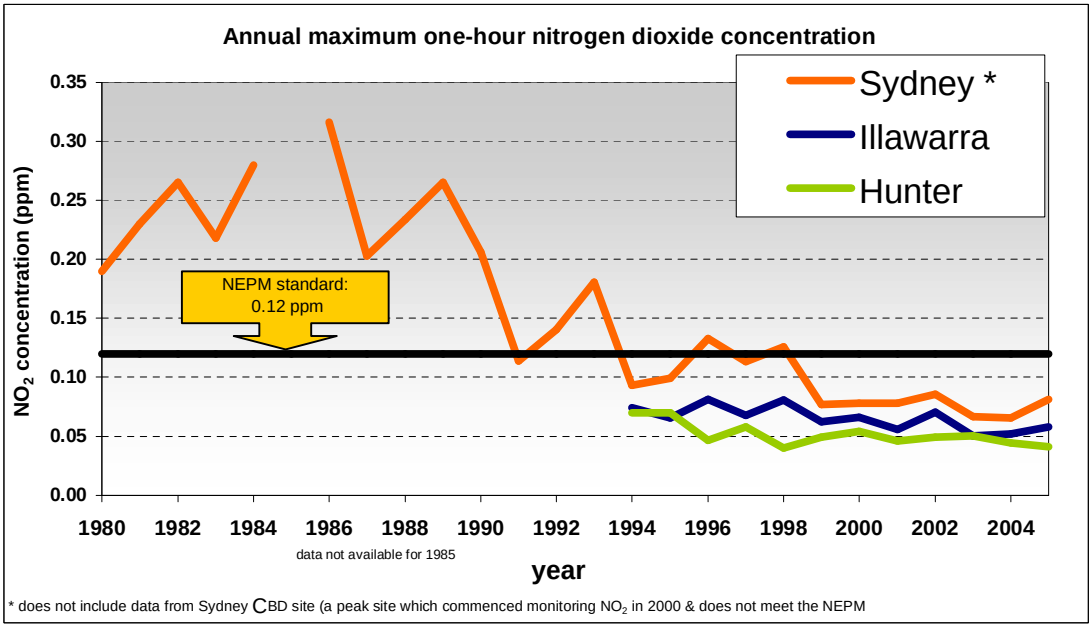


Figure 8: Ambient Nitrogen Dioxide concentrations in Sydney & the GMR

Photochemical smog (as ozone)

Photochemical smog or ground-level ozone, is not emitted directly into the air, but is a secondary photochemical pollutants formed when two precursor pollutants, oxides of nitrogen (NO_x) and volatile organic compounds (VOCs), react in the presence of sunlight.

Ground-level ozone continues to be a problem in Sydney in summer with exceedences of the National Air Quality Standards on up to 25 days per year. Figures 9 to 12 show the trend data for both the one-hour and four ozone standards.

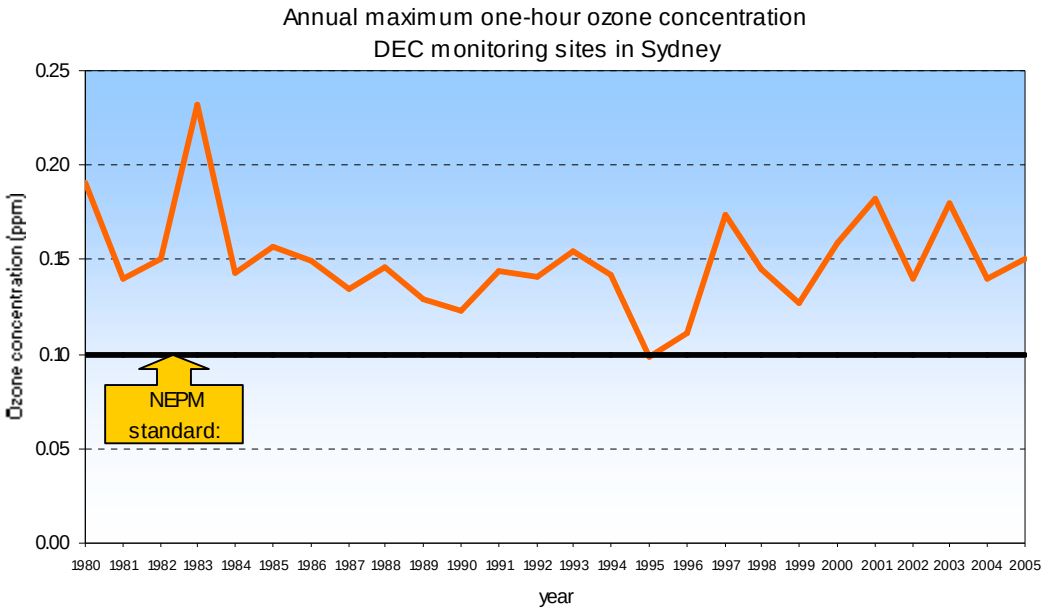


Figure 9: Ambient 1-hour ozone concentrations in Sydney

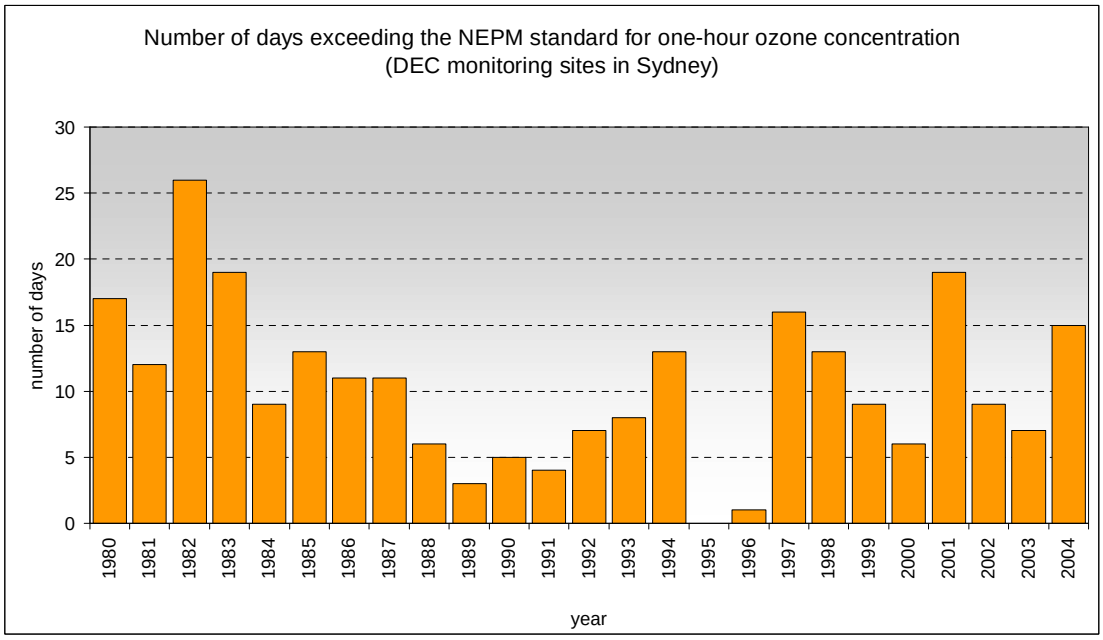


Figure 10: Days exceeding the 1-hour ozone standard in Sydney

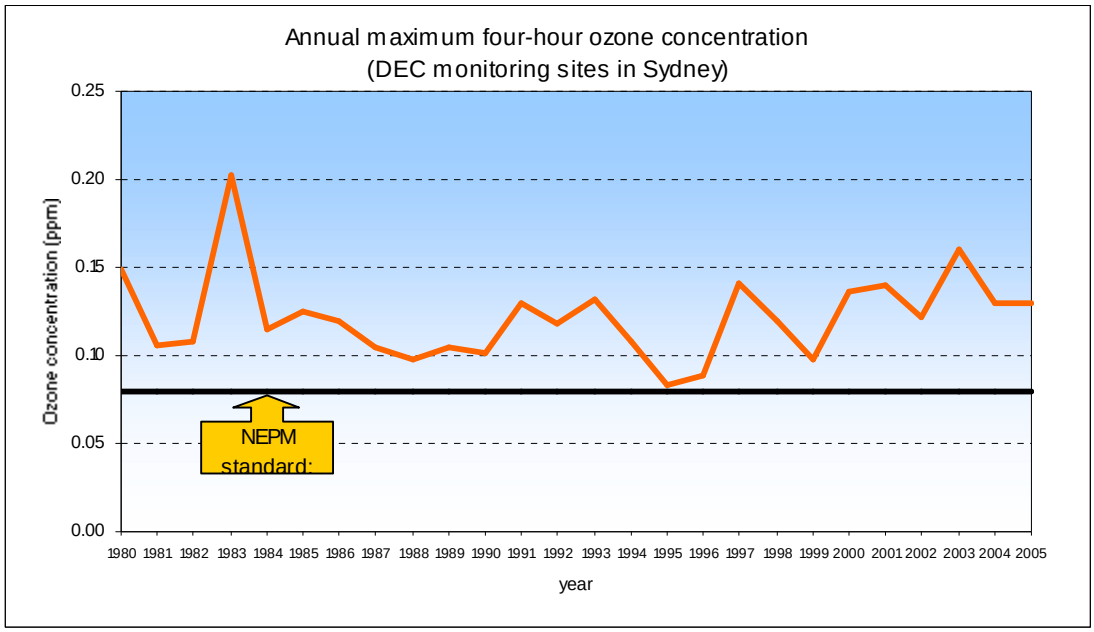


Figure 11: Ambient 4-hour ozone concentrations in Sydney

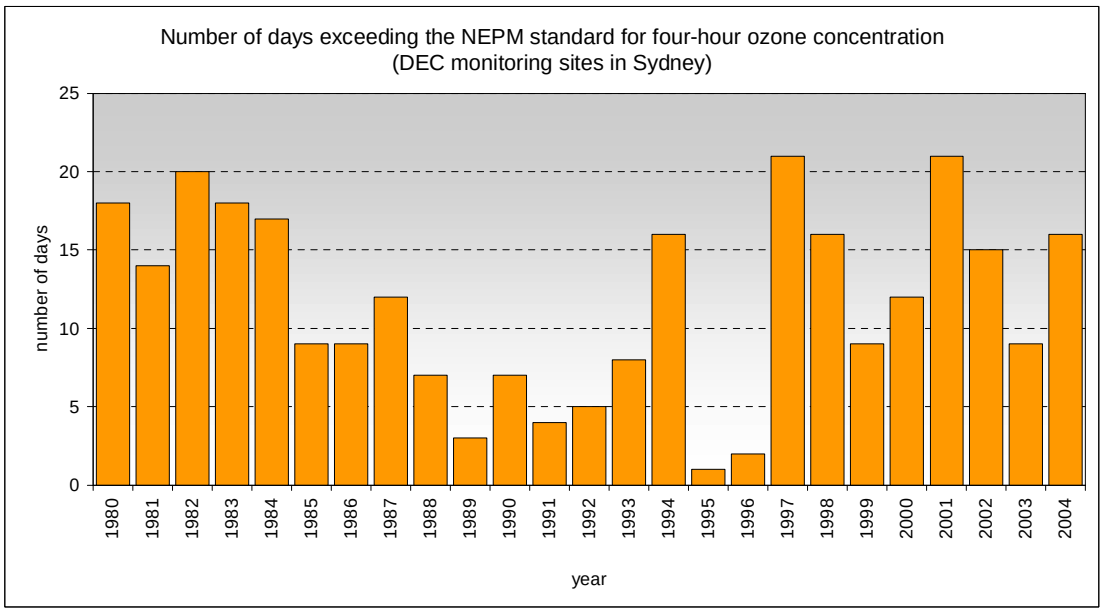


Figure 12: Exceedences of the 4-hour standard in Sydney

Particles (PM_{10} and $PM_{2.5}$)

There is a National Ambient air quality standard for particles as PM_{10} and an advisory reporting standard for particles as $PM_{2.5}$.

Particles generally only exceed the National Standards in the Sydney basin during extreme events such as bushfires or dust storms. However, they remain a specific health issue for the region. Figures 13 to 15 show the trends on particle data for the Sydney and surrounding regions.

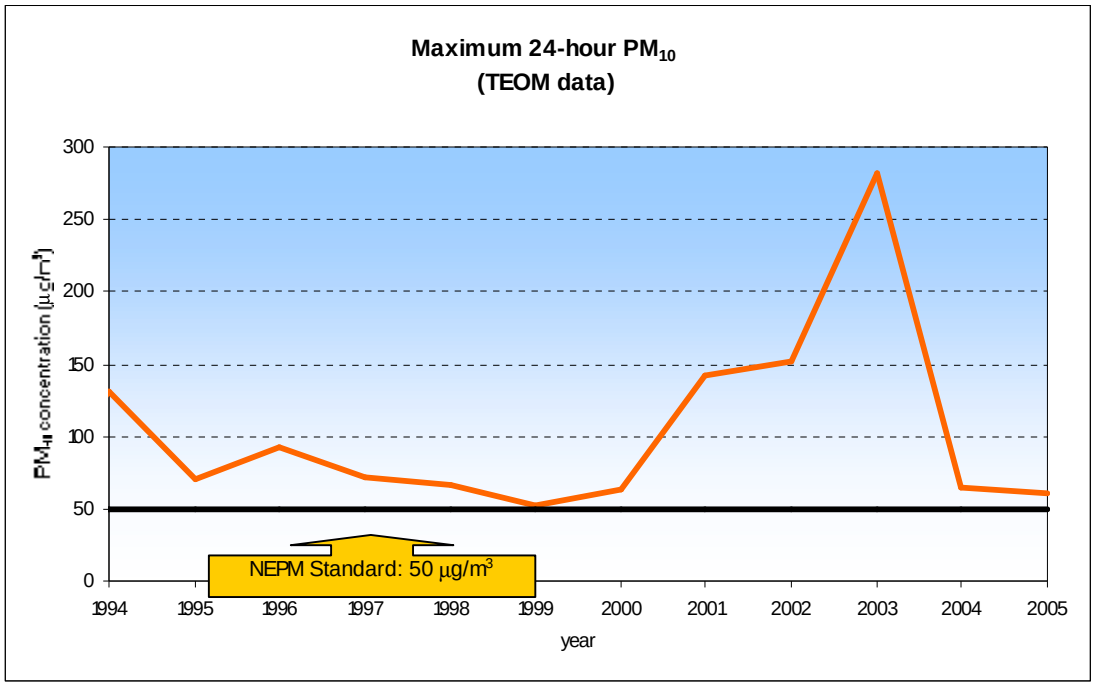


Figure 13: Ambient Particle (as PM_{10}) concentration in Sydney

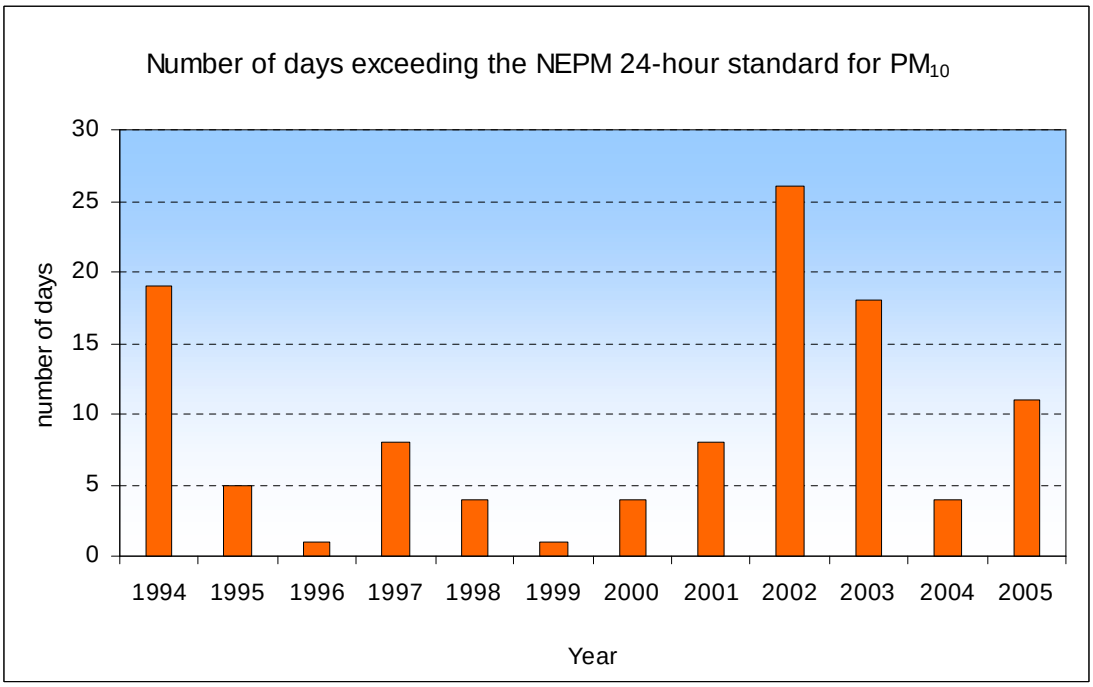


Figure 14: Exceedences of the PM_{10} standard in Sydney

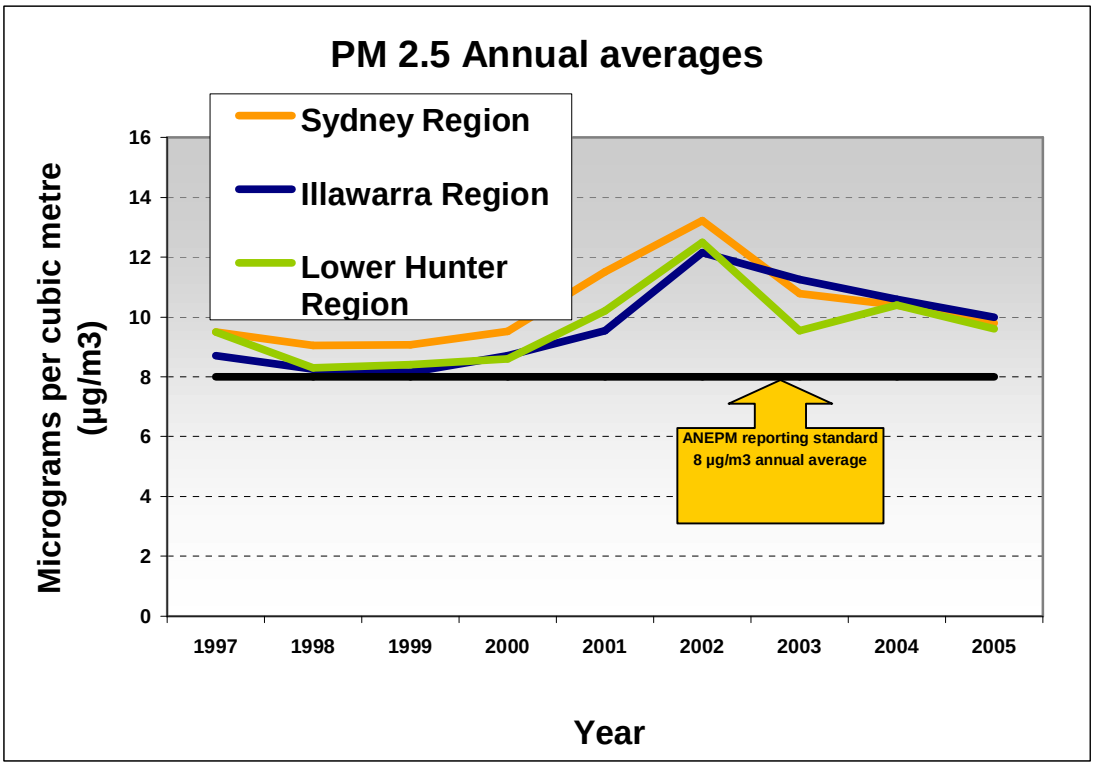


Figure 15: Ambient particle (as $PM_{2.5}$) concentrations in Sydney & the GMR

Air Toxics

The then EPA undertook an Air Quality Research Program from 1996 to 2001 looking at the concentrations of selected air toxics. Air toxics are those air pollutants which, although found in relatively small concentrations, have the potential to adversely impact human health and the environment through long-term exposure.

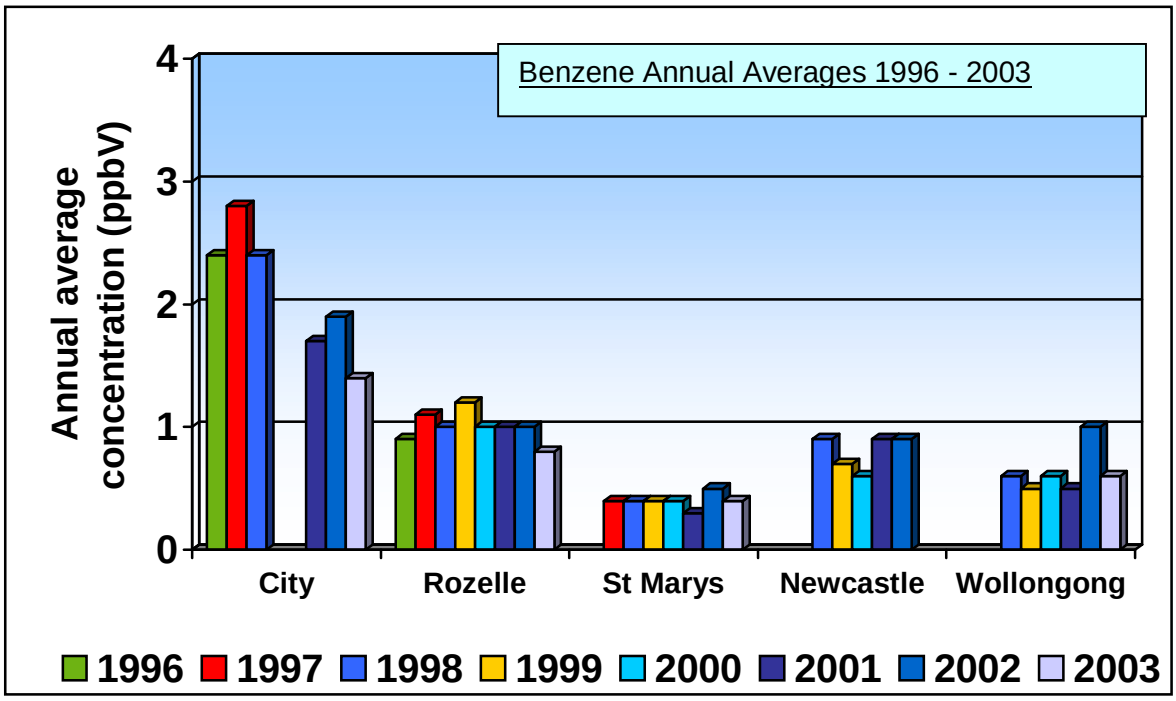
The study examined dioxins, 41 organic compounds (including benzene and 1,3-butadiene), 11 Polycyclic Aromatic Hydrocarbons (including Benzo(a)pyrene) and 12 heavy metals at a total of 25 sites around NSW.

In summary, the study found that most air toxics levels in NSW were low and well below current international standards and benchmarks.

Organics

The annual levels of organics were very low with only benzene and 1,3-butadiene being present at concentrations which approached, but did not exceed the goals for these substances.

Figures 16 to 19 show the results of benzene, toluene, xylene and 1,3-butadiene measured from 1996 to 2003.



NEPM investigation level – 3ppbV (annual average)

Figure 16: Ambient Benzene (Annual Average) Concentrations in Sydney & the GMR

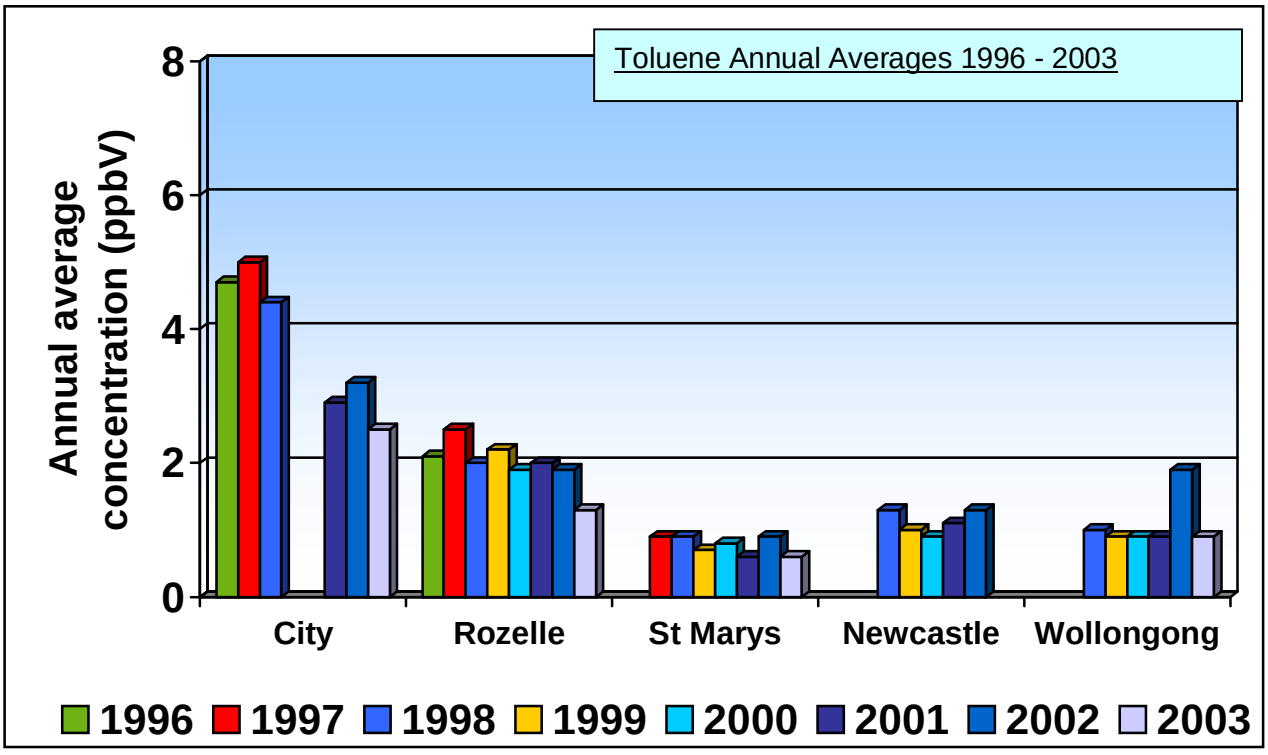


Figure 17: Ambient Toluene (Annual Average) concentrations in Sydney & the GMR

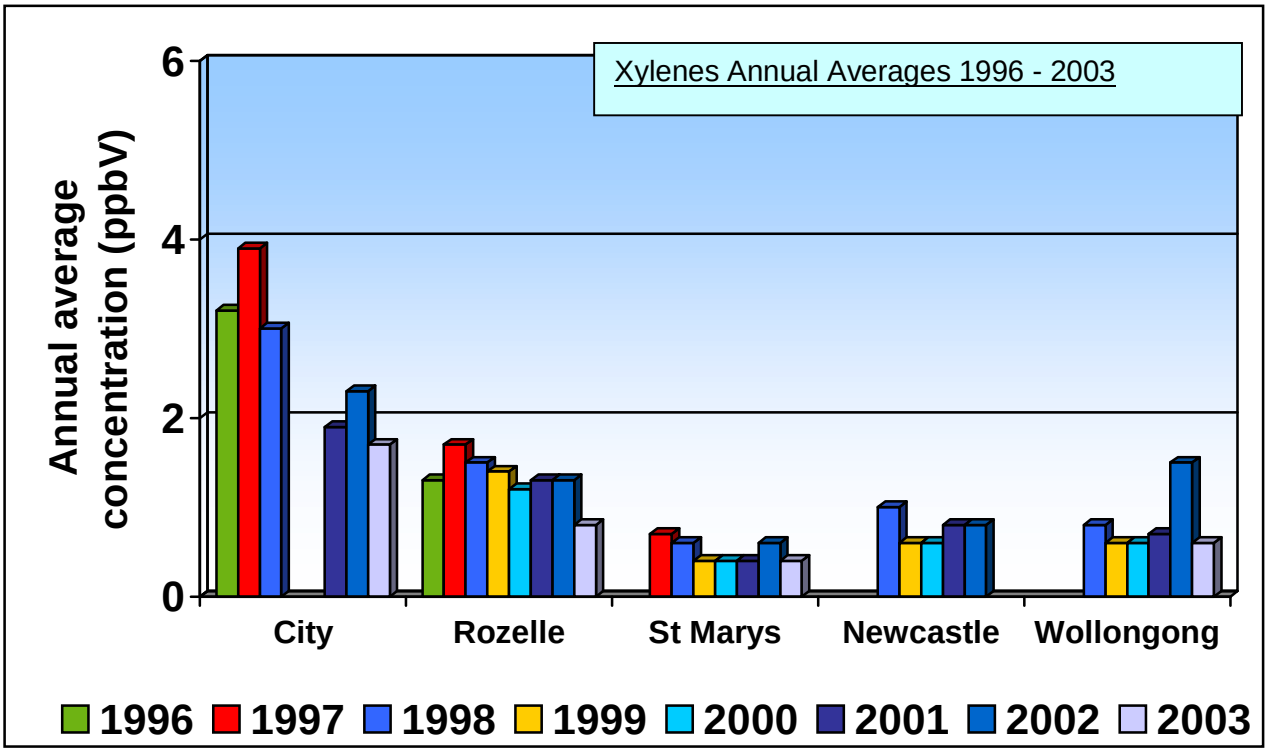


Figure 18: Ambient Xylenes (Annual Average) Concentrations in Sydney & the GMR

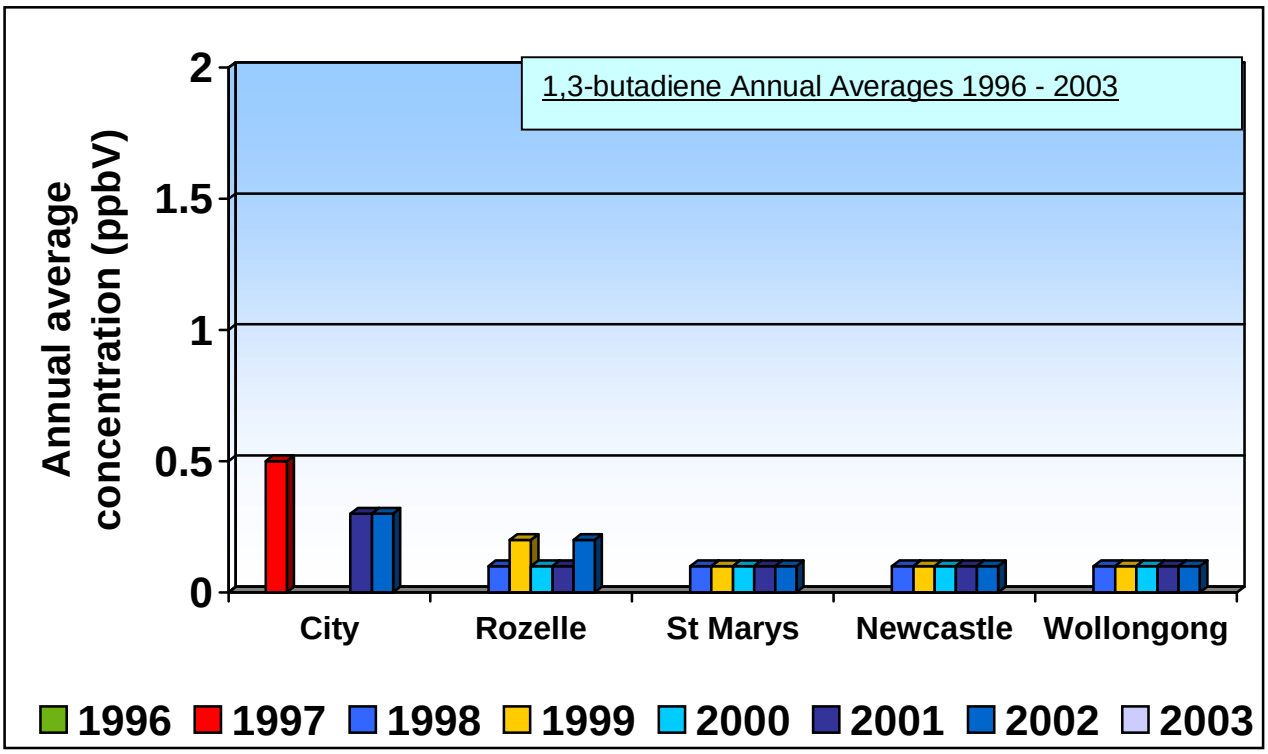
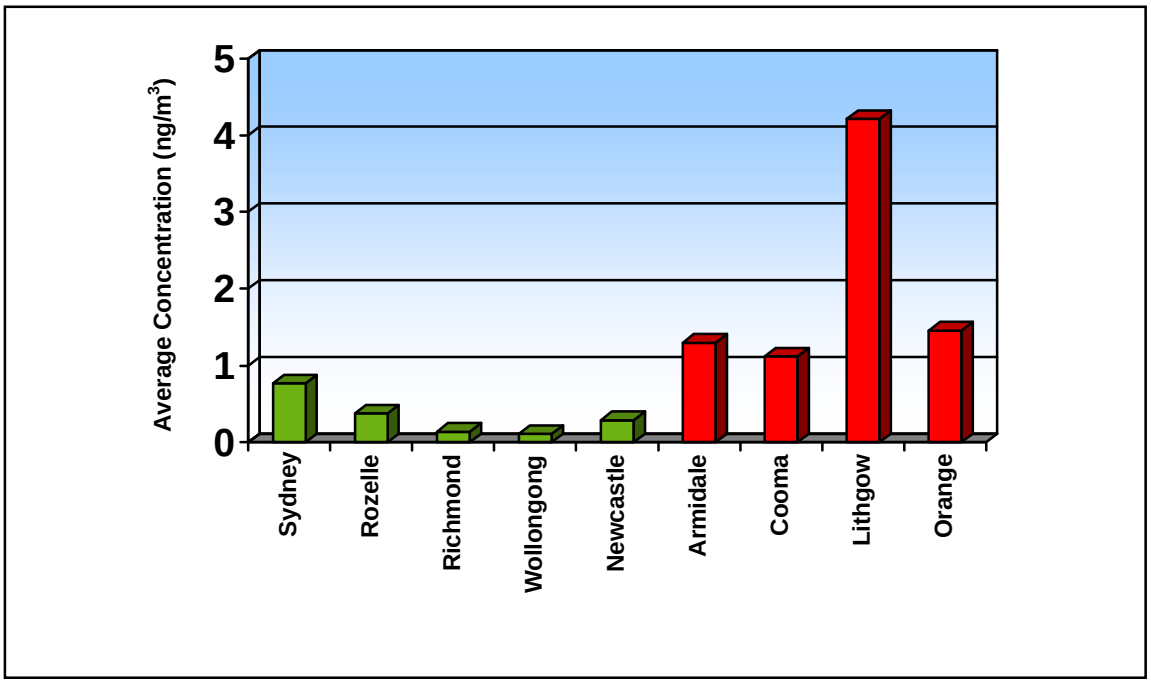


Figure 19: Ambient 1,3-Butadiene (Annual Average) Concentrations in Sydney & the GMR

Benzo(a)pyrene

In winter some parts of Sydney and a number of larger centres in the Great Dividing Range suffer from low visibility due to high levels of smoke associated with solid fuel heating and still weather.

Levels in Sydney were below the international goals for BaP but some of the Tableland centres exceeded these goals. Figures 20 & 21 show these data.



NEPM investigation level for BaP is 0.3ng/m^3

Figure 20: Ambient BaP Winter Averages in Sydney & the GMR

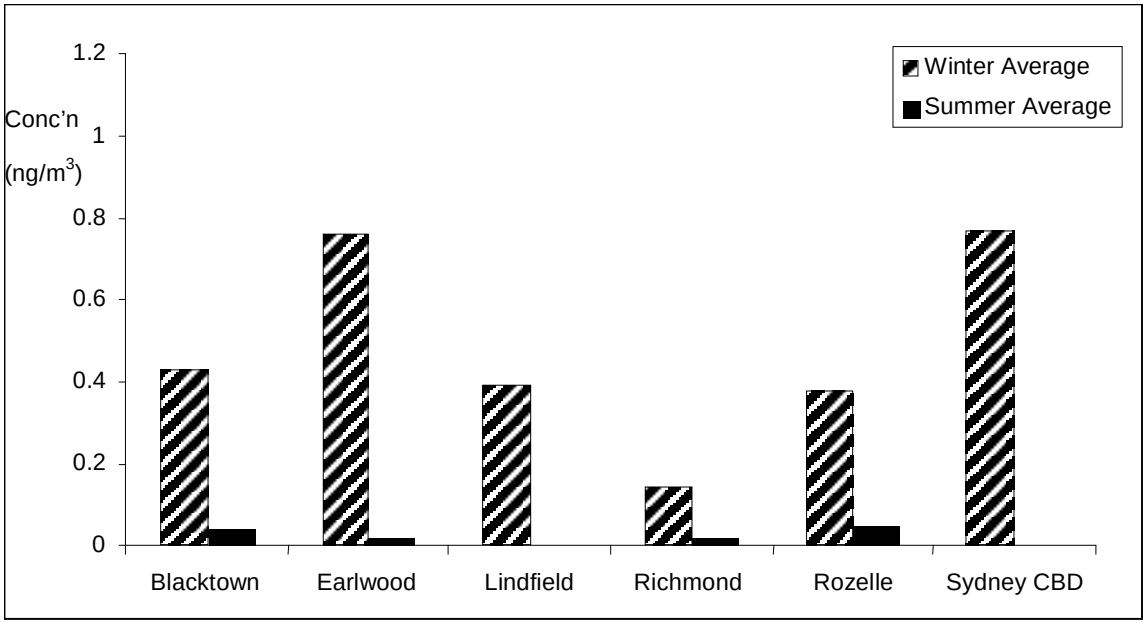


Figure 21: Seasonal variations in Ambient BaP—Sydney sites

Dioxins

Ambient concentrations measured in Sydney were very low when compared with standards in Europe and the US and below measured concentrations in other countries.

Dioxins usually occur as a complex mixture of congeners. To enable the relative toxicity of such a mixture of compounds to be expressed as a single number, the concept of toxic equivalents (TEQ) has been developed. The toxic equivalents are based on the international toxic equivalents scheme (I-TEQ).

The table below shows the results in this study obtained from the three monitored areas, expressed as I-TEQs. The results are presented as femtograms per cubic metre. One femtogram is 0.000000000000001 g.

Dioxins—toxic equivalents at each site

	International toxic equivalents – total (fg/m^3)		
Site	**Minimum**	**Average**	**Maximum**
Siding Spring	0.2	0.64	2.4
Warrawong	3	10	20
Westmead	2.3	14	53

Attachment 1 – AQMN Development Summary

In the 50s

- Introduction of (1st generation, batch type) monitoring for the first time in order to address public anxiety, particularly following the 1952 London smog episode, and to provide advice to the Smoke Abatement Committee;
- Introduction of batch (1st generation, wet chemistry) measurements of gaseous pollutants;
- Introduction of continuous (2nd generation, wet chemistry) techniques to measure sulfur dioxide;
- Introduction of semi-continuous (1-hour batch) measurements of smoke
- Introduction of 24-hour average (1st generation, batch type) measurements of total oxidants.

In the 60s

- Investigation of ambient pollution levels of motor vehicle related emissions;
- Ambient polycyclic aromatic hydrocarbon (PAH) investigations due to concern about link between PAHs and cancer;
- Introduction of a larger number/variety of continuous (2nd generation, wet chemistry type) measuring instrumentation (for acid gases, nitrogen dioxide, total oxidants) and construction of first purpose built monitoring stations;
- Measurement of lead & other metals;

In the 70s

- Measurement of fluorides;
- First carbon monoxide measurements commence;
- First wind speed & direction measurements commence;
- Greater sophistication built into network including introduction of 3rd generation (physical, continuous type) monitoring equipment;
- 4-year Sydney Oxidant Study commences;
- Sir Phillip Baxter award to air pollution officers for development of new 3rd generation ozone analyser using alternative (non-wet chemistry) technology.

In the 80s

- Network upgraded to incorporate new technology, greater sophistication;
- Indoor air quality measurements commence for the first time in NSW;
- Network size and resources reduced.

In the 90s

- Network upgraded to incorporate new data handling system;
- 4-year MAQS commences & network significantly upgraded;
- Network upgraded to incorporate (for the fist time) continuous gravimetric fine particle (PM_{10}) measurements;
- Network upgraded to include continuous $PM_{2.5}$ monitoring;
- ANEPM Monitoring Plan developed;
- First air toxic measurements made using DOAS technology;
- Network given NATA Accreditation status;

In the 00s

- Monitoring facilities re-located to refurbished accommodation;
- Network upgraded to meet NEPM Monitoring Plan;
- New NEPM's developed/introduced requiring additional changes

SUMMARY OF FINDINGS OF HARP STUDIES, NSW HEALTH 1993 – 1996.

Air pollution and daily mortality in Sydney, Australia, 1989 through 1993 **Morgan G et al** *American Journal of Public Health, 1998; Vol88: No 5.*	• Routinely collected mortality data, by cause • Daily ambient fine particles (by nephelometer), ozone, NO_2. • Poisson regression with general estimating equations	• 1% increase in daily deaths for every 10μg/m^3 increase in PM_{10} • 2% increase in daily deaths for an increase in ozone from10th to 90th percentile. • 8% increase in respiratory mortality for an increase in NO_2 from 10th to 90th percentile.
Air pollution and hospital admissions in Sydney, Australia, 1990 – 1994. **Morgan G et al** *American Journal of Public Health, 1998; Vol 88: No12*	• Routinely collected hospital admissions data, by primary diagnosis • Daily ambient fine particles (by nephelometer), ozone, NO_2. • Poisson regression with general estimating equations	• An increase from the 10th to the 90th percentile in NO_2 was associated with a 5% increase in childhood asthma and COPD admissions, and a 7% increase in heart disease admissions in the elderly • An increase from the 10th to the 90th percentile in particulates was associated with a 3% increase in both COPD and heart disease admissions in the elderly.
Prevalence and severity of childhood asthma and allergic sensitisation in seven climatic regions of New South Wales **Peat J et al** *Medical Journal of Australia,1995;163: 3 July*	• Cross-sectional study of symptoms and airway responsiveness in children in different regions, including Sydney	• No increase in measures of asthma in regions with known exposure to air pollution.
Asthma surveillance and air pollution in south western Sydney **Helby L et al** *Proceedings of the Health and Urban Air Quality in NSW Conference, June 1996*	• asthma attendances at selected general practices and hospital emergency departments • Daily ambient fine particles, ozone, NO_2. • Poisson regression with general estimating equations	• showed only an inconsistent association for NO_2 with asthma attendances.
Outdoor air pollution and children's respiratory symptoms in the steel cities of New South Wales **Lewis P et al** *Medical Journal of Australia, 1998;169: 2 Nov*	• Cross-sectional diary survey of children in industrial and non-industrial areas • Ambient fine particle and SO_2 levels	• Increase OR for colds (1.43) and night cough (1.34) for each 10μg/m^3 increase in PM_{10}.
Acute effects of bushfires on peak expiratory flow rates in children with wheeze: a time series analysis. **Jalaludin B et al** *Aust N Z J Public Health, 2000; 24:174-7*.	• Cohort of 32 children with history of wheeze followed for 2 months during 1994 bushfires with twice daily peak flow records • Daily ambient fine particles	• No significant impact detected
Acute effects of bushfires on respiratory symptoms and medication use in children with wheeze in Sydney, Australia. **Jalaludin B et al** *Environmental Health, 2004; 4:20-29.*	• Cohort of 32 children with history of wheeze followed for 2 months during 1994 bushfires with symptom diary • Daily ambient fine particles	• Significant association with evening wet cough, but not other symptoms (OR 1.23 per 10μg/m^3 increase in PM_{10})
Acute effects of ambient air pollution on respiratory symptoms, asthma medication use, and doctor visits for asthma in a cohort of Australian children **Jalaludin B et al** *Environmental Research, 2004; 95:32-42*	• cohort of 125 children with history of wheeze followed for 11 months, recording symptoms and medication use • Daily measures of ambient fine particles (TEOM), ozone, NO_2.	• Associations of PM_{10} with doctor visits for asthma and NO_2 with wet cough • Other outcomes and pollutants not significant

SUMMARY OF FINDINGS OF AIR POLLUTION AND HEALTH RESEARCH, NSW HEALTH, 1996-2006

Impact of ambient air pollution on birth weight in Sydney, Australia **Mannes T et al** *Occupational and Environmental Medicine, 2005; 62: 524-30*	• Maternal data collection records 1998-2000 for single births to Sydney residents (excluding gestational diabetes and hypertension) • Sydney air quality data averaged for months and trimesters • Linear regression analysis, adjusting for smoking and other maternal factors	• carbon monoxide and nitrogen dioxide concentrations in the second and third trimesters had a statistically significant adverse effect on birth weight • PM_{10} in the second trimester had a small statistically significant adverse effect on birth weight
Impact of ambient air pollution on gestational age is modified by season in Sydney, Australia **Jalaludin B et al** *Submitted, Environmental Health Journal, March 2006.*	• Maternal data collection records 1998-2000 for single births to Sydney residents (excluding gestational diabetes and hypertension) • Sydney air quality data averaged for months and trimesters • Linear regression analysis, adjusting for smoking and other maternal factors	• increased risk in preterm births for exposure to O_3 and SO_2 in the early months of pregnancy • few air pollution effects in the third trimester of pregnancy • effects of air pollution on preterm births are modified by the season when conception occurred (greater effects were generally observed in autumn and winter)
The short-term effects of air pollution on daily mortality in four Australian cities **Simpson R et al** *ANZJPH, 2005; 29: 205-212*	• Data on mortality in four cities, including Sydney, 1996-99 • Air pollution data • Poisson regression modelling	• Results similar to Morgan 1998a
The short-term effects of air pollution on hospital admissions in four Australian cities **Simpson R et al** *ANZJPH 2005; 29: 213-221*	• Data on hospital admissions in four cities, including Sydney, 1996-99 • Air pollution data • Poisson regression modelling	• Results similar to Morgan 1998b

SUMMARY OF FINDINGS OF AIR POLLUTION AND HEALTH RESEARCH, NSW HEALTH, 1996-2006

Associations between ambient air pollution and daily emergency department attendances in the elderly, Sydney, Australia **Jalaludin B et al** *Journal of Exposure Analysis and Environmental Epidemiology, 2006; 16:225-237*	• Data on Sydney hospital emergency department attendances by people over 65 years for cardiovascular diseases, 1997-2001 • Air pollution data • Poisson regression modelling	• Attendances for all cardiovascular disease, cardiac disease and ischaemic heart disease associated with all pollutants except ozone • For an IQR increase in PM_{10}, $PM_{2.5}$, NO_2, CO and SO_2 cardiac attendances increased by 1.15%, 1.55%, 2%, 2.5% and 1.6%.
Acute effects of ambient air pollutants on ED visits for asthma in children, Sydney, Australia: a case-crossover analysis **Jalaludin B et al** *Submitted, Environmental Research, April 2006*	• Data on Sydney hospital emergency department attendances by children 1-14 years for asthma, 1997-2001 • Air pollution data • Case-crossover analysis	• Significant associations for all air pollutants tested with increased rates of asthma attendance • For an IQR increase in PM_{10}, $PM_{2.5}$, O_3, NO_2, CO and SO_2 averaged over the same and previous day, asthma attendances increased by 1.5%, 1.3%, 1.8%, 2.4%, 2.8% and 2.1% respectively.
Associations between ambient air pollution and daily emergency department presentations for respiratory disease and cardiovascular disease in the elderly, Sydney, Australia **Jalaludin B et al** *Abstract, 15th Conference of the International Society for Environmental Epidemiology, Perth 2003*	• Data on Sydney hospital emergency department attendances by people over 65 years, 1997-2001 • Air pollution data • Poisson regression modelling	• Attendances for all respiratory disease associated with all pollutants tested • The largest lag effect on respiratory attendances varied by pollutant, and was 2.4%, 2,2%, 1.9%, 5%, 1.8% and 2.7% for an IQR increase in PM_{10}, $PM_{2.5}$, O_3, NO_2, CO and SO_2 respectively.

SUMMARY OF FINDINGS OF AIR POLLUTION AND HEALTH RESEARCH, NSW HEALTH, 1996-2006

The effects of bushfire smoke on daily mortality and hospital admissions in Sydney, Australia, 1994 to 2002 **Morgan G et al** *Submitted: American Journal of Epidemiology, May 2006*	• Routinely collected mortality and hospital admission data 1994-2002 • Sydney air pollution data • 32 bushfire days identified (>90th centile of PM_{10}) • Poisson semi-parametric model	• Bushfire PM_{10} associated with increased respiratory admissions, COPD admissions and adult asthma admissions (1%, 4% and 5% per 10$\mu g/m^3$ increase in PM_{10} respectively) • No significant association with mortality or cardiovascular admissions • Paradoxical reduction in childhood asthma admissions
Multi-city morbidity and mortality study **Simpson R et al** *Draft report to Environment Protection and Heritage Council*	*Not available*	*Not available*
Air pollution and child respiratory health: a case-crossover study in Australia and New Zealand **Barnett AG et al** *American Journal of Respiratory and Critical Care Medicine, 2005; 171:1272-8.*	• Routinely collected hospital admission data children 1-14 years in 7 cities, including Sydney, 1998-2001 • Air pollution data • Case-crossover analysis	• 2.1% increase in asthma admissions in children 5-14 years per 1ppb increase in 24-hr NO_2 • 1.7% increase in respiratory admissions in children 1-4 years per interquartile increase in both PM_{10} and $PM_{2.5}$ • 1.9% increase in respiratory admissions in children 5-14 years per interquartile increase in PM_{10} • 3.5% increase increase in respiratory admissions in children 1-4 years per interquartile increase in ozone in summer

SUMMARY OF FINDINGS OF AIR POLLUTION AND HEALTH RESEARCH, NSW HEALTH, 1996-2006

The Effects of Air Pollution on Hospitalizations for Cardiovascular Disease in Elderly People in Australian and New Zealand Cities **Barnett AG et al** *Environmental Health Perspectives, 2006; 114:1018–1023*	• Routinely collected hospital admission data, adults in 7 cities, including Sydney, 1998-2001 • Air pollution data • Case-crossover analysis	• CO, NO_2 and PM were all associated with increased rates of admissions for cardiovascular diseases (except stroke) • The largest effect estimates were observed with CO: for an interquartile increase in CO, admissions for all cardiovascular, all cardiac, cardiac failure and ischaemic heart disease increased by 2.2%, 2.8%. 6% and 2.3% respectively
An opportunistic blood lead survey in New South Wales children **Balding B et al** *In preparation*	• Blood samples from children 1 month – 7 years undergoing routine tests in second half 1999 • Data on residence, age, sex	• Mean blood lead 2.3µg/dL • Varied with age, sex and location • 1% exceeded NHMRC blood lead goal
Air pollution and children's health UQ and Woolcock Institute of Medical Research – for the Environment Protection and Heritage Council	• not available	• not available

Air quality and emissions savings measures in the State Transit Authority fleet

July, 2006

1. Introduction

As a public transport service provider State Transit is in a unique position to improve the Transport sectors contributions to overall urban air quality through a greater inter-modal share of the transport task and through improved emissions performance of its fleet.

State Transit contributes to improved urban air quality via emissions savings by the displacement of single driver vehicle trips and vehicle kilometres, via its existing fleet emissions profile, and via improved emissions performance as a result of new Euro IV standard bus purchases replacing older Euro 2 standard buses.

State Transit has been a leader in the introduction of Compressed Natural Gas Buses with more than a decade of experience with this technology. It now has a fleet of 404 CNG buses comprising approximately 21% of the total fleet. In the time since its first introduction State Transit has achieved significant cost savings and environmental benefits from CNG and has driven the technical improvement of gas buses and fuelling facilities.

To meet with average Fleet Age requirements and passenger demands for improved comfort and performance, State Transit has been updating its fleet with new vehicles to replace aging pre-Euro 2 standard diesel buses. These new buses help to significantly improve the fleet emissions profile, and the relative advantages of public transport over car travel.

1. TOTAL SYSTEM EMISSION SAVINGS

State Transit fleet of some 1915 buses carried some 199.36 million passengers in 2004/2005 or some 600,000 passengers per day (State Transit Annual Report 2004/2005). In performing this transport task Sydney Buses covered some 78.9 million kilometres, whilst Newcastle buses travelled approximately 8.2 million kilometres.

A single bus trip of average occupancy has been previously reported to displace the equivalent emissions per passenger kilometre of some 40 single occupancy vehicle driver car trips, with a potential for displacement of up to 65 car trips.

Enhanced patronage of public transport and a greater intermodal share of the transport task help to reduce vehicle driver trips and total vehicle kilometres travelled. Given the positive emissions advantage of bus travel per passenger kilometre over the car travel, any translation of travel behaviour from single occupancy car to bus travel will result in emissions savings. The magnitude of these savings will be a function of the:

- number of passenger vehicle trips displaced,
- vehicle kilometres saved and,
- relative emissions performance per passenger kilometre between the two modes of transport.

According to Transport Data Centre key indicators for Residents of Sydney, (December, 2002) weekday bus travel accounts for 6% of all travel modes, compared with 49% for vehicle driver and 21% for vehicle passenger. State Transit bus services accounts for 60% of all bus trips on average weekdays.

Of the total distance travelled by Sydney residents on a weekday, vehicle drivers comprise 80.4% of vehicle kilometres travelled, train trips captured 10.2%, bus trips 4.3% and 3.2% were walk only.

Given an average weekday travel distance by mode of 6.2kms for bus passenger, and a patronage of some 200million per year State Transit provide a significant contribution to urban air quality by providing lower emissions per passenger kilometre alternative to the car.

2. CURRENT FLEET EMISSIONS PROFILE

The Snowy Mountains Engineering Corporation developed for State Transit a Bus Emissions calculator. This calculator provides the unique capacity for predicting bus in-service emissions for different average velocities, as opposed to the traditional static emissions tests.

Utilising the Snowy Mountains Engineering Corporations developed Bus Emissions calculator the emissions profile of our current fleet of 1915 buses comprising of:

- 554 pre Euro 2
- 752 Euro 2
- 204 Euro 4 and
- 404 EEV CNG buses,

equates to the following emission totals, at an average bus fleet speed of 18km/hr:

- CO_2 = 75,121 tonnes/yr
- CH4 = 46 tonnes/yr
- PM_{10} = 15 tonnes/yr
- NOx = 444 tonnes/yr
- HC = 46 tonnes/yr
- CO = 130 tonnes/yr.

3. NEW 505 BUS CONTRACT

Using SMEC developed Emissions Modelling Tool, the new 505 bus purchases will, with the displacement of Euro2 with 250 Euro 5 diesel and 255 CNG buses, result in emission savings of:

- 194 tonnes/year of Greenhouse gases (CO_2 + CH_4),

- 7.2 tonnes/year of Particulates (PM_{10}),

- 172.4 tonnes/year of oxides of Nitrogen (NOx),
- 22.5 tonnes/year of total hydrocarbons (HC),
- 41.6 tonnes/year of Carbon Monoxide (CO),

for average vehicle speeds of 18kph. The new Bus Contract delivery program will result in approximately 100 new bus deliveries each year, with a near similar number of older bus retirements.

4. HEALTH BENEFITS OF PUBLIC TRANSPORT

Previous studies by the Bureau of Transport and Regional Economics (BTRE) into the Health Impacts of Transport Emissions in Australia: Economic Costs (June, 2005) indicates that motor vehicle share of particulate emissions in the Sydney CBD is 55% higher than in other capital cities.

With State Transit buses operating within the Sydney CBD, and the inner western and eastern suburbs of Sydney, its bus fleet with EEV CNG and increasing numbers of Euro IV compliant diesel buses, will emit significantly less particulates, as new buses replace older buses, and in turn will contribute to savings to the health budget in coming years.

The net economic and health benefits of State Transit's bus services are difficult to quantify due to vehicle emissions being only one source of pollutants that have an effect on health and also due to contributing factors such as vehicle age, maintenance and duty cycle contributing to the amount of emissions produced.

5. MAINTENANCE AND MONITORING OF BUS EMISSIONS PERFORMANCE

To ensure that State Transit optimises the rated emissions performance of its fleet, State Transit is entering into voluntary agreements in relation to the RTA Clean Fleet and Greenhouse Challenge Plus Programs.

Membership of the clean fleet program entails a voluntary agreement to comply with RTA's requirements for Clean Fleet, Engine Settings, Maintenance Schedules and Methods and Fault Identification and Repair, and to be independently audited for its compliance and continued certification and membership from time to time. The overall impact of this program will be to maintain and improve upon the operational emissions performance of the fleet, with a mindset focused on minimising bus emissions.

State Transit is preparing to enter into the federally sponsored Department of the Environment and Heritage, Australian Greenhouse Office Greenhouse Challenge Plus

Program. Whilst not yet officially part of this program, State Transit is in the process of gathering the necessary information to enter into this cooperative agreement.

The Greenhouse Challenge Plus Program will entail development of a Greenhouse Gas Inventory for all stationary and non stationary sources, an Action Plan of specific actions to minimise greenhouse gas emissions, performance indicators to monitor progress against the Action Plan, and a commitment to independent verification and annual progress reporting.

CONCLUSION

State Transit has and is continuing to make significant contributions to Sydney's urban air quality through the provision of a lower emissions alternative to the car, through its improved and improving fleet emissions profile with the displacement of older fleet vehicles. The maintenance and continuous improvement of this emissions performance is to be assured by voluntary membership of programs such as the RTA clean fleet and the Federal Department of Environment and Heritage Greenhouse Challenge Plus programs. State Transit will also work in close partnership with its original equipment manufacturers to keep up to date with the latest emission control technologies. While all of these measures help to contribute to the overall air quality, the public transport sectors greatest contribution stems from the displacement of vehicle trips, vehicle kilometres travelled and from a greater inter-modal share of the transport task.

References

State Transit Annual Report, 2004/2005, http://www.sta.nsw.gov.au,

Transport Data Centre, (December 2002). *Bus Users in Sydney*. Sydney: NSW Department of Transport (Issues Paper 2002/02).

APPENDIX 10 EFFECTIVENESS OF PROGRAMS UNDER POEO ACT

POEO licensing and pollution reduction programs

There are strong programs in place for regulating the air quality impacts of industry through a range of compliance schemes including licensing and prosecutions under the POEO Act. The DEC has issued around 1,100 air related licences in the GMR. Since 1991 there have been 13 successful prosecutions for breaches of the legislation specifically relating to air pollution.

Between 2001 and 2005 the DEC negotiated over 200 pollution reduction programs in NSW with investment of over $60 million by companies and councils to reduce air pollution (including odour). Pollution reduction programs are legally enforceable programs negotiated with licensees by the DEC that require changes to works or management practices to bring about environmental improvements. The conditions are attached to the licence and may be implemented in a series of steps over a number of years.

Environmental Compliance Programs

The DEC undertakes a range of environmental compliance programs aimed at assessing compliance with existing requirements and improving environmental performance. Where issues are identified at particular premises, the DEC requires the premises to implement actions to address the issues. The findings of the programs are publicly available and are communicated widely to industry and local councils.

Programs have included focusing on industries that have the potential to impact on air quality in NSW. A summary of these programs is included below.

Asphalt Manufacturing Plants
An industry sector compliance audit program was carried out on the asphalt manufacturing industry in NSW between August 1999 and June 2000. Five of the eleven licensed premises in the Sydney Basin were audited. The main air pollution issues identified by the program included inappropriate design, operation and maintenance of air pollution equipment and the overheating of bitumen, increasing the amount of volatile compound realised.

Piggeries
An industry sector compliance audit program was carried out on piggeries between April and October 2003. Three of the piggeries audited were located in the Sydney Basin. The main air related issue identified by the program was odours, originating from various sources, such as the decomposition of piggery waste (manure).

Coal Mines
An industry sector compliance audit program was carried out on coal mines between October 2001 and July 2002. Five of the coal mines audited were located in the Sydney Basin. The main air related issue identified by the program was the generation of dust. The other cause of concern related to the disposal of carbonaceous or combustible materials that had the potential to cause air pollution.

Solid waste Landfills
An industry sector compliance audit program was carried out on solid waste landfills, between January and July 1998, including seven audits of landfills in the Sydney Basin. The main air issues identified included inadequate dust suppression and lack of landfill gas collection.

Drum or Container Reconditioning Works
An industry sector compliance audit program was carried out on drum or container reconditioning works between August 1999 and September 2000. All eight of the premises

audited were located in the Sydney Basin. The main air issues identified included inadequate containment around drums or other vessels containing substances with potential to cause air pollution and improper operation and maintenance of air pollution equipment.

Livestock Processing Industries - Animal Slaughter and Rendering
An industry sector compliance audit program was carried out on livestock processing industries in NSW between September 2001 and August 2002. Five of these premises were located in the Sydney Basin. The main air pollution issues identified by the program were odours from animal slaughtering and rendering plants, resulting from improper management of effluent treatment ponds, irrigation areas, solid waste disposal areas, and for rendering plants vapours produced by cookers.

Chemical storage, handling and spill management program
A program on chemical storage, handling and spill management practices has recently been completed. The program focused on a number of activities involved in storing and handling chemicals, such as chemical industries and mineral processing and metallurgical works. Audits were conducted at 32 premises in the Sydney Basin. In addition, a number of best environmental practices were identified and reported, including practices to reduce the risk of air pollution. These practices are relevant to all activities storing and handling chemicals.

LBL Audit Program 2002 - 2005
A three year Load Based Licensing Audit program was undertaken between July 2002 and June 2005. Within the Sydney Basin, 18 industries with air emissions were audited during this program. The Program has facilitated improvements in industry understanding and compliance by providing advice and documented audit reports so that administrative and procedural changes can be implemented to facilitate compliance with LBL requirements. Industries audited as part of this program included petroleum refineries, glass manufacturing, electricity generation, ceramics works and paint manufacturing.

Smoky Vehicle Compliance Program
Over the last five years, the DEC has issued over 16,000 Penalty Infringement Notices for vehicles observed by authorised officers emitting visible emissions in contravention of the Clean Air Regulations. In addition the DEC issues warning letters where members of the community report smoky vehicles. Over the last five years over 15,000 warning letters have been sent to vehicle owners advising them of potential problems with their emission controls and the need to have any problems rectified.

<u>Load-Based Licensing</u>

Licensees subject to the load-based licensing scheme are required to report on a subset of the following air pollutants, depending on the industry sector(s) that they fall into:

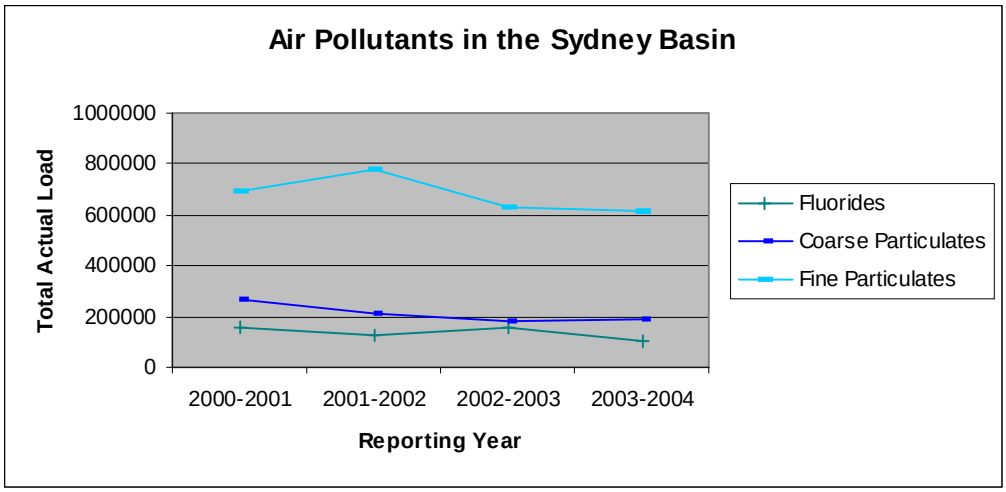
- Arsenic, Benzene, Benzo(a)pyrene (equivalent), Coarse particulates, Fine particulates, Fluorides, Hydrogen sulphide, Lead, Mercury, Nitrogen oxides, Sulphur oxides, Volatile organic compounds.

The load-based licensing scheme appears to be providing an incentive for licensees in the Sydney Basin to reduce their impact on the environment. The following graphs represent the total loads of a number of the above assessable pollutants that were reported by LBL premises located in the Sydney Basin in the last 4 reporting periods.

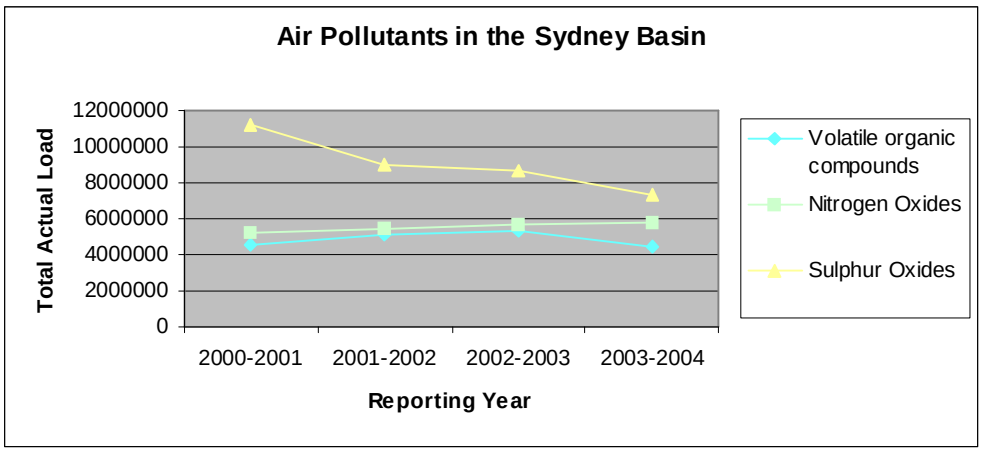
For these pollutants, with the exception of oxides of nitrogen and hydrogen sulphide, the loads reported appear to be trending down, indicating that these premises are emitting less of these assessable pollutants. Emissions of oxides of nitrogen appear to have increase slightly over the last 4 years. However, it is possible that at least a proportion of this increase is due to

increased production over the same period. It should be noted, however, that we only have 4 years of acceptable data, which is statistically not enough to reliably determine trends.

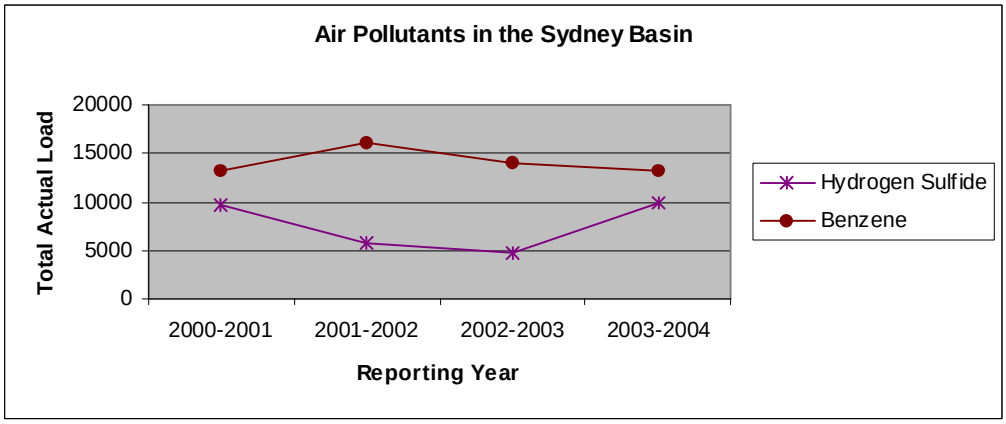
Coarse and fine particles and fluorides



Volatile organic compounds, nitrogen oxides, sulphur oxides



Hydrogen sulphide and benzene



Additional information on industry emissions can be found in the National Pollutant Inventory www.npi.gov.au.

- Assist patients to understand how modifying their behaviour can help reduce exposure to pollutants. For example, people with asthma sensitive to ozone are better to exercise in the early morning in summer, or exercise indoors. On HIGH fine particle days, a patient with emphysema may be better to shop at an air-conditioned mall than the local shops.

Extreme events

Bushfires can result in pollutant levels that may remain HAZARDOUS for several days. A sensitive patient can take further measures such as covering the nose and mouth with a mask rated P2 or P3 (available from hardware stores) and staying in air-conditioned places. It is inadvisable for patients with asthma or chronic cardiac or respiratory conditions to exercise during prolonged periods of high air pollution.

Other air pollution issues to discuss with your patients

The motor vehicle is a major source of air pollution in the Sydney region. Choosing an active form of transport such as walking, cycling or using public transport, helps to reduce air pollution, provides benefits of increased cardiovascular fitness and can reduce obesity.

Environmental tobacco smoke, which consists of fine particles and many gases, remains a major source of exposure to air pollutants for some people. Patients with asthma and chronic cardiac or respiratory disease should avoid being in enclosed places where there is tobacco smoke.

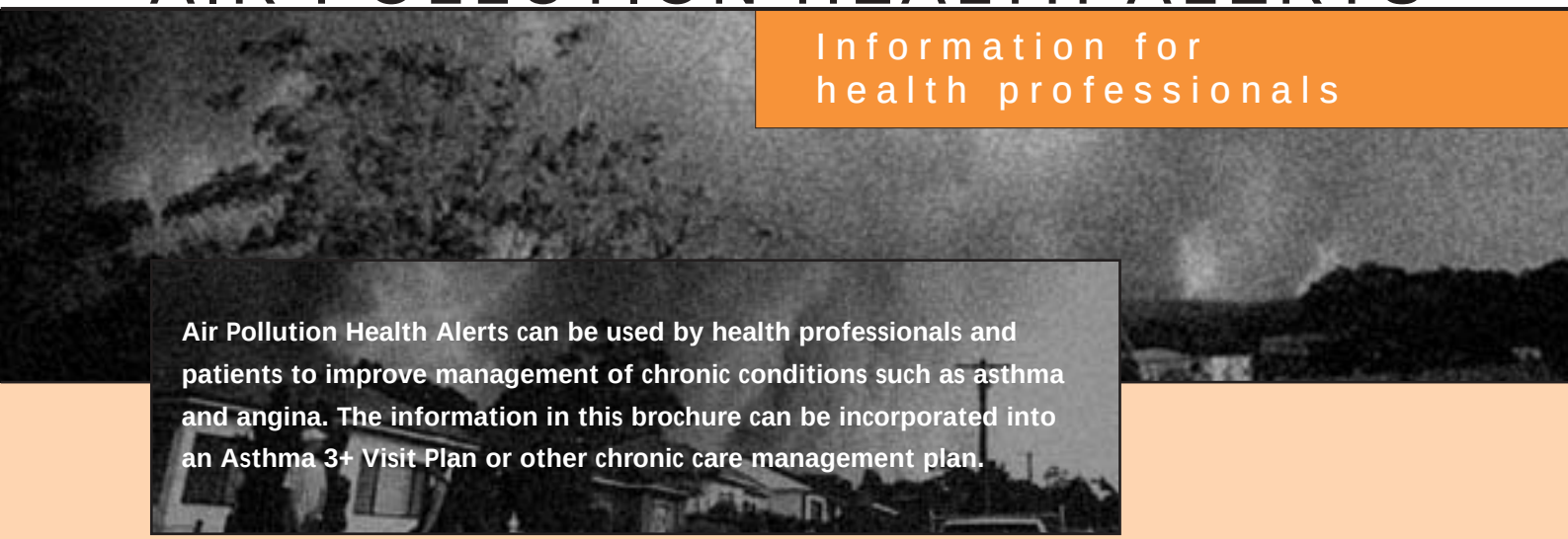
Unflued gas appliances produce large amounts of nitrogen dioxide and carbon monoxide. Elderly people and parents of children with asthma should be made aware of the potential health impacts associated with unflued gas heating and cooking.

Resources

- Air pollution health alerts – What they mean to you – an information sheet for patients
  http://www.health.nsw.gov.au/living/airpollution.html
- Air pollution reports and health alerts –
  http://www.environment.nsw.gov.au/airqual/aqupd.asp
- NSW State of the Environment Report
  http://www.environment.nsw.gov.au/soe/soe2003/chapter3/
- Bushfire Smoke fact sheet
  http://www.health.nsw.gov.au/pubs/factsheet/pdf/bushfire_fs.pdf
- Wood Smoke fact sheet
  http://www.health.nsw.gov.au/pubs/factsheet/pdf/wood_smoke_pub.pdf
- Unflued Gas Heater fact sheet
  http://www.health.nsw.gov.au/pubs/2004/pdf/gas_heaters_fs.pdf
- Smokefree Zone – Best Practice Guidelines:
  http://www.smokefreezone.org/site_files/s1001/downloads/GPFactSheet.pdf
- Asthma & Air Pollution. A guide for health professionals. Australian Government Department of Health and Ageing
  Access at www.NationalAsthma.org.au or contact your local Asthma foundation on 1800 645 130 (Publication date February 2005.)
- Asthma Foundation of NSW
  http://www.asthmansw.org.au/ or 1800 645 130 (toll free)
- The Australian Lung Foundation
  http://www.lungnet.com.au
- The National Heart Foundation
  http://www.heartfoundation.com.au/

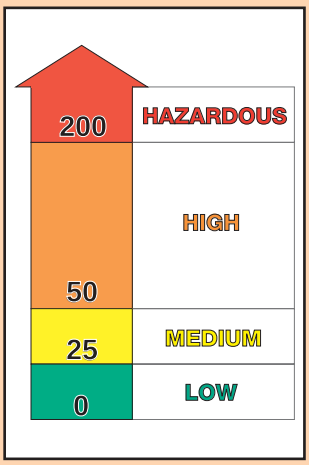
AIR POLLUTION HEALTH ALERTS

Information for health professionals



Air Pollution Health Alerts can be used by health professionals and patients to improve management of chronic conditions such as asthma and angina. The information in this brochure can be incorporated into an Asthma 3+ Visit Plan or other chronic care management plan.

NSW Health and the NSW Department of Environment and Conservation[1] (DEC) have developed a system of air pollution health alerts to better inform the community about how air pollution may affect their health and to assist in the management of conditions exacerbated by air pollution.



The health alert system is linked to the routine reporting of air pollution in the Sydney region, the Regional Pollutant Index (RPI) that is issued twice daily by the DEC. The RPI reports whether air pollutant levels have been LOW, MEDIUM or HIGH, and forecasts likely pollutant levels for the next day. The health alerts are based on the forecast, and also take account of extreme pollution events, such as bushfires.

The RPI rates air pollution as LOW, MEDIUM or HIGH by comparing pollutant levels to health guidelines or environmental goals. On clear windy days the RPI is usually in the LOW range (0-24). When the air is still in hot weather or on cold nights, the RPI is often in the MEDIUM range (25-49), and on several days a year is in the HIGH range (50 or higher). The RPI is usually only considered HAZARDOUS for health when pollutant levels are very high, such as during bushfires.

Air pollution in the Sydney Greater Metropolitan Region

Over the past few decades air pollution levels in our cities have generally improved. DEC routinely monitors and reports against national standards for six pollutants – fine particles, ozone[2], nitrogen dioxide, carbon monoxide, sulfur dioxide and lead. Of these, fine particles and ozone sometimes reach levels across the region that are associated with adverse health effects. The RPI is calculated by comparing fine particle, ozone and nitrogen dioxide levels to national standards and environmental goals and the health alerts relate to these three pollutants.

Fine particles are generated by combustion or wind-blown dust. Principal sources in the Sydney Greater Metropolitan Region (GMR) are wood heaters, motor vehicles and industrial emissions. Fine particles readily penetrate indoors unless buildings are well sealed and air-conditioners or filters are used. Fine particles can cause irritative effects on the upper airways and eyes; some reach the lower airways and produce inflammation and reduced lung function. Recent research has also demonstrated that fine particles are associated with increased serum inflammatory markers, increased blood coagulability and effects on cardiac conductivity. Population studies demonstrate increasing cardiac and respiratory morbidity and mortality as fine particle levels increase.

Ozone in the lower atmosphere is a secondary pollutant, formed by the action of sunlight on other pollutants such as nitrogen dioxide and volatile organics (eg: unburnt petrol and solvents). The main sources of these pollutants in the Sydney GMR are motor vehicles. As sunlight drives the formation of ozone, it is more of a problem in summer,

1 The Environment Protection Authority (EPA) is now part of the new Department of Environment and Conservation.

2 The 'ozone layer' is in the stratosphere, 10 to 15 kilometres above the surface of the earth, and protects humans from the effects of the sun; ozone that is found closer to the ground, in the air that people breathe, has adverse health effects.

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and levels tend to peak later in the day. Due to its reactivity, ozone does not persist indoors. Ozone is also a respiratory irritant. There is a wide range of sensitivity to ozone in the population. The effects of reduced lung function, cough, chest tightness and pain on deep inspiration increase over hours in high ozone areas, especially during exercise. During periods of high concentrations of ozone, hospital admissions for asthma and other respiratory conditions increase.

Nitrogen dioxide is mainly formed through fuel combustion in motor vehicles and industry. High levels are also found indoors when unflued gas appliances are used. People with asthma are more sensitive to the effects of nitrogen dioxide – increased bronchoconstriction when exposed to allergens, increased susceptibility to respiratory infection, and direct impairment of lung function. On a population level, increased levels of nitrogen dioxide are associated with increased rates of mortality and morbidity.

Air pollution and health

Patients with asthma, COPD or cardiovascular disease are most likely to be affected by air pollution. Population studies show there is often a delay of one to several days between high pollution days and associated increases in hospital admissions and deaths. The association between these conditions and the three key air pollutants differs:

- **Asthma** can be exacerbated by any of the three pollutants in the reporting system. People with asthma have a wide range of sensitivities that vary between individuals and the pollutants – for example, an individual may cough and wheeze on days when ozone levels are around 50, but not notice the effects of fine particle pollution when the RPI is 100. The impacts of air pollution may manifest in people with asthma as reduced exercise tolerance, coughing, wheezing, shortness of breath or increased need for reliever medication.
- Patients with **COPD** such as emphysema or chronic bronchitis are most likely to be affected on days with high levels of fine particles, but are also susceptible to high levels of ozone and nitrogen dioxide. Symptoms related to fine particles include coughing and increased dyspnoea. The long-term effects of ozone on COPD patients include accelerated decline in lung function.
- People with **cardiovascular disease** are also most likely to be affected on days with high fine particle pollution. Potential effects include arrhythmias, heart failure, angina, acute myocardial infarction, sudden death and stroke.

People who do not have these pre-existing conditions can also be affected by air pollution. Healthy adults exercising on high ozone days may have significant reductions in FEV_1 or pain on deep inspiration, and reduced exercise capacity. When any of these pollutants are at hazardous levels, the general population can experience respiratory or cardiac effects similar to those found in more sensitive people at lower levels.

The health alert system

When levels of one of the three pollutants are rising, and likely to be HIGH or HAZARDOUS on the following day, an alert is issued with the RPI to electronic and print media outlets. Information on current pollutant levels and health alerts is also available via a freecall-line[3] or on the NSW DEC website.

The alert specifies the pollutant and whether it is likely to be at HIGH or HAZARDOUS levels. During bushfires, both fine particles and ozone may be elevated, and if this is likely the alert covers both pollutants. When pollutant levels are predicted to be HIGH, the alert indicates that air quality is likely to be 'unhealthy for sensitive individuals' the next day; specifies which groups are sensitive; and suggests simple ways to reduce exposure and manage impacts. Alerts on days when pollutants are likely to be HAZARDOUS apply to everyone; however patients with pre-existing disease are more likely to suffer adverse effects.

An example of a health alert

'The Department of Environment and Conservation report that air pollution levels today were HIGH with an index of 52 due to ozone in Sydney's South West. Ozone levels are predicted to be HIGH tomorrow. NSW Health advise that this level of air pollution is unhealthy for sensitive people, and could cause symptoms, especially in people with asthma. Levels will be lower indoors. People with asthma should avoid exercising outdoors. If you have symptoms of asthma, shortness of breath or coughing, you should rest and use your reliever medication. If symptoms persist, seek medical advice.'

[3] Sydney: 1300 130 520 – Newcastle: 1800 817 838 – Wollongong: 1800 819 112.

The health alerts used are shown in this table:

OZONE	
Band	**Health alert**
HIGH	Unhealthy for sensitive people, and could cause symptoms, especially in people with asthma. Levels will be lower indoors. People with asthma should avoid exercising outdoors. If you have symptoms of asthma, shortness of breath or coughing, you should rest and use your reliever medicine. If symptoms persist, seek medical advice.
HAZARDOUS	Anyone could develop symptoms, especially people with asthma. Levels will be lower indoors. Everyone should avoid outdoor exertion and stay inside as much as possible. If you have coughing, wheezing or shortness of breath you should rest, take your reliever medicine or seek medical advice.

NITROGEN DIOXIDE	
Band	**Health alert**
HIGH	People with asthma should watch for symptoms. If you have symptoms of asthma, shortness of breath or coughing, rest and use your reliever medicine. If symptoms persist, seek medical advice.
HAZARDOUS	Levels may be lower indoors. Everyone should avoid outdoor exertion and stay inside as much as possible. If you have coughing, wheezing or shortness of breath you should rest, take your reliever medicine or seek medical advice.

FINE PARTICLES	
Band	**Health alert**
HIGH	Unhealthy for sensitive people and could cause symptoms, especially people with heart or lung disease. Levels may be lower indoors. People with heart or lung disease should avoid exercising outdoors. If you have chest pain, shortness of breath or coughing, use your reliever medicine. If symptoms persist, seek medical advice.
HAZARDOUS	Anyone could develop symptoms, especially people with heart or lung disease. Levels may be lower indoors. Everyone should avoid outdoor exertion and stay inside as much as possible. If you have chest pain, shortness of breath or coughing, you should rest, take your reliever medicine or seek medical advice.

OZONE and FINE PARTICLES	
Band	**Health alert**
HIGH	Unhealthy for sensitive people and could cause symptoms, especially people with heart or lung disease. Levels may be lower indoors. People with heart or lung disease should avoid exercising outdoors. If you have symptoms of asthma, chest pain, shortness of breath or coughing, use your reliever medicine. If symptoms persist, seek medical advice.
HAZARDOUS	Anyone could develop symptoms, especially people with heart or lung disease. Levels may be lower indoors. Everyone should avoid outdoor exertion and stay inside as much as possible. If you have symptoms of asthma, coughing, chest pain, wheezing or shortness of breath you should rest, take your reliever medicine or seek medical advice.

No threshold for adverse effects from fine particles and ozone has been established. Thus, some patients may experience adverse health effects from air pollution on days when the RPI is in the medium range.

Improving patient care using air pollution health alerts

- Encourage sensitive patients to regularly check the RPI, so that its fluctuation becomes familiar, like the temperature or the UV index. Many patients will be able to learn which pollutant at what level is likely to be a problem for them.
- Reinforce the message that patients should ensure they have ready access to reliever medications on air pollution health alert days. When air pollution is likely to be elevated for several days due to still hot weather, still cold nights or bushfires, an increase in preventer medications may be required. This adjustment could be included in their personal management plan.

AIR POLLUTION HEALTH ALERTS

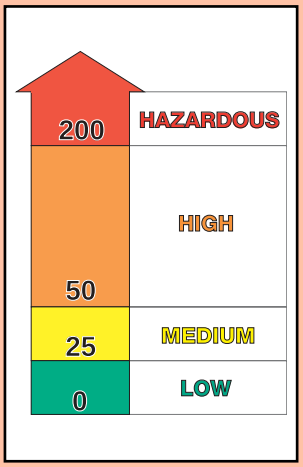
What they mean to you

Take note of regular air pollution reports and health alerts. Learn about the health effects of air pollution and the steps you can take to reduce those effects.

While air pollution levels in the Sydney region are generally quite low compared to large cities overseas, there are a number of days each year when people sensitive to the effects of air pollution are likely to feel its impacts. Extreme episodes of air pollution, such as during prolonged bushfires, can affect everyone's health.

How to get up-to-date air quality reports

The Department of Environment and Conservation[1] (DEC) issues air pollution reports for Sydney, Illawarra and the Lower Hunter twice daily. These reports are in the form of the Regional Pollutant Index (RPI) and are available on the internet[2], via a freecall line[3] and in the *Sydney Morning Herald*. They can also be heard on some TV and radio broadcasts.



The RPI rates air pollution as LOW, MEDIUM or HIGH by comparing pollutant levels to health guidelines or environmental goals. On clear windy days the RPI is usually in the LOW range (0–24). When the air is still during hot weather or on cold nights, the RPI is often in the MEDIUM range (25–49), and on several days a year is in the HIGH range (50 or higher). The RPI is usually only considered HAZARDOUS for health when pollutant levels are very high, such as during bushfires.

Are there different types of air pollution?

Air pollution is a complex mixture of chemicals and particles. Its composition can vary greatly, depending on the season, the weather and the different types and numbers of sources. Three air pollutants, ozone[4], nitrogen dioxide and fine particles, are taken into account in the calculation of the RPI. These pollutants have associated health effects.

Ozone at ground level is the product of the interaction between sunlight and emissions from sources such as motor vehicles and industry. Ozone is more readily formed during the summer months and reaches its highest concentrations in the afternoon or early evening. If we breathe in too much ozone, it can irritate the lungs and can cause coughing, pain on taking a deep breath or reduced exercise tolerance.

Nitrogen dioxide arises from the combustion of fuel in motor vehicles and industry. It is found at highest concentrations near busy roads and can also be high indoors when unflued gas appliances are used. Nitrogen dioxide also irritates the lungs and makes people with asthma more susceptible to lung infections and reactions to pollens and exercise.

Fine particle pollution is mainly from motor vehicles, wood burning heaters and industry. It can reach extremely high concentrations during bushfires. Fine particles irritate the lungs, but can also have a negative impact on the blood and the heart.

Who is affected by air pollution?

Everyone can potentially be affected by air pollution when concentrations of pollutants are very high. Research shows that different groups of people are sensitive to different types of air pollution. The types of air pollution that reach HIGH concentrations in our region are most likely to affect people with:

- asthma
- cardiovascular disease (angina, partially blocked arteries, strokes)
- chronic obstructive pulmonary disease (emphysema, chronic bronchitis).

Different pollutants affect these groups differently. For example, several of the pollutants may trigger symptoms in people with asthma, whereas people with cardiovascular disease are most likely to be affected by particle pollution.

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What is an 'air pollution health alert'?

When the RPI is likely to be in the HIGH or HAZARDOUS range, a health alert is issued. When in the HIGH range the alert targets the group(s) known to be sensitive to that type of pollution, and provides advice to watch for symptoms, have reliever medicine nearby, and seek medical advice if any symptoms that do arise don't settle by using reliever medication and resting. The alert also states whether remaining indoors will help to reduce exposure.

If the RPI is in the HAZARDOUS range, the alert is relevant to everyone. For sensitive groups the advice given in the HIGH alert still applies, but additionally it includes advice on staying inside and limiting exercise.

Six simple steps to help protect you from air pollution

1 Get to know how sensitive you are to air pollution

- Take note of the RPI – as you do the daily temperature or UV index.
- See if you get symptoms on days when the RPI is higher – or one or two days after – and whether you feel better when the RPI is low.

2 Plan activities when and where air pollution levels are lower

- If you are sensitive to ozone, try exercising in the mornings or indoors on summer days when the RPI is HIGH due to ozone.
- Fine particle pollution is harder to avoid, but it will be lower away from busy roads and even lower in air-conditioned buildings.

3 Change your activity level

- If pollutant levels are HIGH you can reduce how much air pollution you breathe by choosing an activity that is less demanding – for example, walk instead of jog; or exercise for a shorter time.

4 Listen to your body

- If you get symptoms during exercise, stop your activity. Find a less demanding activity or wait until pollution levels drop.
- Take note of air pollution health alerts – they include information on who is likely to be affected and advice on what to do.
- Make sure you have reliever medication at hand to use on HIGH pollution days if you need to.

5 Create a clean 'indoor air zone'

Eliminate sources of air pollution from inside your home:

- Don't allow anyone to smoke inside.
- Use electric or **flued** gas heating.
- Choose low emission paints; for other home decorating needs, choose low emission products, if available.
- Open windows when cooking or use a kitchen exhaust that is ducted outdoors.

If you can eliminate air pollution from the indoor sources listed above, closing windows and doors and using a reverse cycle air conditioner may help reduce pollution levels in your home.

6 Talk with your doctor

- You could include actions to follow on air pollution alert days in your management plan.
- If you will be exercising more than usual, discuss this with your doctor to make sure that air pollution levels are taken into account.
- If you have symptoms during a certain activity, ask your doctor if air pollution could be affecting you.

An example of a health alert you may hear

'The Department of Environment & Conservation report that air pollution levels today were HIGH with an index of 52 due to ozone in Sydney's South West. Ozone levels are predicted to be HIGH tomorrow. NSW Health advise that this level of air pollution is unhealthy for sensitive people, and could cause symptoms, especially in people with asthma. Levels will be lower indoors. People with asthma should avoid exercising outdoors. If you have symptoms of asthma, shortness of breath, or coughing, you should rest and use your reliever medication. If symptoms persist, seek medical advice.'

For more information

- NSW Health website
  http://www.health.nsw.gov.au/living/airpollution.html
- Air pollution reports and health alerts
  http://www.environment.nsw.gov.au/airqual/aqupd.asp
- NSW State of the Environment Report
  http://www.environment.nsw.gov.au/soe/soe2003/chapter3/
- Bushfire Smoke fact sheet
  http://www.health.nsw.gov.au/pubs/factsheet/pdf/bushfire_fs.pdf
- Wood Smoke fact sheet
  http://www.health.nsw.gov.au/pubs/factsheet/pdf/wood_smoke_pub.pdf
- Unflued Gas Heater fact sheet
  http://www.health.nsw.gov.au/pubs/2004/pdf/gas_heaters_fs.pdf
- Smokefree Zone
  http://www.smokefreezone.org/
- Asthma & Air Pollution. How you can reduce exposure. Australian Government Department of Health and Ageing. Access at www.NationalAsthma.org.au or contact your local Asthma foundation on 1800 645 130 (Publication date February 2005).
- Asthma Foundation of NSW
  http://www.asthmansw.org.au/ or 1800 645 130 (toll free)
- The Australian Lung Foundation
  http://www.lungnet.com.au/
- The National Heart Foundation
  http://www.heartfoundation.com.au/

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[1] The Environment Protection Authority (EPA) is now part of the new Department of Environment and Conservation

[2] http://www.environment.nsw.gov.au/airqual/aqupd.asp

[3] Sydney: 1300 130 520 – Newcastle: 1800 817 838 – Wollongong: 1800 819 112

[4] The 'ozone layer' is in the stratosphere, 10 to 15 kilometres above the surface of the earth, and protects humans from the effects of the sun; ozone that is found closer to the ground, in the air that people breathe, has adverse health effects.

Appendix 12

THE DEPARTMENT OF RESPIRATORY MEDICINE, THE CHILDREN'S HOSPITAL WESTMEAD

The effects of outdoor air pollution on the respiratory health of children

The global burden of disease due to outdoor air pollution has been well summarised in a recent review, in which outdoor particulate matter (PM) air pollution was estimated to cause about 1% of mortality from acute respiratory infections in children under 5 years of age worldwide, albeit predominantly in developing countries (1). A number of recent studies have examined the effect of air pollution specifically on the respiratory health of children (2-8). Traffic related air pollution was found to be associated particularly with cough in the first 2 years of life, with the association being strongest in the first year (2). Two studies have documented effects of air pollution on lung growth causing deficits in lung function over time (3, 4). Studies on the effects of air pollution on asthma have shown some conflicting results, but there is general consensus that ozone, oxides of nitrogen and particulates lead to exacerbations of asthma, although evidence for the role of air pollution in initiating asthma is less convincing (5). Assessments of the effect of inner city air pollution on respiratory health and atopy in children as part of the ISAAC Study have produced differing results (6, 7). In Dresden, air pollution was associated with increased cough and bronchitis, but no association was found with atopic sensitisation, atopic diseases or bronchial hyper-responsiveness (6). In contrast, in Munich, a positive association was found between urban traffic and pollution exposure with asthma, cough and wheeze, and, in children additionally exposed to environmental tobacco smoke, allergic sensitisation (7). These differences may relate to socioeconomic or other environmental factors differing in the 2 populations. Another study examining the effects of air pollution from traffic on the development of respiratory infections and asthmatic and allergic symptoms in children followed from birth to 2 years of age demonstrated associations of air pollution with increases in wheezing, doctor diagnosed asthma, ear/nose/throat infections, and flu/serious colds (8).

Effects of specific pollutants on asthma have also been studied, again with some variation in results found. Ozone has been shown to be a trigger for asthma attacks (9) and also, in a study conducted in Western and South Western Sydney, on peak flow variability (10). Asthma symptoms in primary school age children appeared to be more common around Lake Munmorah power station (11), but industrial air pollution from incinerators did not seen to influence asthma symptoms or atopy in the Sydney coastal region (12). There is also conflicting data on the effect of bushfires on asthma, with a Sydney study failing to show an association between bushfire smoke and ED presentations for asthma (13) but a recent Darwin study demonstrating a more definite association between PM increases resulting from bushfires and asthma symptoms and need for asthma treatment (14).

In conclusion, there is good evidence for a detrimental effect of outdoor air pollution on the respiratory health in children including effects of respiratory illnesses including infections and asthma and most importantly effects on lung growth. This evidence needs to be taken into consideration when formulating ongoing plans for monitoring and reducing outdoor air pollution in the Sydney Basin.

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The global burden of disease due to outdoor air pollution.
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4. Gauderman WJ, Avol E, Gilliland F et al
The effect of air pollution on lung development from 10 to 18 years of age.
N Engl J Med 2004; 351: 1057-67

5. NSW Health Department.
Asthma and the Environment: Perspectives on the Prevention of Asthma
NSW Health Department 1997; Pages 27 & 37-38

6. Hirsch T, Weiland SK, von Mutius E et al
Inner city air pollution and respiratory health and atopy in children.
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7. Nicolai T, Carr D, Weiland SK et al
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8. Brauer M, Hoek G, Van Vliet P et al
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9. Fauroux B, Sampil M, Quénel P, Lemoullec Y
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Pediatr Pulmonol 2000; 30: 41-6

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Acute effects of low levels of ambient ozone on peak expiratory flow rate in a cohort of Australian children.
Int J Epidemiol 2000: 29: 549-57

11. Henry RL, Abramson R, Alder JA et al
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12. Gray EJ, Harrington J, Peat JK et al
Asthma severity and morbidity in a population sample of Sydney school children: Part I – Prevalence and effect of air pollutants in coastal regions.
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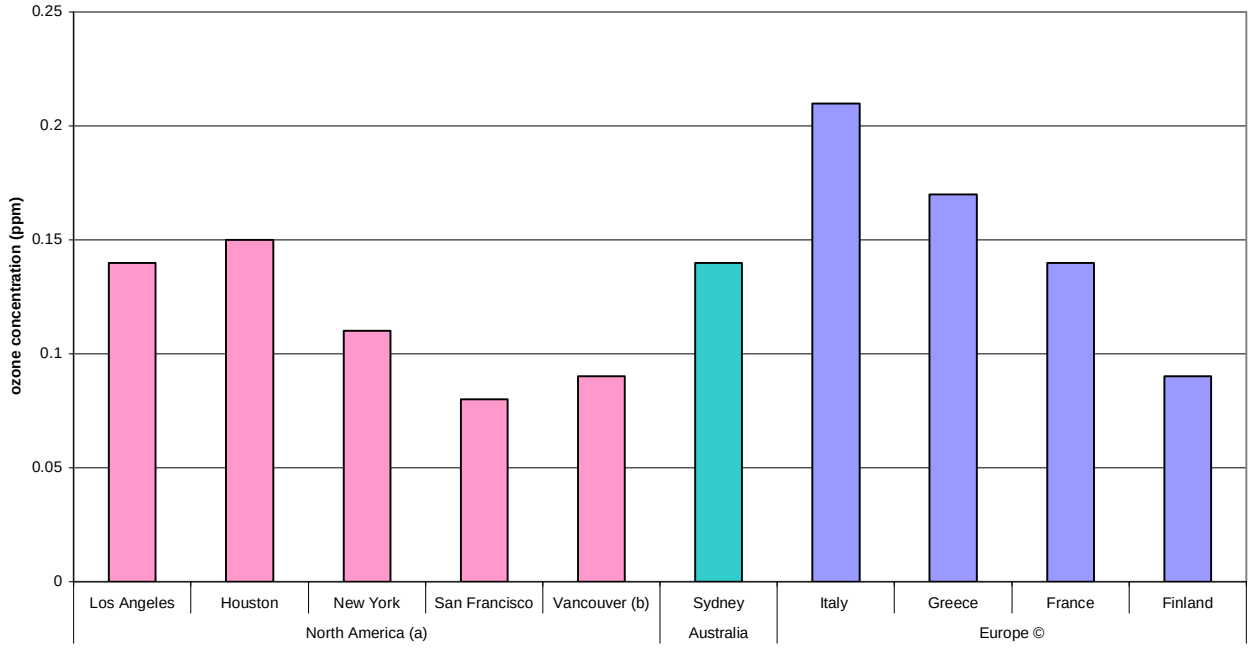
International comparisons of pollution levels for ozone and particles in 2004

Comparative maximum 1-hour ozone, 2004



(a) The US reports ozone peaks which are the *second* daily maximim 1 hour concentration (USEPA Air Trends – peak air quality statistics by city, 2004 - www.epa.gov/air/airtrends/factbook.html). Australia and Europe report the maximum.
(b) The Greater Vancouver Regional District reports maximum 1 hour regional ozone for the Lower Fraser Valley in which Vancouver is located (www.gvrd.bc.ca/air)
(c) The European Environment Agency in *Air Pollution by ozone in Europe in summer 2004* reports the maximum observed concentration on a country by country basis. Countries which had no exceedences of the EU information threshold of 0.09ppm are not reported eg Denmark, Sweden, Poland

Comparative particles levels – annual average particles (PM_{10}), 2004