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Air Pollution in Sydney: An Update

by

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EXECUTIVE SUMMARY

In 1992 the Metropolitan Air Quality Study was commissioned to help identify the sources and problems of air pollution in Sydney. Concurrently, the NSW Health Department began a three year Health and Air Research Program (HARP). These two studies have provided the Government with an understanding of the sources of air pollutants, their distribution and dispersal in the Sydney region and their health effects. With this information, strategies to reduce air pollution can be developed (page 1).

Air borne particles are very diverse in their size and chemical composition. They can be referred to as total suspended particulates, black smoke or described by their size. Common size descriptors are PM_{10} and $PM_{2.5}$, with the numbers referring to the maximum particle diameter in micrometres. Respirable particles (up to PM_{10} in size) can be inhaled deeply into the lung and have been associated with respiratory problems. The HARP study concluded that fine particle pollution accounts for 397 premature deaths in Sydney (pages 3-5).

Ozone is a pollutant formed from the reaction of nitrogen oxides and reactive organic compounds in the presence of light. Ozone can irritate the eyes and air passages and increase the sensitivity of airways to allergic triggers for some asthma sufferers. In the Sydney region, mobile sources account for 82% of nitrogen dioxide emissions and 49% of reactive organic compounds. Ozone production is variable according to meterological conditions. However, during warm summers Sydney is prone to ozone production, which can peak well above World Health Organisation goals (pages 5-7).

Nitrogen dioxide is a pollutant in its own right, in addition to being a contributor to ozone production. Nitrogen dioxide can damage the mechanisms which protect the human respiratory tract. The pollution trend of nitrogen dioxide is not clear (pages 7-8).

Carbon monoxide is a colourless and odourless gas which when in the blood stream prohibits haemoglobin from carrying oxygen around the body. In the Sydney region, motor vehicles account for about 90% of carbon monoxide emissions. The overall levels of carbon monoxide in Sydney are low, although health goals continue to be exceeded in the central business district (page 9).

Sulfur dioxide is a pungent gas which attacks the respiratory tract directly, affecting both upper and lower airways. The combustion of fossil fuels containing sulfur is the main human activity which contributes to sulfur dioxide in the atmosphere. Australian fossil fuel has relatively small amounts of sulfur, and as a result ambient sulfur dioxide concentrations in Sydney are low. However, ‘hot-pockets’ of sulfur dioxide may be found around smelters (page 10).

Lead is a natural metal found in the earth’s crust. Lead enters the atmosphere mainly through leaded transport fuels and industrial point sources, notably metal smelters. In the Sydney region, leaded petrol emissions are the major contributor to airborne lead levels. Unleaded petrol was introduced in 1985, and ambient lead levels in central Sydney have

dropped since then to below World Health Organisation goals. However, industrial emissions of lead have resulted in ambient lead health goals being exceeded in the Newcastle and Illawarra area (page 11).

The name 'air toxics' is given to a large number of toxic organic compounds including chemicals such as benzene, formaldehyde, chlorinated hydrocarbons and polycyclic aromatic hydrocarbons. Pilot studies done by the EPA indicates that motor vehicles are the major source of air toxics in the region. Other sources include the petroleum and chemical industries, emissions from waste incinerators, evaporative emissions from petrol stations, spray painting, dry cleaners and other solvent use. The health effects of 'air toxics' are serious and they may cause cancer, gene mutation, reproductive malfunction, affect foetal development or have neuro-toxic effects (page 11).

In February 1998 the State Government released its air pollution control strategy, called *Action for Air*. The strategy has seven objectives: (pages 12-15)

- 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.

Community, industry and government support is required if the objectives in *Action for Air* are to be achieved. The NRMA initiative Clean Air 2000 campaign is likely to help increase support for the objectives in *Action for Air*. The Clean Air 2000 campaign has been developed as a community based progam that comprises two principal elements: encouraging individuals to adopt cleaner motoring and more responsible travel practices; and improving opportunities for transport choice by working with government, business, industry and the community. The NRMA has brought together high profile stakeholders from all sectors of the community to form the Clean Air 2000 Taskforce. The Taskforce is chaired by Mr Rod McGeoch. The Taskforce has nominated four working groups to investigate areas where opportunities for solutions lie. The Working Groups are: Infrastructure and Planning; Technology and Fuels; Commuter and Fleet Travel Practices; and Pricing and Funding. The Taskforce hopes to make air quality and public transport improvement become amongst the top three issues at the 1999 NSW Government State election (page16).

1.0 Introduction

On a regional scale the devastating effects of burning forests in Indonesia over the 1997/98 summer led to a heightened awareness of the impact of human activities on air quality and the planet. In Sydney, the summer season of 1997/98 was also heralded by pollution events that resulted in ozone pollution twice the recommended world health level.[1] With a steady increase in population growth in the Sydney metropolitan region, unless remediating steps are taken there will be a continued deterioration in air quality. Already, on days with high air pollution there is an increase in mortality of 2-3 percent, and vehicle air pollution results in health and medical costs of around $300 million annually.[2]

The current debate about air pollution can be traced back to 1991, when a critical point was reached with several consecutive days of poor air quality. As a result, the State Government announced the holding of a Summit on Air Quality in July 1991.[3] The first summit was followed up with a second seven months later in February 1992. It was at this second summit that the then Minister for the Environment, Hon Tim Moore MP, announced the following government actions, including:[4]

- the funding of a Metropolitan Air Quality Study (MAQS)
- study of the links between health and air pollution
- the development of stronger controls on source emissions, especially motor vehicles
- continue on-going consultation with stakeholders and interest groups.

This paper is an update of the Briefing Paper No 24/95 'Air Pollution in Sydney'. Since 1995, there have been several major developments in the study and analysis of air pollution in the Sydney metropolitan region. The most important development has been the release of the Metropolitan Air Quality Survey (MAQS), a major three year study on air pollution in the greater metropolitan region of Sydney. The MAQS developed an air pollutant inventory, analysed air movements, investigated air chemistry and developed an urban airshed model. The results of MAQS meant that for the first time, the Government had a comprehensive picture of the causes and movement of air pollution in the Greater Sydney Region. Government responses to air pollution could then be formulated.

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1 "Smog the worst in 5 years as US style haze hits Sydney" in *The Daily Telegraph*, 27 November 1997.

2 Environment Protection Authority, *New South Wales State of the Environment 1997*. 1997 at 57.

3 NSW Government, *Proceedings of the NSW Government Summit on Air Quality*, July 4-5 1991.

4 Environment Protection Authority, *The Second Sydney Summit on Air Quality, Conference Proceedings*, 24 February 1992.

Concurrently with the development of MAQS, the NSW Health Department conducted a three year Health and Air Research Program (HARP). This program found correlations between pollution levels and morbidity rates in the Sydney metropolitan region.

Unlike other forms of pollution, such as beach sewage pollution, air pollution is often very visible to all the residents in a city. As such, it can have an effect on the quality of life for all residents. Because of this, there has been considerable public pressure to 'do something' about air pollution. One example of this has been the formation of the NRMA Clean Air 2000 group, which is an initiative of the motorists group. The activities and programs of the Clean Air 2000 group are discussed in Section 5.0 of this Paper. This call to action to 'clean the air' has intensified as we approach the 2000 Olympics and showcase the 'Green Games' to the world. The NSW Government has recently released a paper *Action for Air*[5] which details the Government's response to reducing air pollution. This strategy is detailed in Section 3.0 of this Paper. Concurrently, the Commonwealth government has been active in the area with the release of the report *Urban Air Pollution in Australia*.[6] In addition, the National Environment Protection Council has released a draft National Environment Protection Measure for Ambient Air Quality.[7] The Commonwealth Government has allocated $16 million over five years for its Air Pollution in Major Cities Program, funded from the Natural Heritage Trust. Part of this funding will go to the National Environment Protection Council to develop the National Environment Protection Measure for Ambient Air Quality.[8]

2.0 The Types and Sources of Air Pollution in Sydney

Which air pollutants to measure and report on is a science that has advanced considerably over recent years. Developed in 1992, the Metropolitan Air Quality Study measured five pollutants: volatile organic compounds; oxides of nitrogen; carbon monoxide; sulfur dioxide and air borne particulates. The 1997 NSW State of the Environment Report analyses air pollution using a set of four 'core indicators'. Air pollutants included in this set of core indicators include: ground level ozone; nitrogen dioxide; fine particles and air toxics. A new Draft National Environment Protection Measure (NEPM) for Ambient Air Quality is being developed, and future NSW State of the Environment reporting will be based on the new national protocol. The NEPM uses the following six indicators: carbon monoxide, nitrogen dioxide, oxidant (as ozone), sulfur dioxide, lead and particles. The air pollutants to be reported in the NEPM are described below.

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5 NSW Government, Environment Protection Authority, *Action for Air*, February 1998.

6 Commonwealth of Australia, *Urban Air Pollution in Australia. An Inquiry by the Australian Academy of Technological Sciences and Engineering*. 1997.

7 The National Environment Protection Council, comprised of a Minister from each of the States and Territories, and chaired by the Commonwealth, develops environment protection measures. These are known as National Environment Protection Measures (NEPM). For more information see: NSW Parliamentary Library Bills Digest No 1/95, *National Environment Protection Council (NSW) Bill 1995*.

8 See the Internet site: http://www.nht.gov.au/programs/airqual.htm

2.1 Particulate Matter

Airborne particles are very diverse in their size and chemical composition. They exist as discrete units ranging in size from 0.0005 micrometre to about 100 micrometres in diameter. Particles can be referred to in various ways: total suspended particles (TSP); black smoke or by descriptions of their size. Common size descriptors are PM_{10} and $PM_{2.5}$, with the numbers referring to the maximum particle diameter in micrometres.[9]

Respirable particles (up to PM_{10} size) can be inhaled deeply into the lung and have been associated with a wide range of respiratory problems. Long and short term exposure to such particles have been linked with increased deaths from heart and lung disease. Many studies suggest that for every 10 $\mu g/m^3$ increase in average PM_{10} levels there is a one percent increase in the daily mortality rate. Exposure to PM_{10} has also been linked to pneumonia, loss of lung function, asthma and other respiratory problems.[10]

The HARP study of air pollution in the Sydney region showed:[11]

- associations between particulates and cardiovascular and respiratory mortality in Sydney on a day to day basis. It was found that for every 10 $\mu g/m^3$ increase in 24 hour PM_{10} levels in Sydney was associated with a one percent increase in mortality. The studies did not determine if the increases in mortality represented days, months or years lost.

- associations between particulate pollution and hospital admissions for chronic obstructive pulmonary disease (a respiratory disease in the elderly) and heart disease in Sydney. An increase of 50 $\mu g/m^3$ in 24-hour PM_{10} levels was associated with a 4 percent increase in COPD admissions in the elderly.

- associations between particulate pollution and the prevalence of respiratory symptoms among primary school children from the industrial centres of Newcastle and Wollongong.

- associations between daily particulate levels and reductions in lung function in children with asthma in Western Sydney.

- it was concluded that fine particle pollution in Sydney accounts for 397 premature

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9 National Environment Protection Council, *Draft National Environment Protection Measure and Impact Statement for Ambient Air Quality*. 1997 at 178.

10 *Ibid* at 178.

11 Environment Protection Authority, *New South Wales State of the Environment 1997*. 1997 at 80.

deaths per year out of a total of 21,500.[12]

Particulate pollution is also responsible for the brown haze seen over the city, which is especially evident during winter when temperature inversions trap fine particles close to the surface.

Sources of Particulate Pollution

Anthropogenic particles are emitted directly into the atmosphere from combustion and industrial processes (known as primary particles), or form from chemical reactions in the atmosphere (secondary particles). Gases such as sulfur dioxide and oxides of nitrogen react over time before condensing into particles. Because fine particles can form as a result of secondary reactions, the source of particulate pollution can be difficult to identify. However, the MAQS study has shown that wood combustion for domestic heating and motor vehicles, particularly diesel vehicles, are two major sources of particulate pollution in the Sydney region. It is estimated that 36 percent of weekday emissions, and 53 percent of weekend emissions is from domestic fuel combustion, most of which is wood.[13]

Regulatory Standards for Particulates

Worldwide there is some controversy over the suitable regulatory standard for PM_{10} and $PM_{2.5}$, as well as how they should be measured and reported. Most commonly, data is summarised as annual averages, although an averaged '24 hour' reading is also used. Table 1 lists the different standards for exposure to particulates in different jurisdictions. Currently in Australia there is no standard for fine particles, although the National Environment Protection Council has recommended that the standard for PM_{10} be 50 $\mu g/m^3$ averaged over a 24 hour period, with one allowable exceedence per year. The Council also acknowledges that with further research, the most suitable standard may be based on $PM_{2.5}$.[14] Presently, the US EPA has set a PM_{10} standard of 150 $\mu g/m^3$ (24 hour), and the UK is proposing a standard of 50 $\mu g/m^3$ over a 24 hour period. The WHO has decided to set no limit because of the absence of a threshold below which there are no effects.[15]

The NSW State of the Environment Report uses an annual average of PM_{10} as a core indicator of air pollution. The Report notes that in Sydney, approximately 30% of months included days on which 24 hour PM_{10} exceeded 50 $\mu g/m^3$ on at least one occasion. The

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12 National Environment Protection Council, *Draft National Environment Protection Measure and Impact Statement for Ambient Air Quality*. 1997 at 185.

13 Environment Protection Authority, *New South Wales State of the Environment 1997*. 1997 at 80.

14 National Environment Protection Council, *Draft National Environment Protection Measure and Impact Statement for Ambient Air Quality*. 1997 at 189.

15 Environment Protection Authority, *New South Wales State of the Environment 1997*. 1997 at 77.

highest 24 hour value, 191 µg/m^3, was measured during the January 1994 bushfires.[16] The NSW Government has recently released its blueprint to reduce air pollution, called *Action for Air*.[17] This document is discussed in detail in Section 3.0. The air quality goals identified in *Action for Air* are also indicated in Table 1.

Table 1: Ambient Air Objectives for Particulates - PM_{10}

Jurisdiction	24 hour µg/m^3	Annual µg/m^3
New Zealand	120	40
United States	150	50
World Health Organisation	No standard	No standard
NHMRC	-	-
NEPM	50	-
NSW - Previous	150	50
NSW *Action for Air* Interim	50	-
Action for Air long term	-	30

2.2 Photochemical smog/ozone

Ozone, often called photochemical smog, is not emitted directly but is formed in the atmosphere by the reaction of precursor compounds and driven by the energy of ultraviolet light. The precursor compounds include oxides of nitrogen and reactive organic compounds (ROCS, also known as hydrocarbons). Management strategies to reduce ozone therefore need to focus on reducing either nitrogen oxides, ROCs, or both. Ozone is measured in 'parts per million' (ppm). The natural background ground level concentration of ozone, as measured at Cape Grim in northwest Tasmania, averages 0.02 ppm, although concentrations of 0.04 ppm have been recorded.[18] Ground level ozone should not be confused with the ozone in the upper atmosphere, about 15 to 20 kilometres above ground level. This upper atmosphere ozone protects the planet by filtering ultraviolet light.

16 Environment Protection Authority, *New South Wales State of the Environment 1997*. 1997 at 77.

17 NSW Government, Environment Protection Authority, *Action for Air*, February 1998.

18 National Environment Protection Council, *Draft National Environment Protection Measure and Impact Statement for Ambient Air Quality*. 1997 at 101.

The MAQS study showed that in the Sydney region, mobile sources[19] accounted for 82% of nitrogen oxide emissions. Motor vehicles are the major contributor to mobile emissions. Mobile sources contributed 49% of reactive organic compounds emissions, while area based sources[20] contributed 41%. Again, motor vehicles dominate mobile ROC emissions.[21]

The effects of ground level ozone include:[22]

- irritation of the eyes and air passages
- increased sensitivity of the airways to allergic triggers for some asthma sufferers. There is evidence that concentrations below 0.12 ppm can increase hospital admissions for asthma and other respiratory conditions. A 1994 HARP study in Western Sydney found associations between daily ozone levels and reductions in lung function in children with a history of respiratory symptoms.
- significant effects of ozone on lung function in people exercising even at concentrations below 0.08 ppm.
- increased susceptibility to infection
- possible association with an increase in mortality
- ozone can also impact on natural ecosystems and agricultural systems by affecting plant growth.

Regulatory Standards for Ozone

Ambient air objectives for ozone in several jurisdictions are listed in Table 2.

The Draft NEPM proposes no adjustment to the current National Health and Medical Research Council standard, which is higher than the WHO goal. The NEPM discussion document noted that health departments supported a goal of 0.08 ppm (1 hour) and 0.06 ppm (8 hour), but these goals were not considered achievable within the ten year time limit set for attainment.[23] The NSW Government policy is to use the WHO's ozone goal of 0.08

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19 This category includes motor vehicles, commercial shipping, aviation, rail transport and marine pleasure craft.

20 These are areas that are too small or numerous to be considered as point sources and include: domestic and commercial application of coatings such as paint; service station and petrol refuelling losses; lawn mowing; domestic/ commercial aerosol use; and the combustion of gas, solid and liquid fuels.

21 Environment Protection Authority, *Metropolitan Air Quality Study. Outcomes and Implications for Managing Air Quality*. 1996 at 27.

22 Environment Protection Authority, *New South Wales State of the Environment 1997*. 1997 at 67.

23 National Environment Protection Council, *Draft National Environment Protection Measure and Impact Statement for Ambient Air Quality*. 1997 at 101.

ppm (1 hour) as the long term objective for air quality in NSW.[24]

Table 2: Ambient Air Objectives for Ozone

Jurisdiction	1 hour ppm	4 hour ppm	8 hour ppm
New Zealand	0.08	-	0.05
European Union	0.08	-	0.05
World Health Organisation	0.08	-	0.06-proposed
NHMRC	0.10	0.08	-
NEPM	0.10	0.08	-
NSW - Previous	0.10	0.08	-
NSW *Action for Air* Interim	0.10	0.08	-
Action for Air long term	0.08	0.06	-

In the Sydney region for 1980-96, the NHMRC goal for ozone was exceeded on up to 26 days per year. During this period, the WHO goal was exceeded on at least six days per year and up to 45 days per year. The data shows considerable variability as ozone production is dependent upon meteorological conditions.[25] However, during warm summers Sydney is prone to ozone production, which can peak at 0.15 ppm (1 hour).[26]

2.3 Nitrogen Dioxide

Nitrogen dioxide is a pungent gas that is corrosive and strongly oxidising. It is produced mainly by combustion processes. Combustion of fossil fuels converts nitrogen contained in the fuel and some atmospheric nitrogen into its oxides, mainly nitric oxide. The nitric oxide slowly oxidises to nitrogen dioxide in the atmosphere. In the presence of reactive organic compounds and light, nitrogen dioxide is a precursor to the formation of ozone. Because of this, nitrogen has traditionally been considered an important pollutant in regard to regional airshed issues. However, scientists are learning that localised effects of nitrogen dioxide are also important. Nitrogen dioxide is measured and reported in parts per million (ppm).

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24 NSW Government, *Developing a Smog Action Plan for Sydney, the Illawarra and the Lower Hunter.* A NSW Government Green Paper, 1996 at 3.

25 Environment Protection Authority, *New South Wales State of the Environment 1997*. 1997 at 69.

26 NSW Government, *Developing a Smog Action Plan for Sydney, the Illawarra and the Lower Hunter.* A NSW Government Green Paper, 1996 at 4.

Nitrogen dioxide can damage the mechanisms which protect the human respiratory tract. Effects include:[27]

- increased susceptibility to respiratory infections in children and increased airway responsiveness, especially in asthmatics
- possible bronchial response to common allergens
- health studies have shown an association between nitrogen dioxide and daily mortality from respiratory related deaths
- strong associations between nitrogen dioxide and hospital admissions for asthma and heart disease, with these effects most pronounced in children (1 - 4 yrs) and people over 65 years.
- a 0.05 ppm increase in the maximum one hour nitrogen dioxide concentration is associated with an 11% increase in daily asthma admissions across all age groups.

Regulatory Standards for Nitrogen Dioxide

The regulatory ambient air standards for nitrogen dioxide in various jurisdictions are listed in Table 3 below.

Table 3: Ambient Air Objectives for Nitrogen Dioxide

Jurisdiction	1 hour ppm	Annual ppm
New Zealand	0.15	-
World Health Organisation	0.11	0.021-0.026
NHMRC	0.16	-
NEPM	0.125	0.03
NSW Previous	0.16	-
NSW *Action for Air* Interim	0.125	0.03
Action for Air long term	0.105	

The NHMRC one hour goal for nitrogen dioxide has not been exceeded in the Sydney region over the years 1994-96. Over the last 15 years, the frequency with which the goal has been exceeded varies and shows no clear trend. Similarly, the number of days in which the WHO goal has been exceeded is also variable, although the frequency is much higher

[27] Environment Protection Authority, *New South Wales State of the Environment 1997*. 1997 at 73.

than the NHMRC goal. The greater frequency of days exceeding the WHO goal suggests that nitrogen dioxide in the Sydney region regularly reaches concentrations of between 0.11 and 0.16 ppm.[28]

2.4 Carbon Monoxide

Carbon monoxide is a colourless, odourless gas which in high concentrations is poisonous to humans. It is present in the air at background levels of between 0.01 and 0.02 ppm. It is produced by natural processes, such as bushfires, and by human activities, such as the incomplete burning of fossil fuels, especially from motor vehicles. When inhaled, carbon monoxide combines with haemoglobin in the blood cells, which prohibits haemoglobin from carrying oxygen around the body. It takes about 4 to 12 hours for carbon monoxide concentrations in the blood to reach equilibrium with the carbon monoxide level in the air, so for this reason carbon monoxide readings are generally reported in terms of an eight hour average. However, the World Health Organisation has also introduced short term goals of 15 and 30 minutes.[29]

In the Sydney region, motor vehicles account for about 90% of carbon monoxide emissions. Table 4 shows the ambient air objectives for carbon monoxide. The proposed NEPM measure is the same as the current NHMRC goal. *Action for Air* does not include carbon monoxide as an indicator.

Table 4: Ambient Air Objectives for Carbon Monoxide

Jurisdiction	1 Hour ppm	8 Hour ppm
New Zealand	30	10
World Health Organisation	25	10
NHMRC	-	9
NEPM	-	9
NSW	25	9
NSW *Action for Air* Interim	-	-
Action for Air long term	-	-

The EPA reports that overall levels of carbon monoxide are low, although levels in the

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[28] Environment Protection Authority, *New South Wales State of the Environment 1997*. 1997 at 73.

[29] National Environment Protection Council, *Draft National Environment Protection Measure and Impact Statement for Ambient Air Quality*. 1997 at 70.

Central Business District continues to exceed the NHMRC goal. However, the number of days that the goal is being exceeded in the CBD is dropping, with a reported 109 days in 1984, compared to 25 in 1995. The maximum one hour concentrations as set by the WHO have not been exceeded since 1986.[30]

2.5 Sulfur Dioxide

Sulfur dioxide is a colourless, pungent gas which is soluble in water. Sulfur dioxide gas attacks the respiratory tract directly, affecting both upper and lower airways. It can provoke wheezing and exacerbate asthma, and can be associated with chronic bronchitis. There are associations between long term exposure to sulfur dioxide and increased incidence of respiratory disease and decreased lung function. Studies also conclude that the effects of sulfur dioxide in the presence of other pollutants may be greater than the effects of sulfur dioxide alone.

The combustion of fossil fuels containing sulfur is the main human activity which contributes to sulfur dioxide in the atmosphere. Fortunately, Australian fossil fuel has a relatively small sulfur dioxide content. The amount of sulfur dioxide emitted in Sydney is small, from sources such as petroleum refineries, chemical manufacturing and motor vehicles. In the Illawarra and Hunter regions, metal smelting is a major contributor to the sulfur dioxide load. Coal fired power stations in the Hunter Valley, central coast and central west contribute 60% of the sulfur dioxide emitted in the greater metropolitan region.

The current NHMRC goals for sulfur dioxide are shown in Table 5. Both NHMRC and the proposed NEPM goals are less strict than the current WHO goals. The EPA reports that ambient concentrations of sulfur dioxide in Sydney are low. However, problems have occurred in the Illawarra district due to the operation of smelters. The Port Kembla copper smelter closed in 1995, and since then sulfur dioxide levels are reported as being low. The reopening of the copper smelter is expected in 1998, and the EPA has noted that it will operate under strict environmental controls.[31]

Table 5: Ambient Air Objectives for Sulfur Dioxide

Jurisdiction	10 minutes ppm	1 hour ppm	24 hours ppm	1 year ppm
New Zealand	0.175	0.12	0.044	0.02
World Health Organisation	0.175	-	0.044	0.02
NHMRC	0.25	0.20	-	0.02

30 Environment Protection Authority, *New South Wales State of the Environment 1997*. 1997 at 84.

31 *Ibid* at 95.

Table 5: Ambient Air Objectives for Sulfur Dioxide				
NEPM	0.20	-	0.08	0.02
NSW	0.25	0.20	-	0.02
NSW *Action for Air* Interim	-	-	-	-
Action for Air long term	-	-	-	-

2.6 Lead[32]

Lead is a soft bluish grey metal which is naturally present in low concentrations in the earth's crust. Most of the lead in the atmosphere is in the form of fine inorganic particles. Lead has been used for many centuries and with the onset of industrialisation, has become a major pollutant.

Lead in the environment is a concern as it can be inhaled or ingested by children, and at blood levels as lows as 10 µg/dL (micrograms per 0.1 of a litre) can have detrimental effects on intellectual development.

In 1979 the NHMRC recommended an ambient air quality goal for lead of 1.5 µg/m^3, based on a three month average. This is the current goal of the NSW Government. A revision of WHO guidelines in 1996 recommended a goal of 0.5 µg/m^3, although this has not been finally adopted. The NEPM has proposed a lead standard of 0.5 µg/m^3, as an annual average reported as a fraction of total suspended particulate matter.[33]

Lead enters the atmosphere mainly through leaded transport fuels and industrial point sources, notably metal smelters. In the Sydney region, leaded petrol emissions are the major contributor to airborne lead levels. Unleaded petrol was introduced in 1985, and ambient lead levels in central Sydney have steadily dropped since then to below WHO goals.[34]

Industrial emissions of lead resulted in ambient lead health goals being exceeded in the Newcastle and Illawarra area. The Boolaroo smelter near Newcastle was responsible for high levels of ambient lead in the air. A pollution reduction program implemented in 1992 has resulted in reduced emissions from the plant. In the Illawarra, the operation of the

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32 For detailed information on lead see: Jenkin,R. *Lead*. NSW Parliamentary Library Briefing Paper 4/93.

33 National Environment Protection Council, *Draft National Environment Protection Measure and Impact Statement for Ambient Air Quality*. 1997 at 70.

34 Environment Protection Authority, *New South Wales State of the Environment 1997*. 1997 at 90.

copper smelter resulted in ambient lead levels considerably higher than the NHMRC goal. The closure of the smelter led to a significant drop in ambient lead in the vicinity of the plant. The re-opening of the plant in 1998 will include an upgrade to control emissions, including lead.[35]

2.7 Air Toxics

The name 'air toxics' is given to a large number of toxic organic compounds including chemicals such as benzene, formaldehyde, chlorinated hydrocarbons and polycyclic aromatic hydrocarbons. The draft NEPM for Ambient Air Quality does not include an air toxics category.

Pilot studies done by the EPA indicates that motor vehicles are the major source of air toxics in the region. Other sources include the petroleum and chemical industries, emissions from waste incinerators, evaporative emissions from petrol stations, spray painting, dry cleaners and other solvent use. The health effects of 'air toxics' are serious and they may cause cancer, gene mutation, reproductive malfunction, affect foetal development or have neuro-toxic effects.

The EPA uses benzene as a core indicator as part of its State of the Environment Reporting. Benzene is a gas which is classified by the United States EPA as a high risk hazardous air pollutant. Long term exposure to benzene can have carcinogenic and genotoxic effects, causing direct damage to genetic material. Benzene occurs naturally in crude oil and can be formed during the petrol refining process. The NHMRC sets a limit for benzene of 5% by volume in petrol. Australian fuels generally contain between 2.5 and 4%. The main sources of benzene in the ambient air are motor vehicle exhaust emissions, evaporative losses during handling and storage of petrol, and emissions from petroleum refineries and chemical industries. The EPA has calculated that motor vehicles emit around 3,100 tonnes of benzene annually, and around 560 tonnes is emitted from major industrial sources.

There is no ambient air quality goal for benzene. The WHO states that, given that benzene is a known carcinogen, there is no safe threshold for benzene in ambient air. The United Kingdom has proposed a health standard of 5 parts per billion (ppb), with a future target of 1 ppb. Sydney has an annual average of 1.2 ppb. However, local areas may have a higher reading. For instance, the Sydney CBD has an average concentration of 2.4 ppb.[36]

The Government strategy *Action for Air* includes funding of $500,000 to investigate the levels of air toxics in the greater metropolitan region.

3.0 The Control of Air Pollution

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35 Environment Protection Authority, *New South Wales State of the Environment 1997*. 1997 at 95.

36 Environment Protection Authority, *New South Wales State of the Environment 1997*. 1997 at 88.

Over the last few years the NSW Government has released for public consultation a series of Green Papers on air pollution. These include: *Developing a Smog Action Plan for Sydney, the Illawarra and the Lower Hunter*; *Developing an Air Quality Management Plan for Sydney, the Illawarra and the Lower Hunter*; and a brown haze action plan. Concurrently, in 1997 a public transport strategy for Western Sydney was released.[37]

After public consultation of the above Green Papers, in February 1998 the NSW Government released an air pollution control strategy, called *Action for Air*.[38] The strategy focuses on seven objectives, which are described below.

Objective 1 - Integrate air quality goals and urban transport planning

This objective acknowledges that urban transport, and specifically motor vehicles, is one of the main contributors to the air pollutant load in Sydney. One measure of the use of vehicles is known as vehicle kilometres travelled (VTK).

Currently, the population in the Sydney region is projected to be 22% higher in 2021 than in 1991. Under present trends, total VTK is projected to grow approximately 35% in the same period. People are using cars more often, with trip lengths increasing and having a greater reliance on the car.

The Government is committed to a two phased VTK target:

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

These targets will require a reduction of around 9% in per capita VTK in the decade 2011-2021. To achieve these targets there will need to be a major shift towards the use of public transport. The Government has directed transport agencies to develop an integrated Transport Plan to achieve the above goals. The Transport Plan is to be provided to the Government by November 1998. Similarly, to reduce the impact of diesel emissions, a freight strategy is also to be developed by the end of 1998.

Objective 2 - Provide more and better transport choices

The Action for Air plan recognises that 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: provide better public transport; promote cycling and walking; and change travel behaviour through education. The Government as part of

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37 NSW Department of Transport, *Greater Western Sydney Public Transport Strategy. A Strategy for improving public transport*. 1997.

38 NSW Government, Environment Protection Authority, *Action for Air*, February 1998.

the 1999-2000 budget process give consideration to a five year funding program to promote public transport. This funding will be directed to those priority areas as determined in the Transport Plan, as discussed in the previous section.[39]

Objective 3 - Make cars, trucks and buses cleaner

Emission standards for vehicles are set by the Commonwealth government, while in-service vehicles are regulated by the State government. The Plan notes that while a new national vehicle emission standard was introduced in January 1997, further action is required. The NSW Government is supporting standards equivalent to those introduced in the USA in 1994 and Europe in 1996. The new standards would achieve for each car further major reductions in emissions of carbon monoxide (20%), ROCs (30%) and nitrogen dioxides (68%), and be a very cost effective method of reducing emissions. If agreed nationally, these measures will come into effect from 2003.

In NSW the Smoky Vehicle Enforcement Program has existed since 1974. It is an offence for a vehicle to emit visible smoke for longer than ten seconds. The plan notes that the EPA and the Roads and Traffic Authority have recently strengthened the smoky vehicles program.

The NSW government also intends to introduce an Inspection and Maintenance (I/M) program for passenger and light commercial petrol vehicles to identify and require the repair of high polluting vehicles. 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 emission testing facilities.

- 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. This will be implemented in the year 2000.

- Phase 3 - will extend the testing program for passenger and light commercial vehicles to the lower Hunter and Wollongong in the year 2004.

The State Government has also signed a formal memoranda of understanding with the petroleum industry to reduce petrol volatility during the peak ozone period of 15 November to 15 March. This will reduce fuel evaporation and reduce emissions of ROCs by about 7000 tonnes each summer.

The Plan also focuses on reducing diesel vehicle emissions. Emission standards are set nationally, and are behind international best practice. Current standards are equivalent to 1991 standards in the USA, 1992 standards in Europe and 1993 standards in Japan. NSW

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[39] For more information on transport in Sydney see the NSW Parliamentary Library Briefing Paper No 17/95, *Sydney, Transport and Ecologically Sustainable Development*.

is supporting a national review to improve emission standards. NSW will also push for a national diesel measure through the National Environment Protection Council. The NSW Government is also committed to introducing a comparable inspection and maintenance program for diesel vehicles, although it is recognised that at present there is no readily available short emissions test for diesel vehicles.

The Plan notes that a high priority is given to ensuring that the State's own bus fleet is as clean as possible. Future diesel bus purchases will need to meet the proposed stringent emission standards, and the Government will continue to purchase natural gas fuelled buses. In addition, the Government will develop a cleaner transport fuels and technology strategy, to be completed by July 1998.

Objective 4 - Promote cleaner business

The Plan notes that strategies to control ROCs during the 1980s have been successful, and that new programs need to concentrate on controlling nitrogen oxides. The EPA is to establish a new framework to control nitrogen oxide emissions in the greater metropolitan area. This will include capping total emissions and establishing a scheme for trading of emissions within that cap. The scheme will be developed during 1998 for implementation in the 1999-2000 financial year. The aim of the scheme is to limit and progressively reduce nitrogen oxide emissions to achieve a long term cap at 1998 levels.

The introduction of load based licensing, the commencement in July 1998 of the *Protection of the Environment Operations Act,* and revised Clean Air Regulations are also identified as factors that should help control air pollution. In addition, the EPA has been working with industry associations to develop cost effective approaches for small businesses such as printers to reduce air pollutant emissions.

Objective 5 - Promote cleaner homes

The use of wood heaters in the home contributes to particle pollution, so an important part of the Plan is to reduce solid fuel heater emissions. Under the Clean Air (Domestic Solid Fuel Heaters) Regulation 1997, all new wood heaters sold in NSW must be certified and labelled to confirm that they comply with emission standards set by Standards Australia. Community education programs on using wood heaters will be continued. An 'Energy Smart Homes' program has been developed by the Sustainable Energy Development Authority to ensure that new homes and redevelopment of homes have a minimum energy performance rating.

Objective 6 - Manage the impact of open burning

Backyard burning was prohibited in the Sydney and Wollongong regions in 1995. The major open burning issue for Sydney air quality now relates to bushfire hazard reduction and forestry management burning. The Plan notes that controlled burns are essential to prevent uncontrolled bushfires. However, the development of smoke management guidelines by June 1998 will establish best practice in reducing the effect on air quality of

these burning activities.

Objective 7 - Monitor, report on and review air quality

Action for Air is a 25 year plan which is designed to be reviewed and adapted throughout its operation. The EPA will upgrade community access to information by including air quality data on the EPA internet site, and set up two advisory groups. One group is to advise on future air quality modelling work priorities, and the other is to be established after the publication of State of the Environment Reports to encourage public input on air quality trends and strategies.

4.0 Recent Public Transport Initiatives

In early May 1998 the Minister for Roads and Minister for Transport Hon. Carl Scully MP announced the construction of a $100 million buses only road linking rail stations between Liverpool and Parramatta. Work will commence on the first two kilometres of the 20 kilometre road later this year, while a feasibility study will determine the best route for the remainder.[40]

Minister Scully also stated that planning had begun for a second buses only roadway linking Parramatta with Rouse Hill, in Sydney's northwest.

5.0 The Clean Air 2000 Campaign[41]

Clean Air 2000 is an NRMA initiative aimed at reducing air pollution in the Greater Sydney Region. The program has been developed as a community based approach that comprises two principal elements: encouraging individuals to adopt cleaner motoring and more responsible travel practices; and improving opportunities for transport choice by working with government, business, industry and the community. The NRMA has brought together high profile stakeholders from the three spheres of government, the environment movement, business, science, health, labour, the arts, sports and the community to form the Clean Air 2000 Taskforce. The Taskforce is chaired by Mr Rod McGeoch. The Taskforce has nominated four working groups to investigate areas where opportunities for solutions lie. The Working Groups are: Infrastructure and Planning; Technology and Fuels; Commuter and Fleet Travel Practices; and Pricing and Funding.

The Clean Air 2000 campaign is now focussing on identifying and mobilising deliverable transport solutions to the Sydney community. The campaign focuses on three messages: walk or cycle for short trips; catch public transport one day a week; and keep your car well tuned. The Task Force has produced a Strategic Action Plan with four objectives, with

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40 "Bus-only road for the west to cut travel time by half" in *The Sydney Morning Herald*, May 4 1998.

41 Information for this section is from the NRMA Internet site: http://www.nrma.com.au

strategies and performance indicators for each objective. The four objectives are:

- Improve Sydney's urban transport systems, particularly in Western Sydney.
- Improve the emissions performance of the Sydney vehicle fleet.
- Improve cycling and walking networks across the Sydney metropolitan region.
- Mobilise all levels of community (government, business, industry, public) towards adoption of strategies and actions that reduce urban air pollution and traffic congestion.

One performance indicator identified in the Plan is that air quality and public transport improvement become amongst the top three issues at the 1999 NSW Government State election.

6.0 Conclusion

The Metropolitan Air Quality Study has provided the community with a baseline understanding of the sources and types of air pollution affecting the greater metropolitan region. It is only with community support that government strategies such as *Action for Air* can succeed. In turn, to gain community support governments must help provide alternatives and provide leadership in regard to actions that help reduce air pollution. Recent announcements of dedicated public transport busways is a step in the right direction to achieve this. Ultimately, air in Sydney will only be clean once the nexus between transport and the car is removed. This will require a huge effort and change in thinking by the wider community at large.