



Select Committee on

Perth's Air Quality

Presented by

Mr F. C. Tubby, MLA

Laid on the Table of the Legislative Assembly

on

21 May 1998

ORDERED TO BE PRINTED

Report of the Select Committee on Perth's Air Quality

Committee members, staff and address

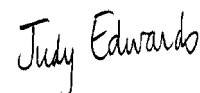
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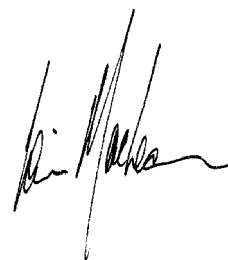


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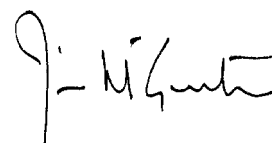
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Chairman's foreword

I am pleased to present to the Parliament of Western Australia this final report of the Select Committee on Perth's Air Quality. I am particularly pleased to say that it is a unanimous report which reflects the goodwill each member has shown toward achieving an effective and bipartisan outcome from this investigation. The process of developing an Air Quality Management Plan for Perth is off to a great start.

We all know that air, along side water, is one of the basic needs for sustaining life. We also know that, for most of the time, Perth's air quality is amongst the best in the world. But this is not a guarantee for the future, and any complacency shown now in planning and implementing air quality management strategies could lead to a less healthy future for the community. When considering this report and the recommendations, I urge the Government to bear in mind the very real and confronting health effects linked to air pollution.

Scientific studies of Perth's air quality have shown that it is influenced by a variety of pollutants from a variety of sources. From the start of the investigation, it was quite clear that the Committee's efforts would need to focus on considering all of these sources, many of which result from our day to day lifestyle choices. It was also clear that there was a broad spectrum of possible strategies to be reviewed for their suitability in providing a basis of an Air Quality Management Plan for Perth. It must be accepted that there are no silver bullets left to be fired at industry - the key issue for the future of Perth's air quality is transport based - cleaner vehicles, cleaner fuels and greater reliance on public transport.

Over the past few years photochemical smog and particulate haze have become a part of our every day language. Scientific experts are researching and predicting the occurrence of these pollution events, the media is reporting on them and our children are learning about them in class. It is an evolving science with which Government policy development must keep pace. Flexibility will be the key for a successful long term management strategy for Perth's regional air quality. That all the answers are not yet available is no justification for delaying the necessary planning and the implementation of strategies. It simply highlights the need to incorporate these knowledge gaps into the overall plan and to develop strategies that will progressively arrive at the answers. It is true that the technical aspects of the physical and chemical processes and reactions taking place to make up our air quality can be somewhat daunting. But it is important that this research continue and that the findings be embraced by the Government and translated into the language of the community.

Consideration of community attitudes and opinions has been central to the Committee's investigation and deliberations. The community wants good air quality and it is clear that people recognise some sort of change is required to achieve this in the long term but it is not always clear how they expect this will be achieved. The general feeling is that the Government needs to provide the direction and facilitate the change. I cannot over emphasise the important role that community education and awareness programs will have in achieving a successful Air Quality Management Plan for Perth. There are a number of misconceptions out there on a variety of air quality issues and strategies, and it will be a challenge for the Government to put in place the mechanisms for these to be addressed. I am also certain that this report will prompt much discussion within the community, industry, business and Government.

On behalf of the Committee I extend our appreciation to all those who have given freely of their time to contribute to and assist this investigation, by giving evidence, providing briefings and in forwarding written submissions. I also extend our appreciation to the Committee's staff and the support staff of the Legislative Assembly.

FRED TUBBY, MLA
CHAIRMAN

Contents

	Page
Committee members, staff and address	i
Chairman's foreword	ii
Acronyms and glossary	vii
Establishment of the Select Committee	ix
Ministerial Direction	x
Summary of recommendations	xi
1.0 Background	1
2.0 Perth's air quality and the health implications	4
3.0 Managing Perth's air quality for the future	12
3.1 Urban design, transport planning & vehicle emissions	16
3.2 Industry	48
3.3 Wood smoke	52
3.4 Air toxics	67
3.5 Indoor air quality	69
3.6 Education	70
3.7 Monitoring, modelling and pollutant inventories	71
4.0 Bibliography	73
Appendices	79
List of Tables	
1 Sources contributing towards the creation of photochemical smog and particulate haze	12
2 Vehicle ownership in Australian cities	16
3 Australian Design Rule Standards for diesel vehicle emissions	27
4 Australian Design Rule Standards for petrol vehicle emissions	28
5 Number of Smokey Vehicle Reports	29
6 Perth vehicle fleet characteristics (1995)	30
7 Emission comparison of alternative fuels to petrol	34
8 Petrol vehicle exhaust emission limits established in the Australian Design Rules	36
9 Emission comparison of Compressed natural gas to petrol (light duty vehicles)	41
10 Emission comparison of Compressed natural gas to diesel (buses)	41
11 Emission comparison of LPG to petrol	43
12 Emission comparison of LPG to diesel	43
13 Air pollutants discharged from key industries located in the Kwinana EPP Area A & B	48
14 Residential heating sources, Perth metropolitan region	53
15 Comparative efficiency information of some domestic heating options	56
16 Comparative emission information of some domestic heating options	56
17 Estimated annual availability of wood	58
18 Ambient air quality monitoring in the Perth metropolitan region	71

Contents cont'd**List of Figures**

1	Source contributions to average PM _{2.5} concentration	6
2	The hierarchal effect of particles on human health	7
3	Predicted future growth in Perth's population and private vehicle use	17
4	Traffic congestion during peak periods	24
5	Perth light duty vehicle fleet characteristics - fuel type and age	30
6	Age distribution of Perth's bus fleet(diesel and all fuel types)	40
7	PM ₁₀ and PM _{2.5} monitoring data - Duncraig	54
8	PM _{2.5} monitoring data - Bunbury	55

Acronyms and glossary

ADRs	Australian Design Rules (for vehicles)
AS	Australian Standards
CALM	Department of Conservation and Land Management. Western Australia
CNG	Compressed natural gas
CO	Carbon monoxide
CO ₂	Carbon dioxide
DEP	Department of Environmental Protection, Western Australia
DKK	Danish Kroner
EPEFE	European Programme on Emissions, Fuels and Engine Technologies
FORS	Federal Office of Road Safety, Australia
g/kg	grams per kilogram
HC	hydrocarbons
LNG	Liquid natural gas
LPG	Liquid petroleum gas (also known commercially as Autogas)
MRWA	Main Roads Western Australia
NEPC	National Environment Protection Council
NEPM	National Environment Protection Measure
NHMRC	National Health and Medical Research Council
NMHC	Non methane hydrocarbons
NO ₂	Nitrogen dioxide
NO _x	Nitrogen oxides
NPI	National Pollutants Inventory
O ₃	Ozone
PAHs	Polyaromatic hydrocarbons
Perth metropolitan region	The area contained within the Shires of Kalamunda, Mundaring, Peppermint Grove, Serpentine-Jarrahdale, Swan, the Towns of Bassendean, Cambridge, Claremont, Cottesloe, East Fremantle, Kwinana, Mosman Park, Victoria Park, Vincent, and the Cities of Armadale, Bayswater, Belmont, Canning, Cockburn, Fremantle, Gosnells, Melville, Nedlands, Perth, Stirling, Subiaco and Wanneroo.
PM	Particle matter
PM _{2.5}	Particle matter sub 2.5 microns in aerodynamic diameter

PM ₁₀	Particle matter sub 10 microns in aerodynamic diameter
Reactive HC	Reactive hydrocarbons, also known as non methane hydrocarbons (NMHC)
ROCs	Reactive organic compounds
RVP	Reid Vapour Pressure
SO ₂	Sulphur dioxide
SO _x	Oxides of sulphur
Transport WA	Formerly known as the Department of Transport, Western Australia
TSP	Total suspended particles
USEPA	United States Environmental Protection Agency
VISI	Visibility
VOCs	Volatile organic compounds

Establishment of the Select Committee

Terms of Reference

On Thursday, 29 May 1997, in the First Session of the Thirty-Fifth Parliament, the member for Roleystone, Mr Fred Tubby, moved the following motion -

- (1) That a select committee be appointed to investigate and report on air quality in Perth, and in particular -
 - (a) Assess community attitudes and concerns in relation to Perth's air quality;
 - (b) Investigate ways in which urban air quality can be improved for current and future generations.
- (2) That the Committee have power to call for persons and papers, to sit on days over which the House stands adjourned, to move from place to place and to report from time to time.
- (3) That the Committee present its final report by 1 April 1998.

The motion as put was passed.

Extension of Reporting Date (1)

On Thursday 2 April 1998, the Legislative Assembly passed the following motion -

That the date for presentation of the final report of the Select Committee on Perth's Air Quality be extended to Thursday 7 May 1998.

Extension of Reporting Date (2)

On Thursday 30 April 1998, the Legislative Assembly passed the following motion -

That the date for presentation of the final report of the Select Committee on Perth's Air Quality be extended to Thursday 21 May 1998.

Ministerial Direction

The Select Committee, in accordance with Legislative Assembly Standing Order 378(c), directs the Ministers for Environment, Health, Energy, Planning, Police, Local Government and the Minister representing the Minister for Transport within not more than three months, or at the earliest opportunity after that time if Parliament is in adjournment or recess, to report to the House as to the action, if any, proposed to be taken by the Government with respect to any recommendations of the Committee which falls within their jurisdictions.

Summary of recommendations

General air quality management and monitoring

Recommendation 4

The State Government should develop and progressively implement an Air Quality Management Plan for the Perth metropolitan region based on the strategies recommended in this report. Page 13

Recommendation 8

Local Government should be encouraged to develop (at both the municipal and regional level) local air quality management plans. Page 15

Recommendation 6

The State Government should establish a co-ordinating committee to facilitate the implementation of the air quality management plan strategies. The Committee members should represent the Ministry for Planning, Transport, Main Roads Western Australia, Office of Energy, Department of Conservation and Land Management, WA Police Service, industry, business and the community, and chaired by the Chief Executive Officer of the Department of Environmental Protection. Page 14

Recommendation 92

The Department of Environment Protection should review and report to Government on the need to increase the number of mobile and/or stationary air quality monitoring stations in the Perth metropolitan region. Page 71

Recommendation 93

The Department of Environmental Protection should include the monitoring of air toxics at strategic locations within the Perth metropolitan region. Page 72

Recommendation 94

The State Government should encourage the community, business and industry sponsorship of air quality monitoring stations in the Perth metropolitan region. Page 72

Recommendation 95

The Department of Environmental Protection should make greater use of mobile air quality monitoring stations in determining "hot spots" in the Perth metropolitan region. Page 72

Recommendation 96

The Department of Environmental Protection should establish and maintain a publicly accessible pollutant inventory for the Perth metropolitan region. Page 72

Community education

Recommendation 7

The Department of Environmental Protection should co-ordinate an ongoing education campaign communicating the importance of good air quality - to be supplemented by seasonal and specific education campaigns. Page 14

Recommendation 90

The State Government should include educational material on indoor air quality as part of a broader and ongoing community awareness and education program. Page 69

Recommendation 91

The Department of Environmental Protection should to continue to facilitate the production of resource material and teacher notes on air quality issues, for distribution to all schools. Page 70

Recommendation 15

The State Government should increase funding to the *Travelsmart* program to expand it across more municipalities and provide ongoing support to sustain changes in community behaviour. Page 20

Recommendation 16

Transport WA and the Department of Environmental Protection should facilitate the development of a promotional campaign aimed at increasing cycling, walking and using public transport for trips under five kilometres in distance. Page 20

Recommendation 32

The Department of Environmental Protection in conjunction with Transport WA should initiate an education campaign focussing on the benefits of having a well maintained vehicle regardless of vehicle age Page 31

Recommendation 56

The Department of Environmental Protection should initiate an education campaign aimed at all sellers and manufacturers of wood heating units to facilitate the introduction of regulations controlling wood heater design. Page 57

Recommendation 60

The Department of Environmental Protection in conjunction with representatives of the wood heater association and Local Government should facilitate community education campaigns focussing on appropriate methods of collecting, purchasing and storing wood for use, appropriate ways in lighting and maintaining a fire, and of the health effects associated with exposure to particles coming from wood smoke. Page 59

Recommendation 61

The Department of Environmental Protection should enhance and improve existing pamphlets on guidelines and procedures for the correct use and maintenance of wood heaters, fire places, and fuel supply and storage. Page 59

Recommendation 55

The Office of Energy should coordinate the compilation of a community information package on the relative effects of heating devices on the environment, including indoor air quality and health issues. Page 56

Health

Recommendation 1

The Health Department of WA should expand its capability to address the public health aspects of air pollution. Page 4

Recommendation 2

The Ministers for the Environment and Health should be responsible for ensuring that the health effects of air pollution on the Perth community are reviewed, based on the currently known health effects as established in the scientific literature. Page 11

Recommendation 11

The State Government should investigate air quality issues in rural areas. Page 19

Recommendation 3

The Department of Environmental Protection and the Health Department of WA should facilitate a 12 month research project, correlating hospital admissions data to Perth's air quality monitoring data. Page 11

Recommendation 89

The State Government should maintain a “watching brief” on the issues pertaining to indoor air quality in Perth through the regional air quality management plan. Page 69

Recommendation 86

The Department of Environmental Protection should investigate and report to the State Government on the status of indicator air quality toxics in the Perth metropolitan region and the need for monitoring. Page 67

Recommendation 87

Main Roads Western Australia should expand its investigative road side monitoring program to determine cyclist and pedestrian exposure to air toxics throughout the Perth metropolitan region, particularly within the central business district and main suburban intersections, shopping and other areas of intense periodic vehicle use such as school car parks and fast food zones. Page 67

Recommendation 88

Main Roads Western Australia should initiate an in-vehicle monitoring program to determine bus driver exposure to air toxics associated with vehicle emissions, particularly during periods of traffic congestion. Page 68

Community and transport planning

Recommendation 20

The State Government and its agencies should develop integrated land use and transportation policies that will accommodate future growth in the Perth metropolitan region in a manner which minimises potential air quality impacts. Page 23

Recommendation 5

State Government policy should require integrated land use and transport planning for all future proposals involving road construction and land development. Page 13

Recommendation 9

The State Government’s land development policy should be to improve the community’s access to public transport networks in existing areas, and to ensure access is provided in the early stages of planning and development of all new communities. Page 18

Recommendation 21

Travel demand management within the Perth metropolitan region should be founded on the priority basis of providing fast, frequent and reliable public transport systems throughout the region. Page 25

Recommendation 22

The State Government should commence planning for the introduction of a high-speed light rail network in the Perth metropolitan region. Page 26

Recommendation 24

As an interim measure to the development of a light rail network, the State Government should allocate bus priority lanes along highways during peak traffic periods. Page 26

Recommendation 23

The State Government should expand the metropolitan rail network to encourage a decrease in private vehicle usage. Page 26

Recommendation 12

The State Government’s land development policy should ensure that land use developments in the vicinity of rail corridors and stations is such that the establishment of services supporting the community are facilitated. Page 19

Recommendation 28

The State Government should encourage the private funding and development of light and heavy rail and other public transport systems in the Perth metropolitan region by enhancing development opportunities adjacent to the chosen route, including supportive land zoning and land allocation. Page 27

Recommendation 10

Dedicated express bus lanes should be provided along the full length of the Kwinana freeway as part of any future expansion (existing or proposed). Page 19

Recommendation 11

Dedicated express priority car pool lanes should be provided along the full length of the Mitchell freeway as part of any future expansion (existing or proposed). Page 19

Recommendation 17

Transport WA should improve and increase bicycle and customer facilities at public transport stations. Page 21

Recommendation 18

Main Roads Western Australia in conjunction with local government should continue to improve and expand the bicycle network by providing bicycle access in all new road constructions and modifications incorporating the well engineered aspects of the Copenhagen model. Page 21

Recommendation 19

Local government should amend By-Laws so that non-residential building approvals are subject to the provision of adequate facilities for cyclists, pedestrians and public transport users. Page 22

Recommendation 13

The City of Perth should, in conjunction with community and business representatives, strategically review the provision of all day parking in the central business district, with a view to reducing the total number of bays allocated to this purpose and increasing the charges for all day parking. Page 19

Recommendation 14

The State Government should amend legislation to allow revenue generated from parking fees in the City of Perth to be used in supporting public transport, cycling and pedestrian based activities and facilities. Page 19

Recommendation 26

The State Government should establish an Economic Advisory Committee to independently review and advise on all new major transport and urban projects with the view to ensuring that all goals of the Metropolitan Transport Strategy are effectively and efficiently achieved. Page 27

Recommendation 25

The State Government should initiate a detailed economic analysis of the public monies provided to various forms of public and private transport modes and facilities. Page 27

Recommendation 27

The State Government should investigate the desirability of transferring the policy function of Main Roads WA to Transport WA to achieve better overall co-ordinated integration of transport in the Perth metropolitan region. Page 27

Recommendation 49

The Environmental Protection Authority's environmental impact assessment process should include consideration of related air emissions arising from transport aspects of a project, including both direct and indirect transit movements. Page 50

Recommendation 38

The State Government should facilitate the implementation of workplace policy adopting tele-commuting within its agencies. Page 35

Vehicle emission management

Recommendation 34

The State Government should implement a vehicle emission testing program for the Perth metropolitan region, based on the Vancouver model. Page 33

Recommendation 35

The Department of Environmental Protection in conjunction with Transport WA should initiate random roadside emission testing using remote sensing equipment. Page 33

Recommendation 45

The Department of Environmental Protection in conjunction with Transport WA should initiate the implementation of road side emission testing of heavy duty diesel vehicles, and the depot testing of fleet vehicles. Page 40

Recommendation 37

The State Government should implement a vehicle scrappage program to accelerate the removal of high polluting vehicles from the fleet, but only in conjunction with a vehicle emissions testing program. Page 35

Recommendation 29

The Department of Environmental Protection and the WA Police Service should enhance the Smokey Vehicle reporting program with enforcement provisions to reduce the number of polluting vehicles in operation. Page 29

Recommendation 30

State legislation should be amended to recognise the visual determination of opacity as an appropriate method for determining the level of particulate emission from petrol and diesel vehicle exhaust. Page 29

Recommendation 31

The State Government should adopt a 10 second (visual determination) emission limit for vehicle exhausts. Page 29

Recommendation 39

The State Government should develop a fuel formulation policy, specifying minimum fuel quality parameters (initially) for sulphur, vapour pressure and other constituents, for locally produced and imported petrol and diesel fuel. Page 37

Recommendation 40

The Department of Environmental Protection should introduce fuel quality testing of locally produced and imported fuel, on a random basis to check compliance with the fuel quality policy. Page 37

Recommendation 41

The State Government should legislate to require the introduction of Stage II vapour recovery at all metropolitan petrol stations by the year 2003. Page 38

Recommendation 36

The State Government should support the progressive revision of Australian Design Standards to be consistent with the standards adopted for new vehicles by the United Nations Economic Commission by the year 2005. Page 34

Recommendation 42

The State Government should support the progressive revision of diesel emission standards specified in ADRs to be consistent with the standards adopted for new vehicles by the United Nations Economic Commission. Page 39

Recommendation 43

The State Government should develop an enforcement policy that addresses procedures and penalties for tampering with vehicles to take them out of compliance with Australian Design Rules. Page 39

Recommendation 47

State Government agencies and private companies should develop vehicle purchase and leasing policies that set targets for the percentage of cleaner fuel vehicles within their fleet. Page 43

Recommendation 44

The State Government should give priority to the introduction of cleaner emission vehicles and cleaner fuels as part of the bus replacement program. Page 40

Recommendation 46

The State Government's vehicle fleet purchasing and leasing guidelines should provide for the inclusion of all costs, including emissions, over the useful life of the vehicle. Page 42

Recommendation 33

State Government agencies and private companies should set voluntary targets for average fuel consumption across their fleets to ensure that the purchasing or leasing arrangements take into account fuel efficiencies when defining or determining cost recovery. Page 31

Industry emission management and planning

Recommendation 48

The Department of Environmental Protection in conjunction with industry should develop guidelines for best practice emissions controls. Page 49

Recommendation 50

Western Power should develop and implement a 10 year plan to reduce its total SO₂ and NO_x contributions from the Kwinana Power Station. Page 50

Recommendation 51

Additional power stations should not be established in the Perth metropolitan region unless it can be clearly demonstrated that they will not adversely impact on Perth's air quality. Page 50

Recommendation 52

BP Refinery should ensure that best practice emissions controls are included as part of the their 10 year planning process for operational changes and expansions at the Kwinana Refinery. Page 51

Recommendation 53

The State Government should request the Federal Government to provide taxation incentives to industries which plan to incorporate new and cleaner technologies as replacements for old technology. . . . Page 51

Smoke emission management - domestic sources

Recommendation 67

The State Government should legislate to ban the further installation of wood fires and wood heaters in designated areas of the Perth metropolitan region with unacceptable local air quality. This ban should be in place by July 2003 in areas that have access to reticulated natural gas. Page 61

Recommendation 66

At the time of sale of a dwelling in the Perth metropolitan region, wood heaters not manufactured to comply with *Australian Standard 4013-1992* should be removed, replaced or rendered inoperable. Page 61

Recommendation 71

Local government By-Laws should be amended to prevent the installation of a wood heater where it is to be the sole source of heat, unless the building has been solar designed. Page 63

Recommendation 64

Local government should be given the authority to charge a rates levy on the installation of wood heaters and

fire places after 1 July 1999.	Page 60
Recommendation 57	
The State Government should legislate the type of fuel and operating procedures appropriate for wood heaters and fire places.	Page 58
Recommendation 58	
The State Government should legislate that no wood with a moisture content greater than 25% can be sold, unless it has been clearly labelled as not meeting this requirement and is not for use without proper seasoning.	Page 58
Recommendation 63	
The State Government should regulate (through the <i>Environmental Protection Act 1986</i>) that the visual determination of opacity is an appropriate method of determining the level of particulate emissions from the use of a wood heater or wood fire.	Page 60
Recommendation 69	
Legislation should make provision for smoke emission offences to be subject to a fine which is increased with each offence.	Page 62
Recommendation 70	
Legislation should make provision for fines to be waived if the offending unit is replaced with a cleaner heat source, is disposed of or rendered inoperable.	Page 62
Recommendation 59	
Legislation introduced by the State Government should require the manufacturing industry to progressively improve the particle emissions beyond those specified in the <i>Australian Standard 4013-1992</i> . . .	Page 59
Recommendation 62	
Local government should be given the appropriate powers to resolve complaints of smoke nuisance from domestic wood fires and wood heaters within their municipality.	Page 60
Recommendation 65	
State and local government should offer an incentive scheme to encourage residents to convert from wood heaters to alternatives, such as gas and solar heating sources.	Page 61
Recommendation 68	
The Department of Environmental Protection should initiate a voluntary program for limiting the use of wood heaters and fire places in the metropolitan region during periods of poor air quality.	Page 62
Recommendation 72	
The Ministry for Planning should develop guidelines and regulations for subdivision approvals that are designed to facilitate energy efficient designed homes.	Page 63
Recommendation 75	
The State Government should legislate to ban the practice of backyard burning in residential areas, giving local government the authority to designate those areas and times where burning may be undertaken under exceptional conditions.	Page 63
Recommendation 74	
The State Government should legislate to require green waste to be collected separately from general rubbish collection.	Page 63
Recommendation 73	
All local government authorities in the Perth metropolitan region should provide residents with a frequent and separate green waste collection service.	Page 63

Smoke emission management - hazard reduction and controlled burning

Recommendation 76

The State Government should support research designed to improve smoke plume dispersal modelling to better predict whether smoke from burning activities will drift over the Perth metropolitan region or other populated areas. Page 64

Recommendation 77

The State Government should formalise the procedures for the Department of Conservation and Land Management to liaise with the Bureau of Meteorology. Page 64

Recommendation 80

The Bureau of Meteorology should publish its advice on the likelihood of smoke dispersion or accumulation as part of the weather forecast. Page 65

Recommendation 81

The media's weather reports should include advice on the likelihood of wood smoke dispersion or accumulation. Page 65

Recommendation 82

The Bureau of Meteorology, Department of Conservation and Land Management, the Bush Fires Board and the Department of Environmental Protection should establish a dedicated telephone service advising on regional (or municipality) smoke dispersion capabilities. Page 66

Recommendation 78

The Department of Conservation and Land Management should prepare a technical report on how the department's fire section can be better resourced to use seasonal workforces to maximise burning activities during suitable weather conditions. Page 65

Recommendation 83

All controlled burns should only be carried out under suitable weather conditions as advised by the Bureau of Meteorology. Page 66

Recommendation 79

Voluntary "no burning days" should be promoted in the community to minimise the number of private or bush fire brigade controlled burns lit during periods when smoke accumulation is likely to occur due to weather conditions. Page 65

Recommendation 84

The State Government should legislate to ban all burning on development sites in the Perth metropolitan region, and establish penalties for breaches of this ban. Page 66

Recommendation 85

State and local government should together provide planning and development concessions to those sites where native vegetation is retained. Page 66

Chapter One

1.0 Background

Introduction

Members of the Committee share a common vision for the future of metropolitan Perth, that -

Perth's high air quality should be a reflection of the city itself. Clean air that is safe to breathe means that the city has an effective and efficient public transport system that is fully integrated within its urban design; where an imaginative blend of urban residential densities has created a community that uses the fullest range of transport methods and is therefore not car-dependent; and where industry provides employment and economic wealth without detracting from the city's attractive natural and social environments.

A review of air quality can be considered at the regional and local level, as well as indoors. Air quality is also influenced by a number of factors including the source of the pollutant, the nature of the pollutant (phase, toxicity) and meteorology (temperature, humidity and wind). The Committee has focussed its attention on considering the regional air quality issues for the Perth metropolitan region, proposing a broad framework for ongoing management that recognises issues will also need to be managed at the local level. Perth's regional air quality issues are primarily associated with photochemical smog and particulate haze events.

Historically, industry was targeted for improving its performance and improving regional and local air quality, notably for the control of sulphur dioxide and lead. An environmental maturity is developing within industry in their approach to managing processes and emissions, and the situation is changing with industry collectively now being just one source of the emissions requiring management. The Committee acknowledges that vigilance is required from industry to ensure that processes and operations are at the leading edge of best practice in future. It is also recognised that the emerging influence on our air quality is the way in which we are choosing to carry out our lives - our day to day activities. Individually these activities do not have a dramatic effect on the air quality locally or regionally. But when multiplied by our growing population (Perth population is currently 1.23 million¹) this indicates the possibility that air quality will decrease in time unless changes are made. These changes do not need to be dramatic nor an economic burden, but it is essential that the change is sustained. A change as simple as choosing to use public transport one day a week rather than driving is significant when multiplied across the community, as is installing insulation in all buildings that require heating or cooling so that energy is used efficiently.

As highlighted in the *Independent Inquiry into Urban Air Pollution*² commissioned by the Federal Government, acceptable air quality will only be assured by the pursuit of a wide range of actions and measures. The measures will only succeed through the coordination of transport planning, infrastructure development and environmental planning.

The work of this Committee follows on from a number of significant technical reviews and research projects that have defined the status of Perth's regional air quality and the predicted future of these pollution events. This research has provided a solid basis for considering future actions for the community, industry, business and Government collectively.

¹ Australian Bureau of Statistics (1997a). *1996 Census of Population and Housing Perth (Statistical Division) - Western Australia*. [Online: [Http://www.abs.gov.au](http://www.abs.gov.au) 22/12/97].

² Australian Academy of Technological Sciences and Engineering (1997). *Urban Air Pollution in Australia*. Commonwealth of Australia.

The *Perth Photochemical Smog Study 1996*³ concluded that Perth experiences photochemical smog levels which exceed goals set by the National Health and Medical Research Council (NHMRC) for protection of health and that the potential exists for the problem to grow. The control of photochemical smog was considered to be complex and not amendable to simple and uniform solutions. Perhaps most importantly, since Perth is not yet experiencing acute smog problems, there is time for the planning, transport and environment agencies to learn from the experience of other cities and develop sound, cost effective smog management strategies for the future.

The *Perth Haze Study 1994-1996*⁴ identified the increasing level of haze occurring in the Perth metropolitan region. Whilst the report also acknowledged the uncertainty in quantifying the potential health risks and costs of the increasing haze levels, it also highlighted the need to develop strategies and action plans to reduce as far as practical the emission of particle matter into the Perth airshed.

The 1997 *WA State of Environment draft report*⁵ concluded that photochemical smog can damage human health and the environment. If Perth's photochemical smog levels increased by modest amounts then the present air quality objectives will be exceeded more often. The growth in emissions of smog precursors from vehicles and industry would need to be reduced to avoid increasing health effects. This report also concluded that haze levels in the Perth region are likely to increase, and that fine particles pose the greatest air pollution related health risk to the Perth community.

Using the standards proposed in the *National Environmental Protection Measure for Ambient Air*⁶, Perth's regional air quality can currently be considered good, with only episodes of poor air quality that do not necessarily occur throughout the entire region at the same time. But based on current monitoring data, this State may experience difficulty in achieving compliance with ozone and particle requirements. There is concern that we may be moving toward more instances of poorer air quality. On this basis, the Committee's investigation has considered strategies that will directly impact on the causes of these episodes.

The Committee agrees that the Perth metropolitan region is at the cross-roads for decision making on the future of Perth's air quality. The fact that the quality of Perth's air is only unacceptable on a number of occasions does not imply that the State can be complacent and adopt measures that only address these bad episodes. With a population projected to increase to 2 million by 2029, with the number of vehicles increasing by 87% and the number of kilometres travelled by 130%⁷, there is every indication that, without effective management strategies in place, air quality will deteriorate. The Committee believes a framework for future development needs to be established now. From comments made in submissions and in evidence presented to the Committee, it is clear that the degree of awareness about the importance of good air quality within the community is growing. The positive response to the majority of suggested strategies presented by the Committee in the discussion papers indicates a clear mandate for Government to initiate changes and strategies that will ensure healthy air quality for Perth in years to come.

³ Western Power Corporation & Department of Environmental Protection (1996). *The Perth Photochemical Smog Study*. Western Australia, Australia.

⁴ Department of Environmental Protection (1996). *The Perth Haze Study 1994-1996*. Government of Western Australia, Australia.

⁵ Department of Environmental Protection (1997). *Environment Western Australia 1997 Draft State of the Environment Report for Western Australia*. Government of Western Australia, Australia.

⁶ National Environment Protection Council (1997). *Draft National Environment Protection Measure and Impact Statement for Ambient Air Quality*. Commonwealth of Australia.

⁷ Ministry for Planning (1997). Submission 22, 27 June 1997.

Process and report structure

Following the establishment of the Committee on 29 May 1997, the Committee held preliminary discussions with key Western Australian Government agencies and industry representatives, giving each group the opportunity to provide an historical perspective on Perth's air quality and the success of past actions, and to express opinions and suggest necessary future actions.

The Committee acknowledges that Perth is not alone in experiencing pollution events, nor alone in seeking solutions. The process undertaken by the Select Committee deliberately sought out to investigate those cities within both Australia (Appendix C) and overseas (Appendix D) that are facing similar issues and which have taken steps to address them. The 32 interstate and international meetings were designed to discuss issues with government agencies, business and technical experts who are responsible for planning and implementing air quality, industrial, transportation and urban design management strategies in their areas.

The Committee's five discussion papers presented a number of these strategies to the community for discussion and comment in order to find out specifically what changes the community perceives necessary and what the community is prepared to act upon. The community's response is summarised and presented in Appendix A. The submissions which specifically address the strategies presented in the discussion papers are represented according to agreement or non-support for the strategy. Submissions not specifically relating to the discussion papers are summarised. All written submissions (237) are available for viewing at Parliament House (Legislative Assembly, Bills and Papers Office).

The Committee has formally met on 35 occasions in addition to its other activities, and has informally met from time to time to review matters pertinent to the term's of reference. 395 pages of formal evidence was taken. This evidence was taken during a series of hearings which called upon the expertise of a number of Perth's health specialists including epidemiologists and respiratory physicians, state and local government agencies, community and interest groups and business and industry representatives. Full copies of the transcripts from these hearings are available for viewing at Parliament House (Legislative Assembly, Bills and Papers Office). The Committee also met with persons and corresponded with companies and organisations to obtain information relevant to the investigation.

This report presents the findings and recommendations of the Committee's investigation on community attitudes and concerns, and ways in which Perth's air quality can be improved. It is presented to the Government on the basis that within 3 months the Government will indicate to the Parliament its future intention for the Committee's recommendations.

The process undertaken by the Committee brings about two significant actions. First is the opportunity for all members of the community to have their thoughts and suggestions heard and presented to the Government. Secondly it is an opportunity for an across Government agreement on future actions to be adopted by Government to ensure that the air quality of the Perth metropolitan region is improved for current and future generations.

Chapter Two

2.0 Perth's air quality and the health implications

The Perth metropolitan region experiences two significant types of air pollution - photochemical smog and particulate haze. Both have the potential to increase in frequency and severity and, for this reason alone, the Committee believes ongoing management strategies need to be developed and implemented as a priority. The Committee was briefed by representatives of Environment Australia on the development of ambient air quality standards designed to protect human health and well being. The inclusion of particulates and photochemical oxidants in the draft *National Environment Protection Measure for Ambient Air*⁸ is a reflection of the concern for the risk that air pollution presents to health of the community.

The Committee was surprised and at times alarmed by the results of international research showing the potential risk to the health of the entire community from particulates in the air. The Committee was especially concerned to learn that even low levels of particulate pollution are placing the community's health at risk. The Committee was also concerned by the limited amount of local analysis undertaken to date, particularly in view of the findings of *The Perth Haze Study 1994-1996*⁹.

It is the Committee's intention in this report to highlight the very real and disconcerting relationships between a variety of health effects and air pollution. While the relationship between pollutant and effect can at times be complicated, and given that research has not yet uncovered all the mechanisms by which these effects occur, it is the Committee's opinion that this State should place a high priority on ensuring that air quality improves or, at worst, does not deteriorate in future.

Recommendation 1

The Health Department of WA should expand its capability to address the public health aspects of air pollution.

Photochemical smog and health

The effect on human health resulting from exposure to photochemical smog, ozone in particular, is well recognised. When inhaled, ozone can cause acute respiratory problems, aggravate asthma in asthmatics and cause significant temporary decreases in the lung capacity of healthy adults. Exposure can also cause inflammation of lung tissue and impair the body's immune system defences¹⁰, making people more susceptible to respiratory illnesses, including bronchitis and pneumonia¹¹. Children have been found to be most at risk from exposure to ozone and, since their respiratory systems are still developing, they are considered to be more susceptible than adults and there is the possibility of long term damage¹². While these disease (morbidity) effects have been well documented, more recent research has implicated ground level

⁸ National Environment Protection Council, *Op cit*, 1997.

⁹ Department of Environmental Protection, *Op cit*, 1996.

¹⁰ Koren H, Devlin R, Becker S, Perez D, McDonnell W (1991). 'Time-dependent changes of markers associated with inflammation in the lungs of humans exposed to ambient levels of ozone'. *Toxicol. Pathol*, 19: 406-411.

¹¹ United States Environmental Protection Agency (July 1997). *Fact Sheet - Health and environmental effects of ground-level ozone*. United States of America.

¹² Dr Nicholas De Klerk, Epidemiologist, Department of Public Health, University of Western Australia and Dr Arthur William Musk, Respiratory Physician/Epidemiologist, Sir Charles Gairdner Hospital. *Evidence* Monday 2 February 1998.

ozone as a contributing factor to the population's rate of dying (mortality)¹³.

Ozone levels around the Perth metropolitan region periodically exceed the recommended health guidelines, with the number and severity of these occasions being predicted to increase. Analysis of air pollution data and medical reports in London for the period from 1987 to 1992¹⁴ demonstrated a clear link between the ground level ozone concentration and the population's rate of death. The study found that ozone levels (same day) were associated with a significant increase in mortality from all causes. A significant increase was also shown for cardiovascular mortality and respiratory mortality. This effect from ozone was greater in the warm season and independent of the effects of other pollutants, such as sulphur dioxide.

The Committee is obviously concerned that pollution can influence the community's mortality rate, but the Committee is also concerned that an increase in the number of photochemical smog events in the Perth metropolitan region could affect the general health of the community. A Canadian study¹⁵ investigating the association between ground level ozone concentrations and the effect on people with respiratory diseases found that an association existed and that it was sufficiently severe to cause hospitalisation. This link was observed to occur on the same day as the ozone event as well as being observed with lags of one and two days. This study also suggested that ozone exposure caused health effects to rapidly trigger new respiratory symptoms, while exacerbating existing conditions. A similar 2 day lag for effects was also identified for incidences of asthma presented at hospital emergency departments in Canada¹⁶. This study also noted that patients made return and repeat visits within 14 days. Research is continuing in this area.

The Committee feels strongly that a research and investigation program should be put in place to routinely examine if changes in the health status of the Perth community is occurring as a result of the occasional photochemical smog events in the region.

Particulates and health

There has also been much discussion internationally on the health effects of exposure to particulate air pollution with a growing list of international research being reported. It is the Committee's opinion that the protection of the community from the health risks posed by exposure to particulate air pollution is a matter of utmost importance.

Air borne particulates come in a variety of sizes and from a variety of sources including natural sources of sea spray and dust, and non-natural sources such as emissions from wood burning, petrol and diesel vehicle exhausts and coal fired power stations. These particulates are also a mixture of both solid and liquid material. *The Perth Haze Study 1994-1996* identified a number of particulate sources in the Perth metropolitan region, including a seasonal influence (Figure 1).

Figure 1 Source contributions to average PM_{2.5} concentration¹⁷.

¹³ Kinney P L, Ozkaynak H (1991). Associations of daily mortality and air pollution in Los Angeles County. *Environmental Research* 54:99-120.

¹⁴ Anderson H R, de Leon A P, Bland J M, Bower J S & Strachan D P (1996). Air pollution and daily mortality in London: 1987-92. *BMJ* 312:665-9.

¹⁵ Burnett R T, Brook J R, Yung W T, Dales R E & Krewski D (1996). Association between ozone and hospitalisation for respiratory diseases in 16 Canadian cities. *Environmental Research* 72, 24-31.

¹⁶ Steib D M, Burnett R T, Beveridge R C & Brook J R (1996). Association between ozone and asthma emergency department visits in Saint John, New Brunswick, Canada. *Environmental Health Perspectives* 104:1354-1360.

¹⁷ Department of Environmental Protection, *Op cit*, 1996.

Particulates from natural sources have a tendency to be larger in size than particulates that are created through combustion processes which are generally less than 2.5 microns (PM_{2.5}) in aerodynamic diameter. From a health perspective, the distribution and deposition of particulates in the human body varies substantially with particle size. The Committee believes it important that the community be aware that the nose, throat, larynx, trachea, lungs, and heart, can all be impacted by exposure to particulates.

The larger sized particulates are more readily expelled from the body by the body's respiratory defence mechanisms, by sneezing, coughing, nose blowing or through the digestive system. Under normal and healthy conditions, this occurs without undue stress and without any decrease in function in the long term. However, fine particulates (PM_{2.5}) are a greater concern as they have a higher probability of being deposited in the periphery of the lung around the respiratory bronchioles and alveoli where gas exchange occurs. The clearance of particles from this area of the lung is relatively slow compared to the clearance of larger particles which may deposit in the airways. Since only a third of our lung capacity is actually used on a routine basis (unless you are an athlete), there is a tremendous reserve capacity. However, by the time a person presents symptoms such as breathlessness especially during inactivity, the damage to the lung may be extensive¹⁸.

Sources of PM_{2.5} tend to come from combustion processes, that is, the combustion of wood and fuel including coal, petrol and diesel. Other compounds are also routinely adsorbed onto the core of these particles, particularly organic substances. So it is not only the particulate itself being deposited in the lung but also a variety of other compounds which under other circumstances may normally be restricted from entering. These fine particulates also easily penetrate indoors and studies have shown that indoor levels of pollutants may reach 70% of the outdoor level.

The Committee was briefed by Dr Simon Taggart¹⁹ specifically on the relationship between particles and their effect on our health. Dr Taggart believed that there was a degree of acceptance in the community about the

¹⁸ Dr Simon Taggart, Lung Specialist, London Hampstead Hospital, United Kingdom. *Pers comm* Thursday 30 October 1997.

¹⁹ Dr Simon Taggart, *Op cit*, 1997.

presence of air pollution in cities. He also pointed out that, while the community may be aware that air pollution is bad for health, the community was most likely not aware that air pollution kills people.

Dr Taggart advised the Committee that death from heart disease as well as death from lung disease was occurring as a result of exposure to particulate air pollution. The number of deaths from heart disease triggered by particulate air pollution was greater than that for lung disease.

This was also found to be the case when the Committee raised the issue with technical experts in Canada. Canadian research had not only verified this, but had also found that the number of deaths was higher for non-metropolitan areas. Country areas routinely experienced higher levels of particulate air pollution as a result of wood burning practices, from both residential and industrial sources. Extrapolation of these results to the Western Australian situation could mean that similar deaths are occurring in the south west of this State as a result of high seasonal particulate levels.

Past and present research studies around the world investigated and confirmed the exact relationships between particulates, mortality and a variety of morbidity effects. The Committee has noted in particular the published work undertaken by Drs Douglas Dockery and Joel Schwartz of the Harvard School of Public Health, and Dr C Arden Pope III of Brigham Young University.

These health effects are summarised in the triangle of health effects (Figure 2).

Figure 2 The hierarchal effect of particles on human health²⁰.

In this triangle, the effects are ordered from the least adverse at the base of the triangle to the most adverse at the top. The area corresponding to a health effect roughly corresponds to the proportion of the population affected by the pollution. As particulate levels increases, exposure increases and the effects become more severe. A study across six cities in the United States of America investigated the relationship between particle levels and the respiratory and lung response of both adults and children in the area.

²⁰

Vedal S (1995). *Health Effects of Inhalable Particles: Implications for British Columbia*. Prepared for the Air Resources Branch, British Columbia Ministry of Environment, Lands & Parks. Canada.

The *Harvard Six Cities Study 1976-1987*²¹ demonstrated a correlation between particulate levels and the number of daily deaths in the cities. The study found that increases in particulate air pollution caused increases of death in the elderly, the sick and generally across the community.

Specifically, this study found that mortality within the population increased with increases in both the two day mean PM₁₀ concentration and the two day mean PM_{2.5} concentration. The increase related to PM_{2.5} was greater than that for PM₁₀. While the relative risk for death of persons age 65 and older was significant, it was only slightly larger than for deaths of all ages. The relative risk for deaths from ischaemic heart disease (mainly myocardial infarction) was larger than for all-cause mortality, with the estimated deaths from chronic obstructive pulmonary disease and pneumonia increasing substantially more than deaths from all causes. On days when PM_{2.5} was below 25 ug/m³, these particles were shown to be a risk factor for increased daily deaths, with a somewhat larger effect size than when higher concentration days were taken into account. A re-evaluation²² of this study replicated the initial results and was considered to be validation of the robustness of the approach taken in the study.

Similar associations between particulate pollution and death have also been researched in Europe. Analysis of air pollution data and medical reports in London for the period from 1987 to 1992²³ confirmed that black smoke concentrations on the previous day were significantly associated with all cause mortality. This association was greater during the warm season and was independent of the effects of other pollutants.

The Committee's discussion with the international experts consulted indicates that the results of these studies are generally transferable from city to city, and country to country. This being the case, the Committee believes that an analysis specific to the Perth metropolitan region and other populated areas of this state should be considered as a matter of priority.

Other international studies have investigated the impact that particulate air pollution may be having on babies. A study designed to evaluate the relationship between post-neonatal²⁴ infant mortality and particulate air pollution²⁵ identified an association between particulate matter and the risk of death. Mortality rates were found to increase with increasing levels of PM₁₀ exposure. For normal birth weight babies, high PM₁₀ exposure was associated with death due to respiratory causes and sudden infant death syndrome. For low birth weight infants, high PM₁₀ was associated with death from respiratory causes.

While these studies have tended not to identify or speciate the particulate sources, it is understood that in most studies the particulates are mainly the result of vehicle and industrial emissions. The importance attributable to both the gaseous and particulate fractions of vehicle emissions in recent years has escalated with vehicle numbers and the total number of kilometres travelled increasing along with the aging of the fleet. Diesel exhaust is currently the subject of a health risk assessment²⁶. The particles from diesel exhaust have carbon cores on which many different substances, including organic compounds, are adsorbed. The particles

21 Schwartz J, Dockery D W & Neas L M (1996). Is daily mortality associated specifically with fine particles? *Journal of the Air & Waste Management Association* 46:927-939.

22 Samet, J M, Zeger S L, Birhane K (1995). The association of mortality and particulate air pollution. In: *Particulate Air Pollution and Daily Mortality: Replication and Validation of Selected Studies. The Phase I Report of the Particle Epidemiology Evaluation Project*. Health Effects Institute. Cambridge, Massachusetts, United States of America.

23 Anderson *et al*, *Op cit*, 1996.

24 Post-neonatal mortality refers to the death of child aged 28 to 364 days.

25 Woodruff T J, Grillo J & Schoendorf K C (1997). The relationship between selected causes of post-neonatal infant mortality and particulate air pollution in the United States. *Environmental Health Perspectives* 105:608-612.

26 California Environmental Protection Agency (1997). *Health Risk Assessment for Diesel Exhaust*. Public and Scientific Review Panel Review Draft March 1997. United States of America.

are also in the range up to PM_{2.5}. The Health Institute²⁷ has found epidemiological data to be consistent in showing associations between exposure to diesel exhaust and lung cancer. Diesel exhaust has also been shown as a likely cause or to aggravate incidents of impaired lung function, asthma, allergic reactions and general respiratory irritation.

Other work has focussed on investigating the relationship between exposure to woodsmoke from domestic wood heaters and the health effects. When wood burns, the pollutants emitted are the products of incomplete burning and are mainly particulates. The chemical composition of wood smoke includes organic carbon, carbon monoxide, methane, ROCs, aldehydes, benzene, NO_x, SO₂, naphthalene and a variety of polyaromatic hydrocarbons (PAHs)²⁸.

The Committee is concerned that the health of the community is being effected by seasonally high smoke levels resulting from domestic wood burning in the metropolitan region. The combined effect of poor combustion in some wood heaters and weather conditions leading to smoke accumulation have been reported in the Perth metropolitan region over recent cool weather periods. If the results from international reviews are applicable to this State, then the Committee believes there is a problem to be addressed both in the metropolitan region and populated country areas where domestic wood burning is being carried out.

A study in Santa Clara County, California²⁹ investigated the possible link between wood smoke and the effect on people with asthma. The study demonstrated an association between ambient winter time PM₁₀ and exacerbations of asthma in people attending hospital emergency rooms for treatment. One of the principle sources of PM₁₀ in the study area was domestic wood smoke. This study focussed on data over six winter periods from 1986 to 1992. Intermittent accumulation of air pollution, most of which was attributable to domestic wood combustion sources, was noted during this time. The Committee notes that comparative research has shown particles found in wood smoke to be similar in type and form to particles found in environmental tobacco smoke³⁰.

The Committee is also concerned with the impact that wood smoke may have on the health of children. A study in Seattle looked specifically at the effect of ambient wood smoke from domestic sources on the health of children with asthma³¹. This two year study found that both asthmatic children and healthy children were affected by wood smoke. This effect was on their lung function and their likelihood to have coughing and wheezing. It concluded that fine particulate matter from wood burning during winter periods was significantly associated with acute respiratory irritation in young asthmatic children, and that the relationship was larger than previously estimated. It also indicated that increases in particulate air pollution are associated with declines in asthmatic children's pulmonary function. Other studies have shown that the decline in pulmonary function persisted for up to two weeks.

Healthy children can also be effected. The Committee was briefed by Dr Sverre Vedal³² on the outcomes of the Port Alberni study in Canada. This study reviewed the health performance of 2 200 primary school children, including approximately 120 asthmatic children over a 15 month period. These health results were correlated to daily 24 hour PM₁₀ concentrations for particles in six size ranges. The study showed that healthy

²⁷ The Health Effects Institute is an independent, non-profit corporation supported jointly by the US Environmental Protection Agency and industry to provide high quality, impartial and relevant science on the health effects of pollutants.

²⁸ United States Environmental Protection Agency (1993). *A Summary of the Emissions Characterisation and Nonrespiratory Effects of Wood Smoke*. EPA-453/R-93-036. United States of America

²⁹ Lipsett M, Hurley S & Ostro B (1997). Air pollution and emergency room visits for asthma in Santa Clara County, California. *Environmental Health Perspectives* 105:216-222.

³⁰ Koenig J Q, Larson T V, Hanley Q S, Rebolledo V, Dumler K, Checkoway H, Wang, S Z, Lin D & Pierson W E (1993). Pulmonary Function Changes in Children Associated with Fine Particulate Matter. *Environmental Research* 63, 26-38.

³¹ *Ibid.*

³² Dr Sverre Vedal, University of British Columbia, Department of Medicine, Respiratory Division, Canada. *Pers comm* Monday 3 November 1997.

children as well as those with asthma were affected by exposure to particulates mainly arising from domestic wood burning.

The Committee believes that the most important message from all of this research is that it is not yet certain if exposure at a young age will result in long term damage. The Committee also is very concerned that the air pollution levels creating concern are lower than previously suspected to be problematic. This has definite implications for this State, especially since only small changes in these low levels appear to be sufficient enough to increase the mortality and morbidity effects in the daily mortality and morbidity rates of people with a pre-existing disease³³. Whilst the short term impact may be a harvesting effect of those sections of the population who may be more susceptible due to a compromised health status where increased daily mortality from respiratory and cardiovascular disease occurs, the Committee finds it disconcerting that the long term effect could mean the shortening of the entire population's life expectancy. Research is continuing to determine if long term exposure is associated with an increase in the rate of morbidity and mortality from respiratory or cardiovascular (or both) causes in the general population.

The Committee is not aware of any completed study undertaken for the Perth population to determine the extent of health effects nor the cost to the community from exposure to particulate air pollution. While an estimated 70 premature deaths a year³⁴ could be related to particulate haze in Perth, a greater proportion of the community will experience other, more immediate health effects, such as needing to increase medication or seeking medical attention.

International investigations of this nature have been completed for a number of cities and with varying results. For example, the Provincial Government of British Columbia, Canada, estimated that the Province saves money by implementing a comprehensive air quality management program when compared to the health costs alone of decreasing air quality³⁵. The cost benefit analysis carried out for the period 1994 to 2020 indicated that the total cost of implementing the various stages of the air quality management plan were approximately CA\$2.9 billion. The total benefits of introducing the plan were calculated to be between CA\$5.3 and CA\$8.0 billion³⁶.

The Australian Bureau of Statistics reports that the estimated ozone-related health effects caused by motor vehicle emissions (alone) in Melbourne cost between AUS\$0.3 million and AUS\$4.4 million in 1992-93³⁷. A study carried out by the National Road Transport Commission³⁸ estimates health costs stemming from motor vehicles emissions in the range of AUS\$46 million to AUS\$789 million, but concludes that this is probably an overestimate and that the more reflective cost is in the range AUS\$20 million to AUS\$100 million with AUS\$50 million the best estimate³⁹.

While it is beyond the scope of this Committee to calculate the actual costs for the Perth metropolitan region, the Committee has serious concerns and therefore raises the issue in the context of this report. The potential cost of health effects should be an inherent consideration by the State Government when considering this Committee's report and recommendations.

³³ Schwartz J (1994). What are people dying of on high air pollution days? *Environmental Research* 64:26-35.

³⁴ Department of Environmental Protection, *Op cit*, 1996.

³⁵ Mr Hu Wallis, Ministry of Environment, Parks and Land, British Columbia, Canada. *Pers comm* Friday 31 October 1997.

³⁶ Mr Morris Mannell, Greater Vancouver Regional District, British Columbia, Canada. *Pers comm* Monday 3 November 1997.

³⁷ Australian Bureau of Statistics (1997b). *Australian Transport and the Environment* (Cat. No. 4605.0). Commonwealth of Australia.

³⁸ Segal L (1995). *Review of Health Costs of Road Vehicle Emissions*. Technical Working Paper 15, March 1995. National Road Transport Commission, Australia.

³⁹ Transcom International Limited (1997). Submission 45, 4 July 1997 and Submission 179, 12 December 1997.

Recommendation 2

The Ministers for the Environment and Health should be responsible for ensuring that the health effects of air pollution on the Perth community are reviewed, based on the currently known health effects as established in the scientific literature.

There was much conjecture in the evidence presented as to the accuracy or relevance of *The Perth Haze Study's* estimate of 70 premature deaths. A number of submissions indicated that there was no certainty about the estimated premature deaths as the figure was extrapolated from international studies, and that it was purely an emotive exercise to present such a number to the community. The Committee specifically raised this concern with a number of health and air quality experts during the international investigations. Dr Ray Copes⁴⁰, Dr Sverre Vedal⁴¹ and Dr Simon Taggart⁴² agreed that there was sufficient confidence in existing research to indicate that the rates of health effect were transportable from one location to another, and that the results could be used to extrapolate a scenario for Perth. The results of the New South Wales Health and Air Research Program has shown an association between particulate exposure and cardiovascular and respiratory mortality in Sydney at a rate comparable to the international findings⁴³.

Locally, Dr Summers⁴⁴ highlighted the point that the deaths are not new deaths. Instead, air pollution was having a harvesting effect, where only people who already had a severe illness were dying prematurely. He believed that there was a strong need to further investigate and quantify the extent of the health impact on Perth's population. There was strong support from the Western Australian medical experts consulted for the correlation of hospital admissions data to the DEP's air quality monitoring data in an attempt to more accurately quantify the effect of Perth's air quality on the population.

Recommendation 3

The Department of Environmental Protection and the Health Department of WA should facilitate a 12 month research project, correlating hospital admissions data to Perth's air quality monitoring data.

The Committee acknowledges the possibility that there is no level of "no effect" for exposure to fine particles. On this basis and noting that exposure to fine particles has been linked to a variety of health problems, the Committee believes that the implementation of strategies to manage particulate haze and particulate levels in the Perth metropolitan region must be a priority for the State.

The Committee reiterates the vital point that evidence of reduced life expectancy in polluted cities exists and that the overall impact of air pollution is not trivial.

⁴⁰ Dr Ray Copes, Ministry of Health, British Columbia, Public and Preventive Health Division, Risk Assessment and Toxicology, Canada. *Pers comm* Friday 31 October 1997.

⁴¹ Dr Sverre Vedal, *Op cit*, 1997.

⁴² Dr Simon Taggart, *Op cit*, 1997.

⁴³ Dr Steve Corbett, Health Department, Sydney, New South Wales. *Pers comm* Wednesday 6 August 1997.

⁴⁴ Dr Summers, Respiratory Physician, Perth, Western Australia. *Evidence* Monday 2 February 1998.

Chapter Three

3.0 Managing Perth's air quality for the future

The Committee heard evidence on the two different types of pollution events experienced in the Perth metropolitan region - photochemical smog and particulate haze. Both have the potential to increase in frequency and severity. Whilst distinctly different in formation, these two events share some common sources. Based on the submissions received, there appears to be some confusion within the community as to the difference between these pollution events and the contributing factors.

Table 1 aims to clarify this for the reader. The Committee considers that the development and implementation of an ongoing awareness and education campaign run through the media will in time allow the community to understand the factors influencing Perth's air quality.

Table 1 Sources contributing towards the creation of photochemical smog and particulate haze

<i>Sources</i>	<i>Photochemical smog</i>	<i>Particulate haze</i>
wood heater smoke	no	yes - a single heater may only be a minor source, but collectively these are a major source (seasonal).
wood fire smoke	no	yes - a single fireplace may only be a minor source, but collectively these are a major source (seasonal).
wildfire smoke	yes - contains high concentrations of ROCs.	yes - meteorological conditions influence the area impacted.
controlled burn smoke	yes - if temperature of burn sufficiently hot to create high concentrations of ROCs.	yes - meteorological conditions influence the area impacted.
land clearing (without burning)	no	yes - mainly through dust which is more a nuisance issue rather than health issue.
land clearing (with burning)	yes - if temperature of burn is sufficiently hot.	yes - meteorological conditions influenced the area impacted.
agricultural burning	no - unless out of control in which case can be considered as wildfire smoke.	yes
petrol vehicles	yes	yes
diesel vehicles	yes	yes - two-thirds of total vehicle particulates come from diesel vehicles.
autogas (LPG) vehicles	yes - but lower emission rate than petrol and diesel equivalent.	no
natural gas (CNG or LNG) vehicles	yes - but lower emission rate than petrol and diesel equivalent.	no
natural gas fired power stations	yes	yes - combustion products may react in atmosphere.
coal fired power stations	yes	yes
oil fired power stations	yes	yes
petroleum refineries	yes	yes
domestic and commercial ⁴⁵	yes - ROC's	yes - secondary reactions of chemicals leading to haze

In summary, photochemical smog is a pollution cocktail caused by the reaction of nitrogen oxides (NO_x) and reactive organic compounds (ROCs) in the presence of relatively high air temperatures and strong sunlight. Ozone is a product of this reaction, and the monitoring of ozone concentration at ground level indicates the presence of photochemical smog. NO_x principally comes from the combustion of fossil fuels (vehicle and

industry emissions), with large quantities of ROCs coming from fuel evaporation (vehicles and refineries). Some ROCs are present in vehicle emissions as a consequence of the incomplete combustion of fuel. The Committee notes the evidence of the Department of Environmental Protection which acknowledges the importance of planning and implementing long term photochemical smog management strategies and that further ongoing scientific research is required to understand the complexities of photochemical smog reactions which determine the distribution of ozone across the Perth metropolitan region. Managing emission sources contributing to photochemical smog formation is a challenge facing this State which is considered essential if Perth is to have good air quality in the long term. Evidence presented by technical experts indicates that a single management strategy will not address this issue. The Committee believes that the implementation of strategies to manage sources of photochemical smog precursors and photochemical smog events in the Perth air shed must be a priority for this State.

Particulate haze is caused by very small particles that are not visible to the eye but in the air they collectively cause the scattering of light and thereby reduce visibility. Particulates come from fossil fuel combustion (petrol, diesel and coal), wood burning and wood fire smoke, industrial activities, dust, vegetation (pollen) and sea spray (salt).

It is also important to acknowledge the seasonal variation, both in the sources of pollutants, and in the degree to which the sources may have an impact on air quality. The most obvious is the seasonal use of wood heaters for heating homes. However, the use of wood hot water heaters can be expected to be all year. Photochemical smog formation by its very nature is seasonal, requiring sunlight and temperature to drive the reaction of NO_x and ROCs. The variety of sources and the seasonal nature of pollution sources and events emphasises the need for a range of management strategies. It must also be recognised that a number of benefits can be achieved from a single strategy.

To ensure Perth's good standard of air quality continues, the Committee considers it essential that the State Government give consideration to establishing an air quality management plan that provides a framework for the ongoing management of air quality both technically and administratively.

Recommendation 4

The State Government should develop and progressively implement an Air Quality Management Plan for the Perth metropolitan region based on the strategies recommended in this report.

The success of the air quality management plan will depend on whether the community can be encouraged to travel by public transport to a far greater degree than is currently being achieved, and to reduce the frequency of the trips currently taken in the private vehicle. Therefore the success of the plan is also inextricably linked to how and where the urban areas of Perth are developed in the future. It is imperative that Government policy be developed with this in mind.

Recommendation 5

State Government policy should require integrated land use and transport planning for all future proposals involving road construction and land development.

Success will also depend on the ability of the key Government agencies involved to inter-relate across their areas of expertise and to work toward goals which traditionally may not be within their normal scope of consideration. The Committee believes that the Department of Environmental Protection should retain its overall lead agency role and responsibility for ensuring air quality goals are achieved in Perth. However the Committee acknowledges that not all of the recommended strategies lie within the functional role of this department, and that, in some instances, the mechanisms needed to achieve the strategies do not exist in the current structure of the involved Government agencies. To facilitate the implementation of a comprehensive and long term air quality management plan, the Committee recommends that the State Government establish a co-ordinating body responsible for facilitating the implementation of the plan, particularly those strategies involving more than one agency. The Committee should ideally be chaired by the Chief Executive Officer of the Department of Environmental Protection and include representation from industry, business and the community.

Recommendation 6

The State Government should establish a co-ordinating committee to facilitate the implementation of the air quality management plan strategies. The Committee members should represent the Ministry for Planning, Transport, Main Roads Western Australia, Office of Energy, Department of Conservation and Land Management, WA Police Service, industry, business and the community, and chaired by the Chief Executive Officer of the Department of Environmental Protection.

With regard to improving community understanding of air quality issues, the Committee met with the manager of the *Spare the Air* program operating in the San Francisco area⁴⁶. This program was initially established as a community awareness initiative to gain voluntary public support for the haze management campaign, known as the *Don't light tonight* campaign. This called upon residents with more than one form of domestic heating to refrain from using wood heaters during periods of expected poor air quality. As community awareness has increased and with efforts being made to reduce the occurrence of summer photochemical smog, *Spare the Air* has become the umbrella for a number of community involvement campaigns, including the promotion of alternative commuting modes and facilitating the establishment of car pooling programs, trip linking and tele-commuting. The program is being promoted through work places where staff in the participating organisations are notified the previous day of a *Spare the Air Day* and to therefore consider alternatives means of commuting to work.

Support packages of information sheets, note pads, participation stickers and campaign launches are features of the program designed to maximise voluntary involvement and a voluntary change in people's behaviour. The single slogan of *Spare the Air* is becoming more widely known each year and is already widely recognised through the community⁴⁷.

Recommendation 7

The Department of Environmental Protection should co-ordinate an ongoing education campaign communicating the importance of good air quality - to be supplemented by seasonal and specific education campaigns.

⁴⁶ Ms Grier McCurdy, Community Focus, Program Director, San Francisco, United States of America. *Pers comm* Wednesday, 5 November 1997.

⁴⁷ Franz J D (1995). *Bay Area Air Quality Management District Air Quality Public Opinion Follow-Up Survey and Focus Groups - Final Draft Report*. J D Franz Research July 1995. United States of America.

The Committee also believes there is much to be gained by the development of local air quality management plans under the framework of a regional and/or State air quality management plan. The Committee received evidence from a number of local government authorities and the Western Australian Municipal Association. While it is clear that there are some issues of commonality amongst the municipalities (such as dealing with complaints about smoke from residential wood heaters, subdivision approvals and the issuing of burning permits) which would benefit from uniform approaches facilitated at the State Government level, there remain some localised issues that will not be common to all municipalities. For example, the proximity of heavy industry to Kwinana, Rockingham and Cockburn, and the forested areas in the hills are very different to the environment being managed in South Perth.

The aim of the local plans should be to facilitate the numerous issues that are best managed at the local level, such as subdivision design and location of facilities for cyclists and pedestrians. These plans could also be developed at the regional council level. The Committee considers the manual⁴⁸ prepared by the Sydney Regional Organisation of Councils to be an excellent model that could be adapted to Perth's needs.

Similarly, the Committee was impressed with the progressive approach adopted by the Leichhardt Council in New South Wales. The Council's *Local Environment Strategy*⁴⁹ identifies seven key areas for environmental policy development that will contribute towards improving the environmental quality in the local area. These key areas are -

- building and streets;
- open space;
- pollution control;
- waste minimisation;
- transport;
- environmental education; and
- green goods.

The Council has formulated local development controls for the new town plan requiring energy-efficient design for new buildings and renovations, reducing traffic and creating a pedestrian friendly urban environment. Solar hot water systems must be installed in new dwellings, together with extensive roof, wall and floor insulation.

The Committee acknowledges that bringing about change to urban design is a medium term strategy, but it is one in which the framework for the future must be put in place now in order to maximise effectiveness.

Recommendation 8

Local Government should be encouraged to develop (at both the municipal and regional level) local air quality management plans.

As outlined previously, the Committee considers it essential that an air quality management plan be developed and implemented for the Perth metropolitan region, and that the strategies be designed to specifically manage emission sources and episodes of photochemical smog and particulate haze as a priority. The Committee's discussion papers presented a number of management options for community comment. The following section of this Chapter is based on the discussion papers and the findings of the Committee's investigation.

⁴⁸ Sydney Regional Organisations of Councils (1994). *Local Air Quality Management - A Manual for Local Government*. New South Wales, Australia.

⁴⁹ Leichhardt Council (1994). *Towards a Sustainable Future - An Environment Strategy for Leichhardt Council*. New South Wales, Australia.

3.1 Urban design, transport planning & vehicle emissions

Based on the information presented and considered, the Committee is unanimous in its belief that the future of Perth's air quality will be determined by the ability of the environment, planning and transport sectors to integrate, and to provide an urban structure that supports the principle use of public transport, cycling and walking over the use of the private vehicle.

The Committee acknowledges that the Perth metropolitan region has evolved and developed around the use of the private vehicle as the main transport method for most of the community. Western Australia has the highest rate of vehicle ownership in Australia (679 vehicles per 1000 people) and the total number of vehicles registered is increasing. 90% of the Western Australian population travel to their place of work or study in a private motor vehicle either as the driver or a passenger. This is the highest percentage in the country (Table 2). It has also been estimated that the average cost to society from emissions generated by the Australian motor vehicle fleet is 0.11 cents per kilometre⁵⁰. Average trip lengths are estimated to be eight kilometres with a yearly average distance travelled of 15 000 kilometres.

Table 2 Vehicle ownership in Australian cities⁵¹

<i>City</i>	<i>Number of vehicles per 1000 people</i>
Western Australia	679
Tasmania	676
South Australia	653
Victoria	637
Queensland	614
Australian Capital Territory	604
New South Wales	545
Northern Territory	520

Modelling of the predicted changes to the private vehicle fleet based on current trends, which include growth in the number of vehicles and growth in the total number of vehicle kilometres travelled (Table 3), indicates that Perth air quality will decline in future years⁵². Modelling also suggests that the technological advances in vehicle emission technology alone will be insufficient to counteract a growing problem, especially when taking into account the slow rate of vehicle turnover in the Perth fleet.

Vehicle emissions collectively (all fuel types and all vehicle types) is the second largest source of particulates in the Perth metropolitan region contributing to seasonal events of particulate haze. Vehicle emissions are also a major source of NO_x and ROCs contributing to the creation of photochemical smog. A variety of other chemicals are also released through vehicle emissions, some considered to be toxic.

⁵⁰ Australian Bureau of Statistics, *Op cit*, 1997b.

⁵¹ *Ibid.*

⁵² Department of Transport, Main Roads Western Australia, Ministry for Planning, Fremantle Port Authority, Westrail & Metrobus (1996). *Metropolitan Transport Strategy*. Government of Western Australia, Australia.

Figure 3 Predicted future growth in Perth's population and private vehicle use⁵³.

The most obvious source of emissions from a vehicle is through the exhaust pipe. However, emissions also arise through evaporative processes such as leaks from the fuel tank and faulty fuel caps. In older vehicles, a significant source of ROCs is "hot soak" emissions where evaporative emissions come from the fuel system of a hot engine whether it be in use or parked unsheltered on a hot day. Therefore there is a concentrated mass of ROC emissions from vehicles driven and parked in and around the Perth central business district during the warmer months of the year. Emissions from a vehicle are dictated by the degree and quality of maintenance on the vehicle, the fuel type and the way in which it is driven. Regardless of vehicle type, vehicle emissions will increase as the total vehicle kilometres travelled increases, and the potential fuel efficiency achievable will decline.

Integrating transport and urban planning

Emissions from vehicles are one of the key issues requiring active management if Perth's air quality is to improve in future years rather than deteriorate. The Committee acknowledges that one of the key ways to reduce vehicle emissions is to use private vehicles less and adopt other transport modes, such as walking, cycling and public transport, for both commuting purposes and short journey routine travel. However, to achieve this, there needs to be a fundamental change in how the urban areas within Perth are planned, designed and constructed. The continual development of faster and more free flowing roads leading into and away from the city centre is encouraging people to live further away from the city and therefore commute greater distances to employment and commercial centres. The Perth central business district provides approximately 16% (81 703 people)⁵⁴ of the employment opportunities in the metropolitan region and is expected to retain this dominance in future. The process of installing capital intensive public transport systems from these initially outlying areas to the central business district or intermediate commercial centres is often delayed, forcing reliance on the use of the private vehicle.

⁵³ Transport WA (1995). *The Way Ahead - Metropolitan Transport Directions for Western Australia*. Government of Western Australia, Australia.

⁵⁴ Australian Bureau of Statistics (1996a). *Census 1996. Perth A Social Atlas*. (Cat. No.2030.5.) Commonwealth of Australia.

The importance of this has been highlighted through the Federal Government's independent inquiry⁵⁵ where it was stated that acceptable air quality will only be assured by the pursuit of a wide range of actions and measures, and that the measures will only succeed through coordination of transport planning, infrastructure development and environmental planning. The inter-relationship of land use patterns and mixes, development density and the location of development in relation to transport networks are determinants of the community's travel behaviour (frequency, distance, speed and mode of travel chosen). This was reiterated to the Committee frequently throughout its investigations.

The Committee firmly believes that the State Government's land use planning policies should seek to minimise the need for commuter travel and encourage the use of less polluting forms of transport. For this reason alone, greater emphasis should be placed on the adoption of the *Liveable Neighbourhoods Community Design Codes*, released during the end of 1997. The State Planning Strategy⁵⁶ will be an important way of improving the community's access to and choice of transport mode in a future which is less heavily dependent on the private car. As highlighted by the Ministry for Planning⁵⁷, the changes to urban form take a very long time to implement, but the Committee believes the long term success of the air quality strategies recommended here are overshadowed by the importance of having a sustainable development plan for the Perth metropolitan region. It must be remembered that the greatest threat to Perth's air quality will be in the long term and therefore planning strategies must be defined now to achieve medium and long term outcomes.

The Committee specifically sought comment from the community on this issue through the release of discussion paper 5 *Transport and Urban Planning*. Reaction to the strategy options presented in the discussion paper are summarised in Appendix A. Additional comments and suggestions from the submissions included -

- ensuring that educational bodies training engineers, scientists and planners include material on energy efficiency, passive solar design and integrated transport planning;
- the need to develop an energy ratings system for buildings and vehicles;
- the development of a planning policy to guide and facilitate the establishment of home-based businesses to reduce vehicle kilometres travelled and vehicle emissions; and
- any changes to the provision of parking in the central business district to consider the possible overflow effect on neighbouring areas.

The Committee believes providing the community with access to a well planned and structured public transport system that is inexpensive, pleasant, convenient and rapid is a key goal for State Government planning. The foundations for such a service are in place now, however the Committee considers that further development of the network, both in infrastructure development and provision of service is needed, and that these should be afforded a high priority in State Government planning and funding.

Recommendation 9

The State Government's land development policy should be to improve the community's access to public transport networks in existing areas, and to ensure access is provided in the early stages of planning and development of all new communities.

⁵⁵ Australian Academy of Technological Sciences and Engineering, *Op cit*, 1997.

⁵⁶ Western Australian Planning Commission (1997). *State Planning Strategy - Final Report and Manual*. Government of Western Australia, Australia.

⁵⁷ Ministry of Planning (1997). Submission 200, 3 February 1997.

Recommendation 10

Dedicated express bus lanes should be provided along the full length of the Kwinana freeway as part of any future expansion (existing or proposed).

Recommendation 11

Dedicated express priority car pool lanes should be provided along the full length of the Mitchell freeway as part of any future expansion (existing or proposed).

Recommendation 12

The State Government's land development policy should ensure that land use developments in the vicinity of rail corridors and stations is such that the establishment of services supporting the community are facilitated.

The Perth central business district is set to retain its destination dominance in the future. Surveys have continued to show the reliance that the population places on the use of the private vehicle for commuting purposes. This is facilitated by major roads links both north-south and east-west. Evidence from the City of Perth indicated that the total number of parking spaces provided in the central business district is 63 000 bays with 46 710 allocated to all day parking.⁵⁸ It has been suggested that the provision of parking spaces in this proportion discourages commuter consideration of the use of public transport, cycling or walking, even in instances where the commuter lives within five kilometres of the central business district where a day's round trip commuting may be less than 15 kilometres.

Where practical commuting alternatives exist, the Committee believes that the practice of private vehicle commuting should be discouraged through the allocation and pricing structure of all day parking in the Perth central business district and other key business districts in the metropolitan region.

Recommendation 13

The City of Perth should, in conjunction with community and business representatives, strategically review the provision of all day parking in the central business district, with a view to reducing the total number of bays allocated to this purpose and increasing the charges for all day parking.

Recommendation 14

The State Government should amend legislation to allow revenue generated from parking fees in the City of Perth to be used in supporting public transport, cycling and pedestrian based activities and facilities.

The Committee considers the *Travelsmart* program undertaken in the South Perth area by Transport WA contains some very interesting and valuable insights on how people choose their commuting mode and how open to change this choice may be. For residents of South Perth who commute into the Perth central business district, the round trip is normally less than 15 kilometres. This area is serviced by a public transport network

58

City of Perth (1997). Submission 58, 5 September 1997.

(bus and ferry), cycling and pedestrian paths (including a scenic path around the Swan River), and the area is also linked to the central business district by a major highway. It is also well serviced by the taxi industry. The *Travelsmart* program in South Perth aimed to exploit people's willingness to change travel patterns. It provided residents with the opportunity to try an alternative to travelling by private car, by making use of public transport, cycling or walking. The findings and outcomes of the program included -

- 38% of all trips were less than three kilometres, 29% of all car trips were less than three kilometres and 41% of all trips were entirely within the South Perth area;
- residents want flexible travel choices; and
- the potential and willingness to change exists⁵⁹.

The Committee considers an expanded *Travelsmart* program is one of the cornerstones of a successful air quality management plan for Perth. The Committee is guided by Transport WA's submission and evidence⁶⁰ on this issue, suggesting that the community needs not only awareness and education programs but perhaps more importantly, active assistance in changing commuting patterns.

Recommendation 15

The State Government should increase funding to the Travelsmart program to expand it across more municipalities and provide ongoing support to sustain changes in community behaviour.

Similarly, the Committee believes that greater emphasis should be placed on providing ongoing promotion campaigns aimed at increasing the number of people and the number of times per week an individual uses public transport, cycles or walks over short distances, particularly for non-commuting trips normally carried out by using the private vehicle. The Committee also believes that building managers should adopt a supportive position towards those who choose to cycle or walk by making secure changing and bicycle storage facilities available for use.

As the South Perth *Travelsmart* program highlighted, 50% of the trips carried out were non-commute type trips, including leisure, escort and shopping activities. This high percentage indicates an important issue for focussing management strategies and to bring about change.

Recommendation 16

Transport WA and the Department of Environmental Protection should facilitate the development of a promotional campaign aimed at increasing cycling, walking and using public transport for trips under five kilometres in distance.

The Committee was particularly impressed by the Copenhagen experience where cycling is not only popular as a leisure activity, but 30% of the workforce cycle to work, 34% drive cars and 35% walk or take public transport. On rainy days 60% of cyclists continue to cycle and 70% continue to cycle during winter. The majority of those who stop cycling during winter shift to public transport⁶¹. And this is in a place where it

⁵⁹ Transport WA (1998). Submission 212, 26 February 1998.

⁶⁰ Mr Greg Martin (Acting Director General, Transport) and Mr Richard McKellar (Manager Policy and Planning, Transport). *Evidence* Wednesday 9 July 1997.

⁶¹ Mr Bjarne Eire, Senior Advisor City Engineer Directorate Road Division, City of Copenhagen. *Pers comm* Tuesday 28 October 1997.

snows during winter! Aside from the inherent cultural position on cycling, from the Committee's investigation, it believes that cycling would remain a viable commuting choice in Copenhagen largely due to the provision of facilities and services specifically for cyclists.

Dedicated cycle lanes are common within the city centre. Most are two to three metres wide and built from asphalt. They are separated from the road and the pedestrian footpath by curbs and operate in one direction. The cycle lanes have been very effective for encouraging cycling, particularly over the short distances of four to five kilometres. There is also extensive provision of free bicycle parking throughout Copenhagen but there is still more demand for parking particularly within public areas. Most residential, commercial and public buildings have bicycle stands outside, undercover or in a basement. For new buildings, it is a requirement that space be set aside for bicycle parking. Most public areas, including the train stations, some bus stations, town squares and parks have space for bicycle parking. There are over 3000 bicycle parking spaces at the four metropolitan train stations in the city centre alone. Two bicycle centres were established at two central stations during 1989. The centres provide covered and supervised parking facilities combined with a bicycle shop⁶². This has provided new employment opportunities and eliminates possible theft or damage to the bikes while unattended.

Traffic accidents occur largely as a result of the motorist failing to acknowledge the cyclist's right of way⁶³. At particularly hazardous intersections, "blue cycle crossings" have been painted in order to focus motorist attention on cyclists. At some traffic light controlled intersections, special cyclist lights have been installed where the green lights are staggered. Cyclists are given a few seconds head start on the motorists so that they are not so easily overlooked, and are halted a few seconds before the cars, allowing the latter to turn unimpeded.

The Copenhagen *City-Bikes* program offers a free and accessible way to travel around the city centre. *City-Bikes* stands are located throughout the city and a bike can be hired for a deposit of 20 Danish Kroner (approximately AUS\$4). The deposit is refunded when the bike is returned to any stand. The program experienced initial problems but is now growing in popularity and demand. There is also a number of sponsors of the program including a local supermarket chain, newspaper, *Coca Cola*, Girl Scout Association, Green Fund, Ministry of Culture, Ministry of Communication and Tourism, *Wonderful Copenhagen* tourism organisation and City of Copenhagen.

Other facilities provided at train stations in Denmark include enclosed shelters at strategic locations along the platforms allowing commuters to seek shelter from the weather (wind and cold). While Perth does not experience the same extremes (that is, snow) there is a lesson to be learnt about providing facilities at the public transport locations to encourage their use and to make the experience as comfortable as possible for the widest possible range of commuters and needs.

Recommendation 17

Transport WA should improve and increase bicycle and customer facilities at public transport stations.

Recommendation 18

Main Roads Western Australia in conjunction with Local Government should continue to improve and expand the bicycle network by providing bicycle access in all new road constructions and modifications incorporating the well engineered aspects of the Copenhagen model.

⁶² City of Copenhagen (1997). *Copenhagen City of Cyclists*. Unpublished.

⁶³ City Engineer's Department (1989). *Copenhagen and The Cyclists*. Municipal Corporation, 4th Department, City Engineer's Department, Copenhagen, Denmark.

Recommendation 19

Local Government should amend By-Laws so that non-residential building approvals are subject to the provision of adequate facilities for cyclists, pedestrians and public transport users.

Toward the end of 1997, the Western Australian Planning Commission released the *Liveable Neighbourhoods Community Design Code*. It has been adopted by the Commission as an optional alternative to the current subdivision policies and has an initial 12 month trial. The Code's emphasis is on developing communities within the urban structure of walkable neighbourhoods, clustering to form towns of compatible mixed uses so as to reduce car dependence for access to employment, retail and community facilities. The Committee acknowledges the principles set out by the Code as they embrace those elements considered vital to developing the urban village. However it is the Committee's impression that there remains a heavy emphasis on the continuing dominance of the private vehicle as the main means of getting around and there needs to be a process of bringing together the principles of the planning codes and the State's Transport Strategy. While it would be premature to assess the Code's effectiveness in such a short time, it must be noted that it has some distinct similarities to the way in which urban areas were designed and constructed earlier in Perth's history. The Committee did however take the opportunity to discuss the practicalities of this type of approach during its investigations overseas.

An example of this comes from the Committee's investigation of the approach undertaken in Copenhagen. The population of Copenhagen has a similar average commute distance to work (approx 20 kilometres each way). Businesses are typically wanting to develop green field sites but this leads to an increase in commuting distance to around 30 to 40 kilometres and increases the use of the private motor vehicle. Research has found that if the commuter lives more than one kilometre from the nearest public transport station then 75% to 80% will commute to work using cars. Therefore the Danish government's policy is for development to be within one kilometre of a public transport junction or a maximum of 500 metres from a railway station⁶⁴.

The Greater Vancouver Regional District in British Columbia, Canada has developed a most comprehensive community plan based around clusters of urban areas being supported by public transport networks, with both cycling and pedestrian facilities taking precedent over the use of the private vehicles. Collectively, this integration of transport modes within the community and supported by a mixture of land uses and land densities within traditional urban areas is commonly referred to as the urban village.

This strategic plan⁶⁵ evolved out of the community's demand for a solution to the growing traffic congestion that did not involve the building of more freeways.

This plan incorporates -

- protecting green zones (natural assets) such as major parks, wetlands and farmland from urban development;
- building complete communities that are focussed on town centres throughout the region with a better balance in the distribution of jobs, housing and public transport system;
- achieving a compact metropolitan region, concentrating on development in growth areas to develop employment and housing areas and to make better use of public transport; and
- increasing transportation choice by encouraging the use of public transport and discouraging single occupant vehicle travel. Initiatives place priority on walking, cycling, public transport and goods movement before private vehicle movement.

⁶⁴ Mr Peter Hartoft-Nielson (Head of Section, Spatial Planning Department, Ministry of Environment and Energy). *Pers comm* Tuesday 28 October 1997.

⁶⁵ Greater Vancouver Regional District Board (1996). *Livable Region Strategic Plan*. British Columbia, Canada.

Recommendation 20

The State Government and its agencies should develop integrated land use and transportation policies that will accommodate future growth in the Perth metropolitan region in a manner which minimises potential air quality impacts.

The Committee has reviewed a vast number of approaches to managing vehicle emissions, and canvassed the community's opinion through discussion papers 3 (*Vehicle emissions*) and 5 (*Transport and urban planning*). These approaches included those based on improving community and industry awareness through educational programs, altering technology, implementing regulatory control and providing economic incentives to improve vehicle emissions. Appendix A shows the community's response to the strategies presented in the discussion papers. There is an obvious demand for improving community awareness through educational programs. A successful and cost effective approach adopted by the Bay Area Air Quality Management District, based in San Francisco, was the use of bill board advertising to promote activities that support improving air quality⁶⁶.

Transport WA in conjunction with the Department of Environmental Protection and Main Roads Western Australia released a discussion paper canvassing the community's response to a variety of technical solutions to reducing vehicle emissions. Among the respondents to the document, there was unanimous support for the reduction of emissions from motor vehicles⁶⁷. Other key points arising from this include -

- support for compulsory vehicle emission testing, especially where it is linked to road worthiness testing;
- higher penalties and improved policing of polluting vehicles was also supported, including the immediate fixing of smokey vehicles; and
- support for vehicle buy back schemes.

The Committee considers the management and reduction of total vehicle emissions to be one of the key mechanisms in which to ensure ongoing healthy air quality in the Perth metropolitan region. In acknowledging this, the Committee does not foresee the complete replacement of the private vehicle fleet with the use of alternative transport modes, but acknowledges the vital importance of improving the community's perception of the role of the private vehicle, and bringing about a philosophical change in attitude toward responsible vehicle use in the metropolitan region in future.

To achieve and sustain this fundamental change it will be necessary to support the community with a public transport structure that is enjoyable and reliable to use, and an easier, time equivalent or faster commuting option than the use of a private vehicle. It also needs to be supported by an urban and city design that gives priority to alternative commuting options over the use of the private vehicle. Surveys carried out in WA and around Australia consistently show that the reasons for choosing to drive are related to convenience, safety, reliability, control, time, flexibility, and a lack of realistic alternatives. Undoubtedly the periods when most vehicles are on the road at any one time corresponds to the commuting periods - Monday to Friday, 7.00 am to 9.00 am and 4.00 pm to 6.00 pm. Other peak periods include from 11.30 am to 2.30 pm week days.

⁶⁶ Ms Lucia Libretti, Public Information Officer. San Francisco, United States of America. *Pers comm* Thursday 6 November 1997.

⁶⁷ Stanley K & Brown G (1998). *Reducing vehicle emissions in Perth - Submissions report*. In conjunction with Department of Environmental Protection and Main Roads Western Australia. Department of Transport, Government of Western Australia, Australia.

Figure 4 Traffic congestion during peak periods⁶⁸

⁶⁸ Transport (1997). *High Occupancy Vehicle and Bus Priority Facilities for the Perth Metropolitan Region*. Discussion paper by Transport, Main Roads Western Australia, Ministry for Planning and the WA Police Service. Government of Western Australia, Australia.

Reducing the number of vehicles on the road will bring benefits in areas other than improved air quality. Figure 4 shows those areas within the metropolitan region experiencing traffic congestion during peak periods. Evidence shows that emissions increase during periods of idling, acceleration and deceleration when compared to even flowing traffic movement. Work undertaken by Cox and Arup Transportation Planning⁶⁹ estimated that most roads are associated with a fuel consumption of about 20 litres per 100 kilometres at speeds of 10 kilometres per hour, decreasing to around 10 litres per 100 kilometres at about 80 kilometres per hour.

The traditional management tool adopted to manage traffic flow is the improvement to road routes such as increasing the number of lanes and constructing new faster flowing routes such as the extension of Kwinana Freeway further south. It is the Committee's opinion that this is not a sustainable approach and that while vehicle drivers and commuters will undoubtedly appreciate improved roads within the metropolitan region a new approach and emphasis is required. This is not to say that improvements of the traditional type should not occur, but that the priority considerations need to better reflect a sustainable outcome.

Recommendation 21

Travel demand management within the Perth metropolitan region should be founded on the priority basis of providing fast, frequent and reliable public transport systems throughout the region.

Roads are expensive to build and to maintain. It has been estimated that \$813 million was spent in 1996 on Perth's roads (across all levels of Government)⁷⁰. While the Perth Transport Strategy states that "all roads are cycling roads", there is a great deal of concern amongst the community (from both cyclists and drivers) that the current road designs are not always practical for both users. The mismatch between vehicle and cycle is obvious, and also between cyclist and pedestrian, particularly when speed is considered in both instances. If drivers and cyclists are to share the roads, and if cycling is to be encouraged within the community to a greater degree as a viable and attractive alternative to driving, then there needs to be a reconsideration of how this will be achieved.

The Copenhagen strategy is one which the Committee considers to be an effective arrangement. In the first instance, bike lanes on major roads are clearly marked and separated from the driving lanes. The bike lanes are normally raised slightly above the height of the driving lane. At major intersections controlled by traffic lights, bike lanes, particularly for turning purposes are marked in blue paint and clearly different to the driving lane. Traffic lights at some intersections include lights dedicated to cyclists. In these circumstances the green light for cyclists will change ahead of that for the vehicles to allow the cyclists to get initially ahead of the vehicles increasing their visibility to drivers who may be turning across their path. Similarly the cyclist lane lights change to red ahead of the car lane lights. This allows drivers to complete turns without coming across the cyclists. Essentially the system makes cyclists more visible to drivers at intersections.

The Committee acknowledges the improvements being made to some of the bus routes in the metropolitan region, particularly rerouting to create the *Circle Route* linking the major commercial centres, universities and hospitals. Submissions and evidence received by the Committee indicates a demand for such a service, but the Committee remains concerned that the speed with which the community will be able to commute to these centres will be lower than that which is achieved through the use of the private vehicle. Surveys of public attitudes toward the use of public transport continually highlight the need for a public transport service to be frequent, reliable, convenient and time efficient. The Committee considers it necessary for the commuting time in buses to be decreased so that the bus journey times are close to or better than those which

⁶⁹ Cox J B & Arup Transportation Planning (1996). *Models for predicting vehicle operating costs in urban areas*, Austroads Project BS3.a.41, Austroads, Sydney, New South Wales. Australia.

⁷⁰ Bureau of Transport and Communications Economics (1997). *Working Paper 34 Taxes and charges in Australian Transport: A Transmodal Overview*. Commonwealth of Australia.

can be achieved by car. To do this, bus lanes should be introduced more widely and policed effectively. Buses should also be given priority over other motor vehicles in urban areas. Ultimately, the Committee considers that a light rail system should be integrated into the Perth metropolitan region to facilitate the movement of people efficiently and effectively. The improvement of public transport linkages between the Perth central business district and established areas such as the south west corridor would have the potential to substantially reduce current motor vehicle use⁷¹.

Recommendation 22

The State Government should commence planning for the introduction of a high-speed light rail network in the Perth metropolitan region.

Recommendation 23

The State Government should expand the metropolitan rail network to encourage a decrease in private vehicle usage.

Recommendation 24

As an interim measure to the development of a light rail network, the State Government should allocate bus priority lanes along highways during peak traffic periods.

The Committee acknowledges that planned urban densities of new areas may not be achieved initially and that services tend to be provided on a priority basis. Under these circumstances, the Committee believes there may be scope for the introduction of an alternative transit service, similar to Paratransit. Paratransit is the name given to a system of privately operated shuttle vehicles, such as vans or buses, used to move groups of people⁷². Paratransit systems are common throughout the United States of America frequently being used as airport shuttle services, and in Asian cities where they are used to move large numbers of people between key points within the central city area. Such a system may prove to be beneficial in Perth within the "walled suburbs" where street design does not facilitate the free movement of larger buses. These privately owned and operated systems could also be beneficial in areas that are not currently serviced by public transport or have infrequent services, and could link into the existing network of buses and trains, or operate as a stand alone alternative transport option. In addition, given the spread of the metropolitan region from north to south, and the legacy of "walled suburbs", the Committee believes it is important to expand the availability of *Park and Ride* facilities in the vicinity of rail and bus networks. Similarly, interchanges between services need to be extended to increase patronage level. Security should also be increased at these facilities to give the public confidence in using the facilities.

If the community continues to place the greatest emphasis on the use of the private vehicle as the principle commuting mode, then improvements to air quality will have to be achieved through reducing the emission from the vehicle, that is, moving toward low and zero emission vehicles. Should this eventuate, the Committee believes State Government policy will need to be in place to ensure that the vehicle fleet is modern and uses up to date emissions control systems.

⁷¹ City of Cockburn. Submission 43, 30 June 1997.

⁷² Gottsman L & McKinney J (1993). *Market incentives to reduce mobile source air emissions: Evaluation of proposed measures and strategic plan for the Mobile Sources Section, Air Toxics Division, EPA Region IX*. The Graduate School of Public Policy, University of California, Berkeley, United States of America.

Recommendation 25

The State Government should initiate a detailed economic analysis of the public monies provided to various forms of public and private transport modes and facilities.

Recommendation 26

The State Government should establish an Economic Advisory Committee to independently review and advise on all new major transport and urban projects with the view to ensuring that all goals of the Metropolitan Transport Strategy are effectively and efficiently achieved.

Recommendation 27

The State Government should investigate the desirability of transferring the policy function of Main Roads WA to Transport WA to achieve better overall co-ordinated integration of transport in the Perth metropolitan region.

Recommendation 28

The State Government should encourage the private funding and development of light and heavy rail and other public transport systems in the Perth metropolitan region by enhancing development opportunities adjacent to the chosen route, including supportive land zoning and land allocation.

Vehicle emissions

A compounding factor to the growth in the number of vehicles being used in Perth is the actual age of the fleet and the standard of pollution control equipment fitted to the vehicle, if at all. The Australian Design Rules (ADRs) established under the Federal Government's *Motor Vehicle Standards Act*, control the design parameters of new vehicle models. Emission standards specify the maximum amount of pollutants allowed in the exhaust gas discharged from the vehicle, and are summarised in Table 3 and 4.

Table 3 Australian Design Rule Standards for diesel vehicle emissions

<i>Standard</i>	<i>Applicability</i>
ADR30/00	Diesel Engine Exhaust Smoke Emissions - Opacity of exhaust smoke emissions. Applies on and after 1 July 1988 to 2 wheeled mopeds; motor cycles; passenger cars, forward control passenger vehicles, off-road passenger vehicles; light and heavy omnibus, light, medium and heavy goods vehicles, and applies on and after 1 March 1991 to 3 wheeled mopeds and motor tricycles.
ADR 70/00	Exhaust Emission Control For Diesel Engine Vehicles - Limits on hydrocarbon, carbon monoxide, oxides of nitrogen, and particulates from the exhaust system of motor vehicles fitted with a Diesel Engine. Applies to all models on and after 1 January 1995 and is additional to ADR30/00.

Table 4 Australian Design Rule Standards for petrol vehicle emissions

<i>Standard</i>	<i>Applicability</i>
ADR 36	Exhaust Emission Control for Heavy Duty Vehicles - hydrocarbon and carbon monoxide exhaust emission limits. Applies to petrol - light goods vehicles 2.7 to 3.5 tonne; medium and heavy goods vehicles. Excludes LPG vehicles.
ADR 37/00	Emission Control for Light Vehicles - hydrocarbon fuel evaporative emissions, and hydrocarbon, carbon monoxide and oxides of nitrogen exhaust emission limits. Requires new motor vehicles to be manufactured to operate on Unleaded Petrol.
ADR 37/01	Emission Control for Light Vehicles - more stringent amendment to ADR 37/00 applicable to models years 1997 and onwards. Applies to the design and construction of all petrol vehicles including motor tricycles; passenger cars, forward control passenger vehicles and off-road passenger vehicles; light omnibus; light goods vehicles up to 2.7 tonne GVM.
ADR 41/00	Mandatory Operation on Unleaded Petrol - To require vehicles to be manufactured to operate on "Unleaded Petrol". Unleaded petrol to contain not more than 0.013 gram of lead per litre, and not more than 0.0013 gram of phosphate per litre. Sulphur limit of 0.05% by mass. Applies on and after 1 July 1988 to all - 2 wheel mopeds, motorcycles including those with sidecar, forward control passenger vehicles over 2.7 tonne, off road passenger vehicles over 2.7 tonne, light omnibus, light goods vehicles over 2.7 tonnes, medium and heavy goods vehicles, and applies from 1 March 1991 to 3 wheel mopeds and motor tricycles. Does not apply to vehicles complying with ADR 37.

The emissions are measured over an engine's or vehicle's test cycle. The requirement to comply with these standards is on the equipment manufacturer. The most recent ADRs for petrol vehicles require the emission control units to be guaranteed for the first 80 000 kilometres or five years, whichever occurs first⁷³. The emission control levels specified in the ADR's are traditionally between five to sixteen years behind the measures adopted in North America and Europe.

Through Western Australian legislation⁷⁴, vehicles are required to comply with the requirements of the ADRs throughout the useful life of the vehicle. State legislation also requires that vehicles be maintained so that exhaust emissions are not excessive. Policing of this has been incorporated into the general assessment of the roadworthiness for passenger vehicles. Special purpose vehicles such as school buses and fuel transport vehicles are subject to periodic inspection.

The Department of Environmental Protection's *Smokey Vehicle* program has operated now for three years and has existed in a variety of forms. The current system operates by any person being able to notify the Department of Environmental Protection of a vehicle that has a smokey exhaust. The vehicle's registration details must be provided along with the reporter's details to ensure that nuisance calls are minimised. With the assistance of the WA Police Service, letters are forwarded to the vehicle owner who is advised that the vehicle has been reported and that it may require maintenance. A questionnaire is provided to seek feedback on the action the vehicle owner may have taken. Table 5 is a summary of the total number of reports received annually since the program commenced.

⁷³ Australian Design Rule 37/01 Emission Control for Light Vehicles (Clause 6.1.2).

⁷⁴ *Road Traffic Act 1974* (WA) and *Road Traffic (Vehicle Standards) Regulations 1977* (WA).

Table 5 Number of Smokey Vehicle Reports⁷⁵

<i>Year</i>	<i>Number of reports to the Department of Environmental Protection</i>
1 July 1995 to 30 June 1996	14 887
1 July 1996 to 30 June 1997	11 465
1 July 1997 to 23 April 1998	6 119

The DEP's *Smokey Vehicle* reporting program is essentially a community awareness program in that no enforcement mechanism is provided. There are no checks to ensure that the improvements have actually been made. In one respect, the program acts as an appeasement to those who have been subject to a grossly polluting vehicle. The Committee considers that, as a minimum, the program be improved by providing an enforcement policy that allows for vehicles to be called in for an emissions test if they have been reported more than once in a given period, or if they are cited by police officers or specialist officers authorised under the provisions of the *Environmental Protection Act 1986* (WA).

Recommendation 29

The Department of Environmental Protection and the WA Police Service should enhance the Smokey Vehicle reporting program with enforcement provisions to reduce the number of polluting vehicles in operation.

Recommendation 30

State legislation should be amended to recognise the visual determination of opacity as an appropriate method for determining the level of particulate emission from petrol and diesel vehicle exhaust.

Based on the number of vehicles being reported monthly under the *Smokey Vehicle* program, it would be impractical from an efficiency perspective to test all reported vehicles by the methods specified in the ADRs as a standard practice. Based on the work being undertaken in New South Wales and the approach adopted in some areas of the USA, the Committee believes it more appropriate for Western Australia to adopt a quick yet efficient test method. For petrol vehicles, the emission of smoke from the exhaust is an indication of the presence of ROCs and particles, formed from the burning of oil due to a worn engine. The Committee notes that this is an indicative test only, since ROCs are invisible and can be emitted without the presence of smoke. For diesel vehicles, smoke from the exhaust is an indication of particles. As a first step to enforcement, the Committee believes that the use of a visual test, such as the "ten second rule" adopted in New South Wales, is an appropriate means of classifying an unacceptable vehicle exhaust emission while the vehicle is in operation. Mechanisms should also be put in place to review this periodically.

Recommendation 31

The State Government should adopt a 10 second (visual determination) emission limit for vehicle exhausts.

75

Department of Environmental Protection (1998). *Unpublished data.*

It is important to note that ADR's do not apply retrospectively. When considering the Perth vehicle fleet, a high proportion of the light duty vehicles (passenger and light commercial vehicles) are pre-1986 operating on leaded fuel. An older vehicle is likely to be less fuel efficient overall and may not be as safe on the road as one of a lower age. Older cars also add to congestion if their speeds are slower or if they break down more often.

Table 6 Perth vehicle fleet characteristics (1995)⁷⁶

<i>Vehicle type</i>	<i>Total number</i>	<i>% of total</i>
Articulated truck	3 284	0.4
Bus	4 311	0.5
Light commercial vehicle	105 856	13.0
Motor cycle	23 223	2.8
Non-freight carrying vehicle	5 352	0.7
Passenger vehicle	652 964	80.0
Rigid truck	20 959	2.6

Figure 5 Perth light duty vehicle fleet characteristics - fuel type and age.⁷⁷

The Federal Office of Road Safety (FORS) conducted a two year study⁷⁸ of the exhaust and evaporative emissions from 640 in service passenger cars. While there has been much conjecture about generalised

⁷⁶ Australian Bureau of Statistics (1995). *1995 Motor Vehicle Census*. Commonwealth of Australia.

⁷⁷ Australian Bureau of Statistics, *Op cit*, 1995.

⁷⁸ Federal Office of Road Safety (1996). *Motor Vehicle Pollution in Australia - Report on the National In-Service Vehicle Emissions Study*. Commonwealth of Australia.

statements and conclusions from the study, the key points accepted by the Committee are that having a new model vehicle does not guarantee that the vehicle continues to operate at its ADR specifications, and that there is deterioration in performance over time regardless of the vehicle age. The Committee also noted the importance of regular and correct vehicle maintenance.

Education programs aimed at encouraging vehicle owners to regularly tune their vehicles throughout their service life received support in response to the Committee's third discussion paper (Appendix A). The Committee believes an advertising campaign of this type should be implemented periodically as part of a broader air quality education campaign. Assistance from the vehicle manufacturing, sales and servicing industry should be canvassed for support. The Victorian Environment Protection Authority and the Royal Automobile Club of Victoria (RACV) launched a program of this type during 1997.

Vehicle repairs that reduce emissions can also improve fuel efficiency. Fuel savings can significantly offset repair costs. Most vehicles will operate more cleanly when they are properly maintained. It is interesting to consider the results from the Canadian *AirCare* program where reviews of the program have shown real decreases in emissions and a reduction in annual petrol consumption (12 million litres)⁷⁹.

Recommendation 32

The Department of Environmental Protection in conjunction with Transport WA should initiate an education campaign focussing on the benefits of having a well maintained vehicle regardless of vehicle age or type.

Recommendation 33

State Government agencies and private companies should set voluntary targets for average fuel consumption across their fleets to ensure that the purchasing or leasing arrangements take into account fuel efficiencies when defining or determining cost recovery.

While there was a strong recognition in submissions that there was a need to reduce vehicle emissions and general support for the introduction of emissions testing, concerns were raised as to how emissions testing would be applied. The most common concern related to the equity of singling out vehicles by age with the suggestion that the lower income earners within the community would be affected the most by such a strategy. Others suggested that emissions testing of all the fleet would be a costly and time consuming exercise for little improvement in the total performance of the fleet, particularly since it was only a small proportion of the fleet that appeared to be contributing the greatest emissions.

As the Federal Office of Road Safety (FORS) study shows, there is no simple way of predicting which vehicles will be high emitters. Random selection of vehicles can be based upon model year of manufacture, detection through visual reporting programs such as DEP's *Smokey Vehicle* program, or the use of infrared detection systems. Recognising that all vehicles are contributing to air quality, granted at different degrees, a more equitable program is to require emissions testing of all vehicles, regardless of age, make or model year. Such programs also provide the opportunity to bring about a change in vehicle owner attitudes as to their responsibility to ensure that their vehicle is maintained in good working order throughout its operating life.

The Committee reviewed and inspected the emission testing facilities in Sydney (New South Wales) (Appendix D), and two compulsory emission testing facilities in Vancouver (British Columbia, Canada) and

⁷⁹

Stewart S J & Gourley D I (1996). *Technical review of the AirCare® Program, Program Year 3 September 1994 to August 1995*. British Columbia Ministry of Transportation and Highways and the Insurance Corporation British Columbia, Canada.

Seattle (Washington State, USA). The Committee was also briefed on the United Kingdom's road worthiness testing program (MOT) which includes both safety and emission testing (Appendix E).

The Greater Vancouver area's vehicle inspection and maintenance program *AirCare* tests exhaust emissions and evaporative emissions (in some instances) of all registered vehicles. The aim of the program is to identify passenger vehicles and trucks that are gross polluters and to have them repaired, thereby improving air quality. The program requires the testing of all vehicles regardless of fuel type and includes dual fuel systems (petrol, diesel, liquid petroleum gas (LPG), compressed natural gas (CNG), LPG/petrol and CNG/petrol). The program has recently been expanded and enhanced to include a mobile testing facility to specifically target heavy duty vehicles which can not be tested in the stationary facilities. The mobile units will mostly operate from truck stop bays.

A number of different emission tests will be carried out on the vehicle depending on its age and model. All non-diesel vehicles are at least tested at idle. Most vehicles are inspected under load, that is accelerating, using a chassis dynamometer. Diesels are tested for exhaust emission opacity. Vehicles which are fitted with on-board diagnostics (electronic sensors installed in the vehicle to monitor the performance of the emission control system) are also reviewed. Following the emissions test, an *AirCare* Inspection report is provided on the spot to the vehicle driver. This report indicates whether the vehicle has passed or failed the inspections of exhaust emissions and/or for pollution control equipment. A valid inspection report (either a pass or conditional pass) is required in order for the vehicle to be re-registered and insurance issued. The inspection report is valid for a period of two years. If a vehicle has failed the test, the report also contains guidance for the repair of the vehicle. A failed vehicle must return for retesting once repairs have been made. The cost of the emission test is CA\$18 (approximately A\$18), and includes one retest. An evaporation test involving the testing of the petrol cap for leaks has now been included in the program.

The *AirCare* program commenced on 1 September 1992. It is administered by the Provincial Government of British Columbia (equivalent to a State Government). However the actual vehicle emission inspections are conducted under contract to the Provincial Government by a private company. Companies tendered for the construction and operation of the emission testing facilities. Repairs to vehicles that fail the emissions test are also carried out by private companies, but there is no company linkage between the testing facility and the repair facility. The Provincial Government provides a certification process. Repair centres are re-certified annually and technicians every three years to ensure that repairs are carried out effectively. This process offers consumer protection as well as ensuring emission reductions are achieved. However there is no requirement for the vehicle owner to use a certified centre or technician - the choice remains with the vehicle owner. Certification of repair facilities and of technicians has been seen as a benefit to business⁸⁰.

The operation of emission testing facilities by private companies combined with the independence of the vehicle repair industry has provided a high degree of confidence within the community as to the quality of the work and the effectiveness of the entire program in British Columbia. The direct cost to the Government in establishing the program was also significantly reduced, with the private companies responsible for establishing the infrastructure. While the testing fees were initially set at a level that would guarantee the program to be self funding after five years, in some locations the program has become self funding after three years, with monies being returned to the Government.

One of the criticisms of vehicle emission testing programs commonly raised is that the system is open to abuse by individuals who attempt to avoid the compulsory test by licensing the vehicle outside the region where it is most commonly used.

The Committee discussed this issue at briefings with both the Vancouver and Seattle sites where it was acknowledged that this had occurred in some states in America. It was considered that the *AirCare* program was likely to minimise this illegal action by having the testing program linked to the compulsory renewal of the vehicle's insurance which in turn was linked to the vehicle owner's principle place of residence. A similar checking system would need to be adopted in Perth, with severe penalties to deter this type of dishonesty.

⁸⁰

Mr Martin Lay & Mr David Gourley, Insurance Corporation, British Columbia, Canada. *Pers comm* Monday 3 November 1997.

The Committee considers that the implementation of a compulsory vehicle emissions inspection and testing program has a vital role to play in the management of vehicle emissions.

Recommendation 34

The State Government should implement a vehicle emission testing program for the Perth metropolitan region, based on the Vancouver model.

In adopting an emission inspection and testing program, it is vital to note that emission testing will identify whether the vehicle complies or does not comply on the day of the testing and therefore depending on how the driver drives the vehicle and maintains the vehicle, the emissions can deteriorate. An annual or biannual testing program will facilitate the collection of realistic performance deterioration rates across the fleet, and facilitate the updating of the State's pollutant inventory and modelling of emissions. To overcome the likelihood of rapid vehicle performance deterioration and to act as a deterrent, the Committee considers the emission inspection and testing program should be supplemented with road side emission testing on a random basis. The identification of gross polluters using remote sensing has proven itself in recent years to be a viable method of identifying vehicles with unacceptable emissions. Recent developments in this technology have expanded the range of specific pollutants identified to include air toxics, such as formaldehyde⁸¹. Such a system would also have the ability to detect vehicles that are licensed outside of the metropolitan region, including interstate vehicles, but are in use in the area.

Recommendation 35

The Department of Environmental Protection in conjunction with Transport WA should initiate random roadside emission testing using remote sensing equipment.

In taking this approach, international research has shown the importance of conveying to the community the benefits of the program not only to air quality but to vehicle owners. Implementation of an education and awareness program should be initiated at least six months, preferably 12 months, in advance of implementing the first test.

The adoption of these recommendations will assist in educating motorists and hopefully develop a culture of maintaining vehicles in good operating condition and driving in a manner that is more sedate and less conducive to the production of excessive emissions.

Improvements to vehicle emissions can also be gained through choice of fuel and vehicle model. Research by the European Programme on Emissions, Fuels and Engine Technologies (EPEFE) has confirmed that both fuel and vehicle technologies are important in determining emission levels⁸².

As outlined in Table 7 the use of natural gas has the greatest potential to reduce emissions other than those of NO_x.

⁸¹ Cadle S H, Gorse R A Jr, Belian T C & Lawson D R (1998). Real-World Vehicle Emissions: A Summary of the Seventh Coordinating Research Council On-Road Vehicle Emissions Workshop. *Journal of the Air & Waste Management Association* 48:174-185.

⁸² Camarsa, M, Hublin M & MacKinven R (1996). *Impact of EPEFE data on the European Auto-Oil Process*. SAE Technical Paper series 961076.

Table 7 Emission comparison of alternative fuels to petrol⁸³

Fuel	Direct emissions compared to petrol				
	Reactive HC	CO	NO _x	Particulates	Toxic emissions
Natural gas	much lower	lower	similar	much lower	much lower
LPG (Propane)	lower	lower	similar	lower	lower
Methanol (M100)	lower	similar	similar ⁸⁴	lower	similar
Ethanol (E100)	lower	similar	similar ⁸⁵	lower	similar

The Committee does not consider the widespread use of methanol, ethanol and their blends to be appropriate alternative fuels for use in the Perth metropolitan region. The replacement of petrol and diesel with methanol, ethanol or their blends could generate additional, or complicate further, the air quality problems in Perth. The Committee believes that this issue requires further investigation prior to the development of Government policy.

The development of the Ballard fuel cell (Canada) is showing excellent promise as an alternative power source for the future. The use of the cell is currently being road trialed in British Columbia and the Committee recommends that a watching brief be kept on the outcomes of this trial.

The standards specified in the ADRs have traditionally been about ten years behind the standards adopted in the United States of America⁸⁶. The Committee considers it imperative that Australia introduces new and improved vehicle technology as it becomes commercially available and viable. With the international trend toward uniformity, it is in the country's and industry's interest to keep pace with these developments if market share is to be retained and expanded.

The Committee has made note of the Prime Minister's statement⁸⁷ on 20 November 1997 where he outlined the key goals of the *Environmental Strategy for the Motor Vehicle Industry* as being -

- bringing forward the phase-out of leaded fuel ahead of the year 2010;
- the progressive tightening of the vehicle emission standards by the year 2003; and
- achieving full harmonisation with the international standards for vehicle emissions by 2006.

Recommendation 36

The State Government should support the progressive revision of Australian Design Standards to be consistent with the standards adopted for new vehicles by the United Nations Economic Commission by the year 2005.

⁸³ Ministry of Environment, Lands and Parks (1995). *Clean Vehicles and Fuels for British Columbia A Policy Paper*. Province of British Columbia, Canada.

⁸⁴ With a dedicated engine and a three-way catalyst NO_x is similar. As a diesel substitute particle emission around 80% lower, NO_x, HC, CO and PAH are lower.

⁸⁵ At higher compression ratios, NO_x may be higher. As a diesel substitute particle emission around 80% lower, NO_x and PAH lower. HC and CO are variable.

⁸⁶ Ms Chris Schweizer, Environment Australia, Canberra. *Pers comm* Friday 8 August 1997.

⁸⁷ Howard J (1997). *Safeguarding the future: Australia's response to climate change*. Statement by The Prime Minister of Australia The Hon John Howard MP, 20 November 1997. Australia.

A further supplementary program to emissions testing is facilitating the retirement of vehicles from the fleet. A number of these vehicle scrapping programs operate in the United States of America, and in Vancouver. Vehicle buy back programs in California have become an increasingly popular strategy for reducing vehicle emissions. The program in place by the Bay Area Air Quality Management District (San Francisco, USA) recognises that normal rates of attrition remove the older vehicles from the fleet over time, but aims to accelerate this process by removing an additional 1000 vehicles annually for an initial three years. The Bay Area Air Quality Management District selects specific model years and makes (which have been shown to be highly polluting) from which vehicles will be considered for buyback. The vehicles accepted must have a current valid emissions test pass to be accepted for buyback. The vehicle scrapping is carried out by a private company under contract. While some components of the vehicle, such as door panels, can be recycled, the engine, body, chassis and exhaust system components must all be scrapped. The US\$500 paid to the owners of these vehicles is funded through a US\$4 surcharge on all vehicle registrations within the area. This surcharge also provides funding for a number of other projects, including ride sharing and assistance to groups purchasing clean fuel buses. A variation of this scheme is to offer “free bus passes” in exchange for the trading in of an old polluting vehicle.

Recommendation 37

The State Government should implement a vehicle scrapping program to accelerate the removal of high polluting vehicles from the fleet, but only in conjunction with a vehicle emissions testing program.

Submissions were supportive of the introduction of vehicle scrapping programs, seeing the strategy as a positive inducement to removing older vehicles from the fleet.

Vehicle scrapping programs could assist the process of reducing the number of vehicles in use in Perth, particularly in the older age group of vehicles. However, it must be supported with a network of alternatives for commuting to work or alternative working arrangements, such as telecommuting. It is in a support role that the Committee considers that tele-commuting programs have a valuable role to play, and that Government should take a lead role in facilitating the development of this activity within its own sphere of activities.

Recommendation 38

The State Government should facilitate the implementation of workplace policy adopting telecommuting within its agencies.

Petrol vehicles (leaded and unleaded)

In the Perth fleet, petrol fuelled cars, light commercials and motor cycles are by far the dominant type of vehicle in terms of numbers, and they are used to the greatest degree. The key pollutants of concern emitted from petrol vehicles includes ROCs, particulates, NO_x and air toxics. Historical improvements to vehicle fuel, design and the equipping of vehicles with emission control equipment, such as catalytic converters has improved the emissions from new model vehicles, as outlined in Table 8.

Table 8 Petrol vehicle exhaust emission limits established in the Australian Design Rules⁸⁸

Standard	Emission limit (grams per kilometre)		
	HC	NO _x	CO
ADR 27 (introduced 1976)	2.1	1.9	24.2
ADR 37/00 (introduced 1986)	0.93	1.93	9.3
ADR 37/01 (introduced 1997-1999)	0.26	0.63	2.1

Evidence presented to the Committee suggests that fuel quality is one area where air quality improvements can be made, and this has been supported in the findings of the *Urban Air Pollution in Australia* independent inquiry. Historically the obvious example is the reduction in the lead content in fuel. At the international level, the Federal Canadian Parliament legislated in 1990 to ban the sale of leaded petrol. It has also been banned in the USA, Japan, Austria, Sweden, Brazil, Columbia and South Korea. The Prime Minister of Australia has indicated that Australia will move toward the phasing out of leaded petrol by the year 2010. Based on local demand for leaded petrol, industry representatives⁸⁹ questioned the viability of maintaining and retaining the leaded fuel distribution network beyond the year 2005.

Representatives of BP Refinery, Kwinana, questioned the quality of the fuel being imported into this State. It was suggested to the Committee that imported fuels could contain higher levels of sulphur and impurities than the fuel produced by Australian refineries. The Committee believes this is a reasonable possibility since fuel quality will initially be influenced by the quality of initial crude, and the extent and the type of processing adopted within the refinery. Concern was expressed to the Committee that there was no active monitoring or auditing mechanism in place to review the quality of fuel used in Perth.

The advent of the catalytic converter as the principle emission control device in a vehicle exhaust system has reduced the level of emissions from a vehicle, but these devices are sensitive particularly to the sulphur content in the fuel, and need to be functional for emissions to be controlled. The Auto-Oil Programme and more specifically the European Programme on Emissions, Fuels and Engine Technologies (EPEFE) study has shown unequivocally that sulphur in petrol reduces the efficiency of any optimally functioning three-way catalytic converter. The catalyst used in the catalytic converters, designed to reduce emissions of carbon monoxide, ROCs and NO_x is poisoned by sulphur and therefore the catalyst is less effective in the reduction of emissions.

A catalyst designed to be fully tolerant of sulphur has not yet been achieved, and as catalyst technology has progressed, the sensitivity of the catalyst to sulphur has appeared to increase⁹⁰. Sulphur levels in the order of 300 ppm are found in UK petrol. Reduction of this concentration to 30 ppm will reduce a car's post catalyst (when warm) emission of hydrocarbons by 50%, its nitrogen oxides (NO_x) by 20% and carbon monoxide by 40%⁹¹. The sulphur content in petrol available in Australia is specified in the ADRs to not exceed 500 ppm (0.05% sulphur by mass). To achieve further emission reductions, sulphur levels need to be reduced. Vehicles imported to Australia that may have emission controls to American or European standards will not achieve these low emissions unless fuel with a low sulphur content is used.

⁸⁸ National Environment Protection Council, *Op cit*, 1997.

⁸⁹ BP Kwinana Refinery. *Pers comm* 8 July 1997.

⁹⁰ United States Environment Protection Agency (1998). *Tier 2 Study Draft*, 23 April 1998. EPA420-P-98-009. United States of America.

⁹¹ Department of the Environment & The Scottish Office (1996). *The United Kingdom National Air Quality Strategy, Consultation Draft*. United Kingdom.

The Committee also received information detailing that vehicle evaporative emissions are as much a concern as exhaust emissions, and the most recent international research indicates that those vehicles with gross exhaust emissions will not necessarily be those with the greatest evaporative emission⁹². Due to the structural nature of petrol, it readily evaporates especially when ambient temperatures increase. Reid vapour pressure (RVP) is a measure of how quickly fuel evaporates. The level of RVP can be altered physically and chemically, and is normally lowered during the warmer months to reduce evaporative emissions of ROCs. With improving vehicle technologies it has been suggested that RVP should be subject to maximum standards, to ensure that emissions are minimised particularly during warmer periods when the ROCs are active in the creation of photochemical smog.

The Committee considers the suggestion by the Conservation Council of Western Australia,⁹³ for the State Government to develop a fuel formulation policy, has merit, and should be applicable to fuel produced locally and imported. Such a policy needs to place emphasis on vapour pressure, sulphur, and other components within the fuel.

Recommendation 39

The State Government should develop a fuel formulation policy, specifying minimum fuel quality parameters (initially) for sulphur, vapour pressure and other constituents, for locally produced and imported petrol and diesel fuel.

Such a policy would require a checking mechanism, with compliance the responsibility of the local producer and the local importer. Penalties for non-compliance would also need to be developed as a deterrent.

Recommendation 40

The Department of Environmental Protection should introduce fuel quality testing of locally produced and imported fuel, on a random basis to check compliance with the fuel quality policy.

Research has demonstrated that people are briefly exposed to low levels of known carcinogens and other potentially toxic compounds while pumping petrol⁹⁴. The escape of ROCs also contributes to the creation of photochemical smog. There are two technological solutions to this problem available now. The first is to equip additional vapour recovery equipment to all existing vehicles. Some new models are being equipped with this second stage recovery equipment. While the natural attrition of the fleet would eventually see the fleet being equipped, this will take at least ten years given the average age of the Perth vehicle fleet. Policing of the retrofitting could be difficult. The second is to fit all petrol bowsers with the recovery equipment. The Committee considers this to be the more effective method of managing this issue. Installation of equipment could realistically be achieved within a five year period with emission and exposure improvements achieved, regardless of the fleet's characteristics. The equipment is commercially available and has been used in other countries.

⁹² Cadle S H *et al*, *Op cit*, 1998.

⁹³ Conservation Council of Western Australia (1997). Submission 159, 28 November 1997.

⁹⁴ Backer L C, Egeland G M, Ashley D L, Lawryk N J, Weisel C P, White M C, Bundy T, Shortt E and Middaugh J P (1997). Exposure to Regular gasoline and ethanol oxyfuel during refuelling in Alaska. *Environmental Health Perspectives*. v105, no 8 August 1997.

Recommendation 41

The State Government should legislate to require the introduction of Stage II vapour recovery at all metropolitan petrol stations by the year 2003.

Diesel vehicles (including heavy duty vehicles)

In recent years diesel vehicles have increased in popularity, particularly in the light commercial vehicle range.⁹⁵ Public health concerns about exposure to diesel emissions has also recently increased for the following reasons:

- diesel particle emissions are very small in nature and readily respirable;
- numerous chemicals are adsorbed onto the surfaces of diesel emission particles, including known and suspected carcinogens and mutagens;
- the gaseous phase contains many irritants and toxic chemicals;
- the combustion products includes NO_x which reacts photochemically; and
- the public can be exposed both in the occupational and ambient environments.

The Perth Haze Study estimated that diesel vehicles contribute two thirds of the total motor vehicle contribution of particles to the Perth air shed. Therefore the Committee believes that any continued growth in the market for diesel vehicles can only be sustained if a drastic improvement in emission quality can be achieved in the immediate future.

The amount and composition of particles emitted from diesel engines varies greatly, depending on factors like engine design, load, operating speed and fuel composition. Light duty diesel engines emit 50 to 80 times more particles than typical catalytically equipped petrol engines, with heavy duty diesel engines emitting 100 to 200 times more than their petrol equivalents⁹⁶.

Diesel exhaust is a complex mixture of gases, vapours and fine particles. Some of the exhaust components, such as arsenic, benzene and nickel are known carcinogens. At least 40 other components of the exhaust, including suspected carcinogens benzo[a]pyrene, 1,3-butadiene and formaldehyde have been listed as hazardous air pollutants by the USEPA. The composition of the exhaust varies depending on the engine type, operating conditions, fuel, lubricating oil and whether an emission control system is present and operating correctly. Many of the individual exhaust constituents remain unidentified.

Diesel exhaust particles carry many of the harmful organic and metals present in the exhaust. The particles are typically smaller than 10 micron in diameter (PM₁₀) and are easily inhaled into the lung where they may promote the onset of cancer, and is currently subject to a health risk assessment by the California Environmental Protection Agency. Particles are expected to remain in the air for around 10 days, provided the weather is dry. Precipitation is effective in removing diesel particles which therefore persist in the air for much shorter periods during periods of rainfall.

Since diesel engines operate with excess air (around 25-30 parts air to one part fuel), the primary gaseous components of diesel exhaust are nitrogen, oxygen, carbon dioxide and water vapour. It also contains carbon monoxide, nitrogen oxides, sulphur oxides, hydrocarbons, particulate matter, aldehydes, ketones, sulphates, cyanides, phenols, metals and ammonia. Some of these components will also contribute to ozone formation. Diesel exhaust particles yield an average composition (by weight) of carbon (88.3%), oxygen (4.9%), hydrogen (2.6%), sulphur (2.5%), metals (1.2%) and nitrogen (0.5%).

⁹⁵ Mr Brian Hobsbawn, Environment Australia, Canberra. *Pers comm* Friday, 8 August 1997.

⁹⁶ McClellan R O (1986). Health Effects of Diesel Exhaust: A Case Study in Risk Assessment. *American Industrial Hygiene Association Journal*, 47(1): 1-13, January.

Recommendation 42

The State Government should support the progressive revision of diesel emission standards specified in ADRs to be consistent with the standards adopted for new vehicles by the United Nations Economic Commission.

The over fuelling⁹⁷ of heavy diesel engines has been cited as a common practice within the service and maintenance industry, essentially as a means of increasing the power of the engine⁹⁸. Anecdotal evidence suggests that tampering with heavy duty vehicle fuel injectors is common practice. While this tampering can bring about an increase of power to the vehicle, it also brings about an increase in exhaust emissions. The Committee heard evidence that a Mack truck with an approximate 10% over fuel adjustment will cause an increase in emissions of 400%⁹⁹. The Committee considers that roadside emission testing be supplemented with a penalties systems for those vehicles identified as having been tampered with.

Recommendation 43

The State Government should develop an enforcement policy that addresses procedures and penalties for tampering with vehicles to take them out of compliance with Australian Design Rules.

The Committee understands that negotiations are taking place for the development of a *National Environment Protection Measure for Diesel* by representatives for the National Environment Protection Council. In the interim, the Committee believes that the State Government should give notice to industry of the need to improve fuel quality and that industry should report what steps it plans to take to address this issue voluntarily.

As with petrol, the quality of diesel fuel is influenced by the quality of the initial crude and the refining process. The level of impurities in the diesel can influence the quality of the exhaust emission from the vehicle. The BP Kwinana Refinery is the principle supplier of diesel used in the metropolitan region. To minimise the potential for NO_x, SO_x and particles to be present in the diesel exhaust, the Committee believes that the State Government should develop a fuel quality policy for both locally produced and imported fuel. This is particularly important when considering that catalytic converters fitted to diesel vehicles to reduce carbon monoxide and ROCs emissions can be made ineffective due to the presence of sulphur. For example, the potential emissions improvements from the use of the CAT buses in Perth cannot be realised due to the commercial unavailability of low sulphur diesel.

When considering the age distribution of the bus fleet (Figure 6), diesel buses are dominant, with the majority operating as part of the public transport network. Based on the emissions quoted previously, and the potential emission reduction from choosing alternative fuel such as natural gas, the Committee believes that there is scope to achieve emissions improvement immediately, particularly through Government vehicle purchasing strategies for the bus replacement program.

⁹⁷ Alterations made to the diesel injectors and/or the fuel line to create a back pressure that forces more fuel into the injector.

⁹⁸ Mr D A Riley, Association of Australasian Diesel Specialists. *Evidence* Tuesday 23 September 1997.

⁹⁹ Mr D A Riley, *Op cit*, 1997.

Figure 6 Age distribution of Perth's bus fleet(diesel and all fuel types).

Recommendation 44

The State Government should give priority to the introduction of cleaner emission vehicles and cleaner fuels as part of the bus replacement program.

It is the Committee's opinion that while the total number of diesel vehicles in the Perth fleet is significantly less than their petrol equivalents, the disproportionate impact of diesel emissions is a priority issue to be addressed.

Recommendation 45

The Department of Environmental Protection in conjunction with Transport WA should initiate the implementation of road side emission testing of heavy duty diesel vehicles, and the depot testing of fleet vehicles.

A demonstration of emission testing was carried out by the Association of Australasian Diesel Specialists and the Robert Bosch company¹⁰⁰. An opacity meter was used to measure the amount of particles in the exhaust from three diesel trucks. The opacity metre used took five readings and averaged the three central readings, disregarding the maximum and minimum readings. A printout of the reading is also obtained from the unit. The test on each truck took less than 10 minutes each¹⁰¹. The Committee considers that legislation should be formulated to support the use of opacity metres as an appropriate method of determining acceptable levels of particulate emissions from diesel vehicle exhaust.

Natural gas vehicles (compressed and liquid)

Natural gas when used as a vehicle fuel is essentially methane (80% to 99.6%) and a mixture of ethane, propane and butane. Natural gas can be stored for use in either its gas or liquid phase. As a fuel, it can be

¹⁰⁰ Great Eastern Highway, Greenmount, 28 November 1996.

¹⁰¹ Mr D A Riley, *Op cit*, 1997.

substituted for either petrol or diesel. Table 9 and 10 summarise the relative comparison of emissions from equivalent engines using petrol, diesel or compressed natural gas¹⁰².

Table 9 Emission comparison of Compressed natural gas to petrol (light duty vehicles)

<i>Fuel</i>	<i>Direct emissions compared to petrol</i>				
	<i>ROCs</i>	<i>CO</i>	<i>NO_x</i>	<i>Benzene & 1,3-Butadiene</i>	<i>Formaldehyde</i>
Compressed natural gas	lower (up to 70%)	lower (up to 40%)	lower (up to 30%)	much lower (95%)	lower (10%)

Table 10 Emission comparison of Compressed natural gas to diesel (buses)

<i>Fuel</i>	<i>Direct emissions compared to diesel</i>		
	<i>CO</i>	<i>NO_x</i>	<i>Particulates</i>
Compressed natural gas	much lower (up to 80%)	lower (10-20%)	much lower (90-100%)

In supporting the use of natural gas, the Committee acknowledges the greenhouse gas potential of natural gas¹⁰³ and that particular care should be emphasised in vehicle refuelling and fuel storage needs. The significant reduction in particles when natural gas is substituted for diesel is an important consideration for regional air quality where efforts are being targeted at reducing particulate haze. Work undertaken in the United States of America to assess and compare the performance of in-use alternative fuels to diesel and petrol have shown the following preliminary results in the 1995 assessment¹⁰⁴ -

- light duty vehicles -
 - ▶ notably lower emissions of exhaust pollutants from the CNG vehicle when compared to equivalent petrol vehicles (non methane hydrocarbons approximately 60% lower, carbon monoxide approximately 40% lower and NO_x approximately 30% lower; and
 - ▶ on average, emissions of toxic hydrocarbons such as benzene and 1,3-butadiene were approximately 90% lower than in the equivalent petrol vehicle tests, and the ozone forming potential of the emission was approximately 80% lower.
- transit buses -
 - ▶ emissions of particulate matter are reduced to nearly zero in engines fuelled with compressed natural gas;
 - ▶ on average exhibit lower carbon monoxide and NO_x emissions than diesel counterparts; and

¹⁰² Department of Transport (1996). *Emissions, fuel consumption, alternative fuels and engines, vehicle technology. A memorandum by the Department of transport, House of Lords Select Committee on Science and Technology, Subcommittee II - Towards Zero Emissions for Road Transport*. United Kingdom.

¹⁰³ Methane is a significant greenhouse gas having around 24 times the global warming potential of CO₂.

¹⁰⁴ Department of Energy (1996) *Federal Alternative Motor Fuels Programs*. Fifth Annual report to Congress - 1996. United States of America.

- ▶ while the total hydrocarbon emission from the CNG powered buses were on average higher than the emission from the diesel buses, the CNG emission is typically 90 to 95% methane and therefore would not be contributing to the creation of photochemical smog.

A further finding from this work is that vehicles which have been retrofitted with conversions to run on CNG have not achieved the same emission reductions as achieved by a purpose built CNG vehicle. The CNG conversions on light duty vehicles showed a general increase in the emission of carbon monoxide or NO_x or both¹⁰⁵.

The Committee considers the wider use of natural gas as a vehicle fuel to be a positive move for Perth's air quality. Depot based fleet vehicles such as buses, couriers and government fleets are well suited to run on alternative fuels such as compressed natural gas or liquefied petroleum gas, both of which offer substantial emission benefits over diesel fuel. Increased gas fuel usage in urban delivery and public service vehicles could help reduce urban NO_x and particle concentrations. The Committee notes that the expansion of a distribution network is being facilitated by Federal Government funding, initially in Sydney and Melbourne. The Committee understands that one of the limitations in Western Australia to the introduction of a natural gas fleet is the absence of a suitable fuel distribution network. The Committee also understands that one of the tenders in this State's Bus Replacement Program includes not only the provision of natural gas buses but also commitments to the establishment of a distribution network to support the initial fleet. The Committee believes that there is an opportunity for this State to be pro-active in the introduction and acceptance of alternative fuel vehicles as part of mainstream use.

Recommendation 46

The State Government's vehicle fleet purchasing and leasing guidelines should provide for the inclusion of all costs, including emissions, over the useful life of the vehicle.

Liquid Petroleum Gas (Autogas)

Liquefied petroleum gas (LPG) is a mixture of mainly propane, butane and propylene gases. It can be processed from either crude oil or natural gas. When LPG is pressurised (compressed moderately at normal temperature) it becomes a liquid. In this form, it is pumped into vehicle fuel tanks. LPG has a higher octane rating than petrol.

LPG as a fuel for vehicles can be substituted for both diesel and petrol and is used alone or in a dual system. Table 11 and 12 summarise the comparison of emissions from equivalent engines using petrol, diesel and a dedicated LPG system¹⁰⁶. Preliminary results from the American Federal Alternative Motor Fuels Program indicates that emission reductions are not achieved to the same degree, if at all, where a vehicle has undergone conversion to operate on LPG or as a dual system. In some circumstances the emissions from these dual vehicles (when operating on petrol) were actually higher after the conversion when compared to the pre-conversion test.

¹⁰⁵ Whalen P, Kelly K, Motta R & Broderick J (1996). *Alternative Fuel Light-Duty Vehicles - Summary of Results from the National Renewable Energy Laboratory's Vehicle Evaluation Data Collection Efforts*. United States of America.

¹⁰⁶ Department of Transport, *Op cit*, 1996.

Table 11 Emission comparison of LPG to petrol

<i>Direct emissions compared to petrol</i>				
<i>Fuel</i>	<i>Reactive HC</i>	<i>CO</i>	<i>NO_x</i>	<i>Toxic emissions</i>
Liquid petroleum gas	lower	lower	similar	lower

Table 12 Emission comparison of LPG to diesel

<i>Direct emissions compared to diesel</i>			
<i>Fuel</i>	<i>CO</i>	<i>NO_x</i>	<i>Particles</i>
Liquid petroleum gas	lower	lower	much lower

LPG as a fuel is not currently subject to federal government tax. The current Federal Government as part of its election platform said there would be no excise on LPG until at least 1 July 2003, with five year's notice of any change. The Committee would like to see this market incentive continue into the future.

The pump price for LPG can fluctuate quite significantly, and this is considered to be one of the factors holding back the widespread use of LPG in the vehicle fleet. The Prices Surveillance Authority maintains a watching brief on LPG prices. Research indicates that the cost fluctuation is a direct result of international market forces where demand for LPG in the northern hemisphere increases during the northern winter and therefore a higher price can be gained through exports. Costs locally increase because of the limited storage capacity and the elevated price being received internationally.

There tends also to be a cost variation between prices charged in Western Australia compared to the prices charged in the eastern states. It is believed that the transporting costs of importing LPG to WA accounts for the price difference.

Depot based fleet vehicles such as couriers and government fleets are well suited to run on alternative fuels such as LPG, where significant reductions in emissions of NO_x and particulates can be achieved where diesel vehicles are replaced. Similarly if petrol vehicles were to be replaced, reductions in reactive hydrocarbons, carbon monoxide, NO_x and some air toxic benefits could be achieved.

Recommendation 47

State Government agencies and private companies should develop vehicle purchase and leasing policies that set targets for the percentage of cleaner fuel vehicles within their fleet.

3.2 Industry

Industry is collectively a major contributor to the discharge of nitrogen oxides (NO_x) and reactive organic compounds (ROCs) that combine to form photochemical smog. Depending on the type of activity, industry also contributes to the overall amount of air toxics, and to the production of particulate haze due to either direct emissions of particulates or where gaseous pollutants react following their release into the environment.

Emissions from industry are regulated under the provisions of the *Environmental Protection Act 1986 (as amended)* and this Act makes it an offence to cause pollution. Control measures can be implemented against individual industries such as in the issuing of a licence, or may encompass all industries in a region via an Environmental Protection Policy.

The Kwinana industrial area is the key location point for heavy industry in the Perth metropolitan region. Based on current proposals and the degree of development already there, it can be expected that Kwinana will continue to be a key location. On this basis the Committee believes it is essential that regional air quality is managed so that it does not deteriorate as industry grows and expands, and it must be recognised that industry can only develop in the area on the basis that air quality is maintained both now and into the future.

There are already a number of mechanisms in place that manage the potential impact of industry on the environment and which ensure that appropriate areas exist for the future development of industry. This includes the Kwinana Environmental Protection Policy and the WA Planning Commission's State Industrial Buffer Policy.

Table 13 Air pollutants discharged from key industries located in the Kwinana EPP Area A & B

<i>Industry</i>	<i>Business</i>	<i>Air pollutant monitored or discharged restricted by licence¹⁰⁷</i>
Alcoa Australia Ltd	Alumina refinery	SO ₂ , NO _x , ROCs, particulates
BP Refinery	Petroleum refinery	SO ₂ , NO _x , ROCs, particulates, hydrogen sulphide
Cockburn Cement	Cement manufacturer	SO ₂ , NO _x , ROCs, particulates (lead)
Coogee Chemicals	Fertiliser and chemical manufacturer, and fuel importer	SO _x , particulates (zinc oxide, calcium sulphate, copper, ferrous sulphate)
Tiwest Joint Venture	Titanium dioxide manufacturer	SO ₂ , NO _x , ROCs, particulates (ammonium nitrate), carbon monoxide, chlorine, titanium tetrachloride
Wesfarmers CSBP	Fertiliser and chemical manufacturer	SO ₂ , NO _x , ROCs, particulates, hydrogen fluoride, ammonia, chlorine
Western Mining Corporation	Nickel refining	SO ₂ , NO _x , ROCs, particulates, ammonia
Western Power	Electricity	SO ₂ , NO _x , particulates

During the 1970's sulphur dioxide levels in the Kwinana area were of extreme concern, especially the frequency at which standards and guidelines were exceeded. Industry has subsequently adopted a number of changes, including the use of cleaner fuels such as natural gas, improved technology and operations to reduce the frequency with which standards were exceeded. Industry has been successful to the extent that, for the past four years (as recorded at the Wattleup air quality monitoring station) one hour average limits and

¹⁰⁷

Licence issued in accordance with Part V of the *Environmental Protection Act 1986* (WA).

standards specified in the Environmental Protection (Kwinana) (Atmospheric Wastes) Regulations 1992 (WA) were not exceeded.

Emissions from industry with a potential to impact on the environment are principally controlled under provisions of the *Environmental Protection Act 1986* (WA) and the *Environmental Protection Act Regulations 1987* (WA). The proposed *National Environment Protection Measure for Ambient Air Quality* will establish standards for the State to achieve regionally, but will also depend in part on the ongoing performance of industry to improve. Legislative changes have been made to the licensing provisions of the Act to encourage continuous improvement by industry and to recognise and reward good environmental performance¹⁰⁸.

Similarly, the Environmental Protection Authority expects new projects to incorporate the four basic elements of ISO 14000¹⁰⁹, being -

- an environmental management system;
- an environmental management plan with objectives and performance indicators;
- audit, both of the system and environmental performance; and
- review and amendment of the plan and system for continuous improvement¹¹⁰.

The Committee considers the development and successful implementation of these operational and strategic management plans (incorporating internal and operational review processes) to be imperative, particularly if industry is to compete effectively in the market, both economically and environmentally.

To this end, the rationalisation of industrial process and procedures in the first instance, needs to occur at industry level and not through the regulatory process. If industry fails to deliver the results, then regulatory controls should be available as a backup measure. It is therefore essential for the Government to clearly articulate to industry and the community its policy for industry best practice, best technologies and ISO 14000.

Recommendation 48

The Department of Environmental Protection in conjunction with industry should develop guidelines for best practice emissions controls.

It must be acknowledged that the Kwinana industrial area is a key source of emissions contributing to Perth's air shed, and that all future development proposed for the industrial area must take into account not only the emissions arising from any new industry or expansion of an existing facility, but also the subsequent increase in transport emissions to the area as a result of material and product delivery and commuting.

The Committee believes that, where projects are being assessed by the Environmental Protection Authority, consideration of related transport issues would be beneficial to assessing the project's overall environmental impact. In particular, the Committee believes the State Government should be concurrently planning the provision and integration of public transport commuting facilities as part of the proposed plans at Jervoise Bay to the immediate north of Kwinana.

¹⁰⁸ Department of Environmental Protection (1997). *Annual Report 1996-1997*. Government of Western Australia.

¹⁰⁹ International Standard on Environmental Management Systems which guides the design and operation of processes to ensure quality outcomes with a commitment to continuous improvement.

¹¹⁰ Environmental Protection Authority (1997). *Annual Report 1996-1997*. Government of Western Australia.

Whilst this is a specific example, the Committee believes that it should become standard practice for major projects, expansions or developments to give consideration to how work forces will access the site, and where possible assist in the provision of public transport services.

Recommendation 49

The Environmental Protection Authority's environmental impact assessment process should include consideration of related air emissions arising from transport aspects of a project, including both direct and indirect transit movements.

From Western Australia's pollutant inventory, the Kwinana Power Station and BP Refinery are undoubtedly the main contributors of industrial emissions in Perth's air shed.

The Kwinana Power Station commenced operation in 1970 as an oil fired facility. Four of its six boilers were later converted to use coal (1978), with the facility is now equipped to use natural gas also (1982). The Committee visited the Kwinana Power Station and also heard evidence from representatives of Western Power. Western Power expects the power station to continue operating for the next 15 years at least. The close proximity of the power station to the metropolitan power users means that the delivery cost of power to the community is more cost effective than one would expect from a facility of this age, technology and efficiency. Emissions from the plant are dependent not only on the demand for power, but also the fuel being used at the time within the facility. From a fuel supply point of view, Western Power indicated that coal is the cheapest fuel source (excluding the possible use of recycled oil)¹¹¹. Western Power's opinion is that this cost differential, combined with the non-secured continual supply of natural gas from the Northwest Shelf will necessitate their continual use of coal into the future.

Western Power have also indicated that the cost of retrofitting pollution control equipment to the Station is economically prohibitive and physically problematic as a result of the compactness of the facility. Consequently, the Committee considers the long term future of the Kwinana Power Station in its current form is questionable and that air quality issues must be central in considering the future location of power stations to supply the energy needs of the metropolitan region.

Recommendation 50

Western Power should develop and implement a 10 year plan to reduce its total SO₂ and NO_x contributions from the Kwinana Power Station.

Recommendation 51

Additional power stations should not be established in the Perth metropolitan region unless it can be clearly demonstrated that they will not adversely impact on Perth's air quality.

The Committee is supportive of Western Power's approach to encouraging power users to use energy more efficiently. Such programs should be continually improved and expanded. Similarly, the Committee considers the buyback program where Western Power purchases surplus electricity from private producers to be a worthwhile program. An example of this is the combined cycle natural gas fired co-generation facility operated by Mission Energy for BP Refinery in Kwinana. The facility was constructed to generate steam for the refinery plus power previously sourced from the State grid. Surplus electricity produced by the plant is sold to the public grid.

¹¹¹

Mr Lenad Ninkov, General Manager Corporate Strategy, Western Power, *Evidence* Monday 2 February 1998.

With regard to the operations of BP Refinery, the Committee notes the work undertaken on site to reduce evaporative emissions of ROCs and appreciates that significant reductions have occurred since the time of the publication of *The Perth Photochemical Smog Study*. However, the Committee notes that the refinery remains a massive source of ROCs and that, as yet, no assessment has been completed to compare this improvement to what is achievable under best practices. The Committee therefore believes that efforts should continue towards achieving best practice, particularly in the area of ROCs and SO₂ emissions.

Recommendation 52

BP Refinery should ensure that best practice emissions controls are included as part of the their 10 year planning process for operational changes and expansions at the Kwinana Refinery.

In order to assist industry to more rapidly introduce state of the art emission control equipment and technology as part of operations, the Committee believes that the Federal Government can play an important role in facilitating improvements through the provision of tax incentives.

Recommendation 53

The State Government should request the Federal Government to provide taxation incentives to industries which plan to incorporate new and cleaner technologies as replacements for old technology.

3.3 Wood smoke

Love it or hate it - that is the community's response to wood smoke in Perth. More often than not, it is emotion that rules the debate. However, more critical is the community's apparent lack of appreciation of the health effects caused by smoke. In the same way that exposure to cigarette smoke can increase our risk of developing cancer, so too can our health be harmed by exposure to smoke from wood heaters and fires where incomplete combustion is occurring.

Undeniably, fire has played a vital role in the management of this State's native forests and grasslands. Fire is a natural environmental factor in southwest ecosystems but it is not harmless¹¹². It has also been a popular means of reducing green waste and debris on land development sites and for removing agricultural stubble at the end of the crop growing season. At one stage, it was the only available means of cooking and heating. Wood fire remains a popular choice for heating today, either as the primary or backup heating option.

Fire must be used responsibly, whether it be on a large or small scale. When considering the contribution of smoke to Perth's air quality, it is as much a consideration of where the smoke comes from, as to where and when it disperses. Smoke sources beyond the metropolitan region, principally from hazard reduction burning activities or wild fires where large volumes of smoke are created, can bring about periods of poor air quality in Perth under specific weather conditions¹¹³. Similarly a collection of wood heaters within proximity of each other in metropolitan suburbs contributes to the deterioration of air quality locally.

Smoke, regardless of source, contains several pollutants that can trigger serious health problems. These include acrolein, aldehydes (such as formaldehyde), carbon monoxide, nitrogen oxides, particulates, polyaromatic hydrocarbons and reactive organic compounds. Many of these pollutants are strongly associated with chronic respiratory effects such as increased airway resistance and reduced lung capacity. Some have a small cancer risk, although the exact degree of risk has not yet been determined.

Smoke contributes to a reduction in visibility and to the creation of particulate haze. Particles within smoke have been associated with health effects (refer to Chapter Two).

The Committee reviewed issues, opinions and strategies for managing smoke emissions and their impact on Perth's air quality through discussions papers number 1 (*Smoke emissions from homes*) and 2 (*Smoke emissions from open burning*). Over a third of the submissions were in direct response to managing smoke emissions from homes. There are a number of possible reasons for this, including the direct targeting by the Committee of community members who had taken part in a wood heating issues survey previously.

Similarly the greatest response to discussion paper 2 was received from officers involved directly with Bush Fire control agencies, including voluntary groups, and the Department of Conservation and Land Management.

Management strategies for dealing with smoke emissions are not all necessarily applicable to each type of smoke source. The Committee has considered management strategies to address smoke from hazard reduction burning activities carried out by the Department of Conservation and Land Management, burns authorised by local authorities approved under provisions of the *Bush Fires Act* (WA), and the generation of smoke from activities in the domestic setting.

¹¹² Department of Conservation and Land Management (1997). Submission 44, 27 June 1997.

¹¹³ Mr Len Broadbridge, Bureau of Meteorology, Perth. *Pers comm* Wednesday 9 July 1997.

Residential wood burning

It was evident from the written submissions that there is a degree of emotion surrounding the issue of whether or not wood burning is an appropriate means of heating in the Perth metropolitan region. The argument is quite clearly demarcated between the wood burning appliance¹¹⁴ and wood supply industries and the users of wood burning appliances who do not want their right impinged upon, and neighbours who have been subject to nuisance smoke and who experience health effects from the wood smoke.

Putting the emotion aside and considering the growing scientific data available, the Committee acknowledges that smoke from domestic wood burning is a major factor influencing episodes of poor air quality in Perth. While a single and well operated wood burning appliance may have a minimal smoke output when compared to one that is not operating efficiently or effectively, collectively wood burning appliances have unequivocally contributed to episodes of poor air quality in the Perth metropolitan region in cool weather during recent years. It is imperative that any action taken by the State Government on this issue be emphasised by the fact that wood smoke is more than a nuisance - it significantly impacts on human health.

When wood burns, the pollutants produced are products of incomplete combustion. The particulates produced have been shown to be comparative in nature to the particulates found in tobacco smoke. Ambient wood smoke has been associated with acute respiratory irritation in asthmatic people and healthy children. Exposure to particulates are also linked to increases in total mortality, as well as mortality from respiratory disease and cardiovascular disease.

Table 14 Residential heating sources, Perth metropolitan region¹¹⁵

<i>Main source of heating</i>	<i>Number of Residences</i>		
	<i>Perth</i>	<i>Rest of WA</i>	<i>Total</i>
• No heating	36 200	22 700	58 800
• Electricity	115 700	31 100	146 800
• Mains gas	188 800	12 300	201 100
• Wood/coal	100 800	79 700	180 500
• Oil	16 900	2 900	19 900
• Bottled gas	6 400	11 100	17 500
• Other	10 600	5 500	16 100
<i>Total</i>	<i>475 300</i>	<i>165 300</i>	<i>640 700</i>

<i>Backup source of heating</i>	<i>Perth</i>	<i>Rest of WA</i>	<i>Total</i>
• Electricity	104 800	38 100	142 900
• Mains gas	15 700	1 200	16 900
• Wood/coal	20 600	7 300	27 900
• Oil	7 800	2 900	10 700
• Bottled gas	1 500	3 700	5 100
• Other	3 400	1 400	4 800
<i>Total</i>	<i>153 800</i>	<i>54 600</i>	<i>208 300</i>

Census data from the Australian Bureau of Statistics indicates that in 1995 (the most recent available data) 21% (100 800) of Perth residences rely on wood heating as the primary source of heating, and 4.3% (20 600) of homes have a secondary source of heating which is wood heating, so that there is approximately 121 400

¹¹⁴ The *Australian Standard* applies to domestic solid fuel burning appliances including space-heating appliances and space-heating appliances that include water-heating devices. It excludes site-built masonry appliances, central heating appliances, cooking appliances and appliances used solely for water heating.

¹¹⁵ Australian Bureau of Statistics (1997c). Unpublished data.

homes in the Perth metropolitan region that have wood heaters or wood fires, with another 87 000 distributed throughout the State.

A comparison of the air quality monitoring data provided by the Department of Environmental Protection for non-residential and residential areas shows a distinct contrast between peak levels of particulate matter over the same eight hour time period. This indicates that something is happening locally. A comparison of carbon monoxide monitoring data over the same period indicates similar peaks in residential areas. While the main source of carbon monoxide in the metropolitan region is vehicle emissions, it is also a product of poor combustion within a fire. Carbon monoxide levels increase when oxygen flow is restricted to the fire. The dampening down of a wood heater (reducing oxygen flow) in order to keep the fire alight but reduce the rate at which the wood is consumed causes increased local concentrations of carbon monoxide.

The Department of Environmental Protection has also provided data comparing the PM₁₀ and PM_{2.5} data for Duncraig and other residential areas where wood heaters are known to be used in the area. The data shows that around 90% of the PM₁₀ is made up of PM_{2.5} (Figure 7). As outlined in Chapter Two, PM₁₀ and PM_{2.5} are the particles of greatest concern from a health perspective, with most concern focussed on PM_{2.5}.

Figure 7 PM₁₀ and PM_{2.5} monitoring data - Duncraig¹¹⁶.

While the Committee's work has focussed on the Perth metropolitan region, the opportunity arose to review monitoring data for two major population centres in the southwest of Western Australia (Busselton and Bunbury). The PM₁₀ monitoring data (Figure 8) shows the levels in Bunbury to be similar to those being experienced in suburban areas of the Perth metropolitan region. Similar situations were brought to the Committee's attention during the international investigation¹¹⁷. The estimated health effects to the population in these non-metropolitan centres were higher than in the metropolitan region. However, historically, little attention had been paid to these areas. While the Committee's Terms of Reference have not allowed the Committee to pursue this issue further, the Committee considers the issue of such importance that it should be brought to the Government's attention for appropriate action.

Recommendation 54

¹¹⁶ Department of Environmental Protection.

¹¹⁷ Mr Hu Wallis, *Op cit*, 1997.

The State Government should investigate air quality issues in rural areas.

Figure 8 PM_{2.5} monitoring data - Bunbury¹¹⁸

The first discussion paper released by the Committee presented 34 possible management strategies that could be adopted to address the issue of smoke emissions from homes. This list was by no means exhaustive, and did not imply that all strategies should necessarily be adopted. One of the criticisms arising out of the submissions was that the Committee did not present any discussion on the comparative environmental performance of alternative heating sources and that there is a need for the community to have access to comparative information along the lines of energy and cost efficiency, indoor and outdoor air emissions, and any other concerns that may be relevant¹¹⁹. From a particulate emission point of view where the aim is to manage haze levels, wood heaters and fire places are by far the worst performers when compared to the use of an oil or gas heater. When consideration is given to energy efficiency, being the ratio of energy input to energy output at the source, again gas and oil heaters are significantly better performers as detailed in Table 15.

If consideration is given to the internal environment, the comparisons are not as distinct, as wood heaters and wood fires will contribute to the level of particulates in the indoor environment, unflued gas heaters will contribute moisture and levels of nitrogen oxides, with unflued oil heaters also contributing moisture to the indoor environment. Unflued units use air from the room for combustion purposes and, being unflued, emissions are sent back into the room. Whilst some moisture (humidity) is desirable indoors, excess humidity can increase mould and bacteria levels, and cause long term structural damage around windows in a well sealed house. Control measures apply to the design of unflued gas heaters to ensure that emissions are minimised, including inbuilt oxygen sensors, automatic gas cutoff and restricting the maximum heating capacity of an unflued unit to 25 mJ¹²⁰. The moisture and nitrogen oxides issues do not arise in the indoor environment if flued units are used. This is summarised in Table 16. From an internal environment aesthetics point of view, that can only be judged by the individual's preference.

Table 15 Comparative efficiency information of some domestic heating options

¹¹⁸ *Ibid.*

¹¹⁹ Dr Sue Graham-Taylor. *Evidence* Tuesday 2 September 1997.

¹²⁰ Alinta Gas (1997). *A Guide to using Alinta Gas* [Online]. Available: http://www.AlintaGas.com.au/guide_costs.html [1997, October 6].

<i>Heating type</i>	<i>Efficiency¹</i>
Natural gas (unflued)	90%
Oil (unflued)	90%
Natural gas (flued)	75%
Oil (flued)	75%
Wood stoves and heaters (airtight)	40-60%
Wood stoves and heaters (non-airtight)	30%
Open fireplace	15%

Table 16 Comparative emission information of some domestic heating options

<i>Heating source</i>	<i>Indoor emissions</i>	<i>Outdoor emissions</i>
Oil (flued)	minimal since emissions vented outdoors through the flue	NO _x
Oil (unflued)	moisture, NO _x	all emissions are indoors
Natural gas (flued)	minimal since emissions vented outdoors through the flue	NO _x
Natural gas (unflued)	moisture, NO _x	all emissions are indoors
Open fireplace	wood smoke ^A	wood smoke
Wood stoves and heaters (airtight)	wood smoke	wood smoke
Wood stoves and heaters (non-airtight)	wood smoke	wood smoke

A - Wood smoke consists of particulates and gases. The chemical composition of the emission includes organic carbon, carbon monoxide, methane, ROCs, aldehydes, benzene, NO_x, SO₂, naphthalene and a variety of polyaromatic hydrocarbons (PAHs)¹²¹.

The Committee believes that the consumer should have ready access to this type of information at the point of sale of all heating devices. While the Committee acknowledges that any comparative assessment of products should involve a cradle to grave analysis, at the end of the assessment it is questionable that an authoritative best option would present itself since consumer preference of an aesthetic nature is unquantifiable. However it is important that the community have access to factual information in an unbiased and uncomplicated manner, and that the choice remain with the consumer.

Recommendation 55

The Office of Energy should coordinate the compilation of a community information package on the relative effects of heating devices on the environment, including indoor air quality and health issues.

Evidence from the Conservation Council says that the burning of wood for heating purposes can be considered to be CO₂ neutral where the wood resource is replaced by planting tree seedlings. However no evidence was presented to indicate that this balance is being achieved. The argument against using electrical heating is that the pollution source for electricity supply is shifted from the home to the source of power

¹²¹

United States Environmental Protection Agency, *Op cit*, 1993a.

generation and, for natural gas, if the unit is unflued, it will shift the pollution indoors. However it must be recognised that power generation in Western Australia is subject to the pollution control provisions of the *Environmental Protection Act 1986* (WA) and therefore the collective consideration of the pollution contribution from using electrical heating is subject to pollution control. Domestic wood heating currently is not.

As outlined in Chapter Two, there is growing concern about the health effects of exposure to particles from wood smoke. The Committee is of the opinion that, while research continues in the area, it is necessary to adopt a precautionary approach to managing this source of pollution. The Committee recognises the community's right to decide on how their residence will be heated, but it must also be recognised that smoke from wood burning can be a nuisance and more importantly can contribute to poor air quality and health impacts. The Committee believes there is sufficient evidence to support this cautious approach, and to ignore the international evidence would be irresponsible. The Committee considers that the adoption by this State of the *Australian Standards* to dictate the design, installation and operation of wood burning devices is a priority.

Recommendation 56

The Department of Environmental Protection should initiate an education campaign aimed at all sellers and manufacturers of wood heating units to facilitate the introduction of regulations controlling wood heater design.

*Australian Standard AS 4013-1992*¹²² specifies a test method for determining the rate of particulate emission from batch-fed solid fuel burning appliances and the associated particulate emission acceptance criteria. This standard applies only to domestic solid fuel burning appliances including space heating appliances. It does not include appliances used solely for water heating purposes. Appliances without catalytic combustors must achieve an appliance particulate emission factor not greater than 5.5 g/kg. Appliances with catalytic combustors must achieve an appliance particulate emission factor not greater than 3.0 g/kg.

While sections of the manufacturing and sales industry have voluntarily adopted these *Australian Standards*, this has by no means been an industry wide practice. Anecdotal evidence suggests that because Western Australia did not adopt the standards, units from those States which had adopted the standards were being sold here¹²³.

While it is acknowledged that the units complying with the *Australian Standards* are designed to have a lower emissions output, emissions from wood heaters will continue. When considering the total emission from a wood heater, the total number of units in operation, the heater's design and associated flue equipment, and the way in which the unit is operated are all important. One major criticism of the *Australian Standard* is that the specified fuel loading for testing compliance is not necessarily reflective of real operating conditions, and as with motor vehicles, emissions are a product of fuel and operation.

Wood for fuel purposes has been sourced by a variety of means, with little or no quality control being adopted. The Department of Conservation and Land Management (CALM) routinely designates specified areas where the public can gather wood for personal use. Evidence was given to the Committee that CALM also allocates contracts for the collection of wood by merchants from designated areas where all fallen matter must be removed whether it is suitable for use or not. Mill ends are also sold to the public, either direct from

¹²² *Australian Standard AS 4013-1992 - Domestic solid fuel burning appliances - Methods for determination of flue gas emission.*

¹²³ Mr Max Barton, Immediate Past President, Wood Heaters Association. *Evidence* Tuesday 23 September 1997.

the mill or through merchants. "Recycled timber" from scrap yards is also utilised. Table 17 is an estimated summary of where wood is sourced¹²⁴.

Table 17 Estimated annual availability of wood¹²⁵

<i>Wood source</i>	<i>Estimated tonnes available per year</i>
CALM - State Forest major contractors	32 000
CALM - State Forest individual collectors	30 000
Private property, major contractors	9 000
Sawmill mill ends	20 000
Furniture and cabinet makers	5 000
Tree lopping operators	50 000
Building demolition sites	10 000
Used power poles, sleepers, bridge timbers	10 000
House building sites	3 000
Reject pallets and packaging timber	6 000
<i>Total</i>	<i>175 000</i>

The Committee believes that there is insufficient information available to make a sound estimate of the amount of wood collected privately for use, whether collection is from designated areas or scavenged. When a fire is lit, the occurrence of flames is preceded by the generation of products of incomplete combustion, including smoke, and the fire temperature is depressed due to heat loss in water vapour. The greater the moisture content of the wood the greater the quantity of smoke likely to be produced. The maximum moisture content considered suitable for fire wood has been the subject of much debate both locally, interstate and overseas. From the consumers perspective it must be realised that a higher moisture content within the wood will mean less heat from each piece of wood.

Recommendation 57

The State Government should legislate the type of fuel and operating procedures appropriate for wood heaters and fire places.

Recommendation 58

The State Government should legislate that no wood with a moisture content greater than 25% can be sold, unless it has been clearly labelled as not meeting this requirement and is not for use without proper seasoning.

¹²⁴ Forest Industries Federation (WA) Inc. Submission 116, 28 November 1997.

¹²⁵ *Ibid.*

The Committee heard evidence that wood heaters have a definitive life span, between seven and fifteen years, depending on the type of unit and the way in which it has been operated. This provides an opportunity for long term planning to be implemented now, but still allowing both the industry and the community to become adaptive to strategies that would be inequitable in the short term, such as the introduction of restrictions. The Committee considers it essential that the Government send a clear message to the metropolitan community and the manufacturing industry that, the use of wood heaters is not a sustainable activity in urban areas unless operational emissions per unit are drastically reduced.

Recommendation 59

Legislation introduced by the State Government should require the manufacturing industry to progressively improve the particle emissions beyond those specified in the Australian Standard 4013-1992.

In the interim, the community must become vigilant in the way in which wood heaters are operated, ensuring that only appropriate fuels are used. The Committee considers that seasonal educational and awareness programs must be run in the community in order to encourage people to adopt responsible behaviour. The Committee is aware that target programs have been run with varying success and in most instances have been conducted on shoestring budgets or through sponsorship. In line with the Committee's earlier recommendations relating to public awareness campaigns, the Committee considers that education programs need to be in advance and continually reinforced through support mechanisms. It is important that the community understands that, while an individual unit may not be causing a nuisance problem alone, collectively it is contributing to the periodic decline in air quality and that health issues are associated with exposure to wood smoke.

Recommendation 60

The Department of Environmental Protection in conjunction with representatives of the wood heater association and Local government should facilitate community education campaigns focussing on appropriate methods of collecting, purchasing and storing wood for use, appropriate ways in lighting and maintaining a fire, and of the health effects associated with exposure to particles coming from wood smoke.

Recommendation 61

The Department of Environmental Protection should enhance and improve existing pamphlets on guidelines and procedures for the correct use and maintenance of wood heaters, fire places, and fuel supply and storage.

While community education programs can be implemented in the short term, there will be a delay period between implementation of the programs and detectable changes in behaviour. Consequently the current situation of neighbour complaints about smoke from nearby wood heaters can be expected to continue as a result of incorrect operation, incorrect fuel or poor design of chimney and chimney location. Evidence from government agencies, local government authorities, community representatives, and written submissions from members of the community, indicates a strong dissatisfaction for the current method used to "resolve" complaints.

The Committee considers the most definitive solution to this is to adopt a penalties system for the operators of units which are creating an ongoing problem. A combined approach of fines, restricted use and compulsory replacement of a poorly operating unit may be appropriate provisions to provide for in legislation. The

Committee considers that Local government and trained officers should be provided with the powers to carry out the following -

- investigate and resolve complaints directly;
- review the user's wood heater operating procedures, including fuel storage and supply;
- issue notices of warnings to improve operator's procedures;
- issue fines to operators for failure to improve burning procedures following the issue of a warning; and
- restrict or ban the use of a wood heater that continues to cause a problem following the issuing of a fine.

Recommendation 62

Local government should be given the appropriate powers to resolve complaints of smoke nuisance from domestic wood fires and wood heaters within their municipality.

Clear guidelines need to be developed concurrently as to how smoke emissions can be assessed and to recognise the difference in smoke emissions that occur during the different stages of the fire lighting and wood burning cycle. Opacity is a measurable indicator of particulate emissions and can be determined visually especially with comparison to a standard chart during day light. An opacity measure can take into account the stages of the wood burning cycle to allow for when the fire is initially lit and during periods when additional wood is added to the fire. Legislation should provide for the visually determined opacity level to constitute *prima facie* evidence of unlawful operation, as is the case in some overseas jurisdictions¹²⁶.

Recommendation 63

The State Government should regulate (through the Environmental Protection Act 1986) that the visual determination of opacity is an appropriate method of determining the level of particulate emissions from the use of a wood heater or wood fire.

In recognition of the direct impact and effect which wood burning has on the immediate and regional environment, and in line with the polluter pays principal, the Committee considers that the charging of a nominal levy on properties which install and operate these facilities is appropriate. For equitable reasons, the Committee believes this fee should be introduced in the medium to long term. This would allow those residents who have recently purchased wood heaters in good faith to continue to use the units over the operating life of the unit. The fee could be an annual or a once only charge, with the funds being used by the local authority for related administrative or educational purposes. It has also been suggested that these funds could be used to fund an incentives or subsidy program that encourages residents to convert from wood burning to an alternative heating sources.

Recommendation 64

Local government should be given the authority to charge a rates levy on the installation of wood heaters and fire places after 1 July 1999.

Recommendation 65

State and local government should offer an incentive scheme to encourage residents to convert from wood heaters to alternatives, such as gas and solar heating sources.

Where it has been determined by the Department of Environmental Protection or the local government authority that the local air quality cannot sustain any further increase in the level of particulates from the use of wood heaters, the Committee considers it imperative that legislation provides for appropriate management. Under these circumstances, provisions should exist for the banning of the further installation of these units in a designated area, and that all units not complying with the *Australian Standards* should not continue in use.

Recommendation 66

At the time of sale of a dwelling in the Perth metropolitan region, wood heaters not manufactured to comply with Australian Standard 4013-1992 should be removed, replaced or rendered inoperable.

Recommendation 67

The State Government should legislate to ban the further installation of wood fires and wood heaters in designated areas of the Perth metropolitan region with unacceptable local air quality. This ban should be in place by July 2003 in areas that have access to reticulated natural gas.

Wood heaters in a suburban situation can collectively contribute to periods of poor air quality. When weather conditions are stable, wood smoke can become very concentrated at ground level. Under these circumstances, the Committee believes episode management strategies are essential. Seeking the voluntary support of the community to not use wood burning appliances if alternative heating devices are available is an equitable approach in the first instance. The Environment Centre of Western Australia suggested that the replacement of wood heaters with alternative heating devices prior to the selling of a property was a more appropriate strategy than an outright ban on the use of wood heaters. In this way, at least the cost of a new heating device can be factored into the asking price of the property¹²⁷.

Outright bans on the sale or use of wood heaters received varied support. Those supporting the bans had invariably been on the receiving end of a neighbour's smoke emission. In contrast, banning was not supported on the basis that it was a draconian, outdated and an unnecessary approach to a non-issue. As stated previously the Committee has no doubt that, based on the scientific data, smoke emissions from wood heaters are a major seasonal influence on air quality.

Wood smoke curtailment programs, as they are known in Canada and the United States of America, essentially restrict wood burning activities during periods of poor air quality. The program relies heavily on public education programs being in place, and can be implemented either by voluntary or mandatory compliance. The programs have proven to be an effective control strategy¹²⁸. A voluntary program, called

¹²⁷ Submission 180, December 1997.

¹²⁸ Greater Vancouver Regional District (1994). *GVRD Air Quality Management Plan Working Paper - Residential Wood Burning Stoves and Fireplaces*. Canada.

Don't light tonight was trialed in New South Wales last year and received general community support, but not the support of the Wood Heaters Association¹²⁹.

There was mixed reaction in the submissions to the suggestion of implementing a voluntary *Don't light tonight* campaign. Reasons for not supporting this type of voluntary action campaign included the view that those who did not have an alternative heating source to a wood heater or fire would be disadvantaged and suffer physically from cold weather conditions, and the campaign assumed that all wood burning appliances were causing a problem, even if they were complying with *Australian Standards*. The Committee believes that the implementation of a voluntary program is beneficial not only in reducing the total particulate levels being emitted but also as a valuable tool in raising community awareness and understanding of the issues. The Committee believes that planning should commence now for the implementation of a trial program during the winter of 1999.

Recommendation 68

The Department of Environmental Protection should initiate a voluntary program for limiting the use of wood heaters and fire places in the metropolitan region during periods of poor air quality.

Legislation should also provide for a series of penalties for not complying with the legislative requirements. A staggered system of increasing fines for the number of times an offence has occurred seems appropriate and may provide impetus for ensuring the correct operating procedures are followed in future or for an alternative heating device to be used. To encourage the removal of old units and the change to a cleaner heating device, the Committee believes that provisions should be made for a fine to be waived if the unit is replaced with a cleaner heat source, is disposed of or rendered inoperable permanently.

Recommendation 69

Legislation should make provision for smoke emission offences to be subject to a fine which is increased with each offence.

Recommendation 70

Legislation should make provision for fines to be waived if the offending unit is replaced with a cleaner heat source, is disposed of or rendered inoperable.

In a broader context, the Committee has also considered the role of designing and constructing dwellings and buildings to be energy efficient and thereby reducing the need for supplemental heating. As highlighted in the urban planning section of this report, the Committee believes that one of the most effective ways of ensuring that energy efficient principles are adopted is for planning authorities and agencies, such as local authorities, to develop planning policies that facilitate and in some circumstances favour these principles.

As has been experienced by the Leichhardt Municipal Council in New South Wales, planning concessions have proven to be effective in the implementation of their energy efficient housing development control plan.¹³⁰

As part of the long term plan, the Committee believes that greater emphasis should be placed on improving the design of homes and buildings so that less reliance is placed on the need for artificial heating. Similarly,

¹²⁹ Ms Anita Shuhevych, Environment Protection Authority, New South Wales. *Pers comm* Tuesday 5 August 1997.

¹³⁰ Ms Sophie Handley, Leichhardt Municipal Council. *Pers comm* 7 August 1997.

less reliance should be placed on the use of wood burning devices as the principal or only source of heating in new homes.

Recommendation 71

Local government By-Laws should be amended to prevent the installation of a wood heater where it is to be the sole source of heat, unless the building has been solar designed.

Planning at the subdivision level should be taking into account the street alignment which ultimately influences the way in which the buildings will be positioned on the block.

Recommendation 72

The Ministry for Planning should develop guidelines and regulations for subdivision approvals that are designed to facilitate energy efficient designed homes.

Residential backyard burning

The Committee considers the backyard burning of waste to be an outdated practice for the metropolitan region, especially given the level of rubbish collection service provided by local government, and the number of services specifically providing for the separate collection or disposal of green waste. The Committee supports the approach being taken toward the separate collection of green waste.

Recommendation 73

All local government authorities in the Perth metropolitan region should provide residents with a frequent and separate green waste collection service.

Recommendation 74

The State Government should legislate to require green waste to be collected separately from general rubbish collection.

The Committee acknowledges that some authorities have banned or restricted the practice of backyard burning. However, this is not uniform throughout the metropolitan region and, while some local authorities have policies that are not supportive of backyard burning, the policy is not always supported with By-Laws or other regulatory controls or enforcement measures. The Committee believes that the practice of backyard burning should be banned in the more densely populated areas of the metropolitan region, and that penalties should be introduced to deter the practice.

Recommendation 75

The State Government should legislate to ban the practice of backyard burning in residential areas, giving local government the authority to designate those areas and times where burning may be undertaken under exceptional conditions.

Hazard reduction burning & controlled burns of bush, agricultural land & development sites

The use of fire is a valuable tool and in some circumstances a necessary tool. The Committee acknowledges that from a resource management perspective, the banning of all burning activities would not be a practical option. However, there is the need to rationalise how, where and when fire is used as a management tool. At the same time there are justifiable reasons for ensuring that the population of Perth and urban areas outside of Perth are not unduly exposed to particles from these fires.

For the foreseeable future, hazard reduction burning will continue to be the Department of Conservation and Land Management's key management strategy and the implementation of this mechanism will continue to require vigilance by the agency with particular regard to burning periods and the predicted and actual weather conditions.

The Committee heard evidence detailing how the Department of Conservation and Land Management takes into account the Bureau of Meteorology's predictions for smoke dispersion or accumulation. The Committee noted that this is one of a number of pieces of information that the department considers when determining if a hazard reduction burn should be initiated. The Committee acknowledges that the Bureau of Meteorology is continually improving its prediction ability and, given that the nature of meteorological conditions are changeable, understands the frustration that officers involved with hazard reduction burning must feel with changing predictions. The Committee was briefed on the inherent difficulties involved in predicting the likelihood of weather conditions that will result in smoke accumulation and the ultimate smoke dispersion patterns. It is important that research continues in order to enhance the smoke accumulation and dispersion prediction capabilities specifically for the Perth and Western Australian situation.

Recommendation 76

The State Government should support research designed to improve smoke plume dispersal modelling to better predict whether smoke from burning activities will drift over the Perth metropolitan region or other populated areas.

The Committee also considers there are benefits to be made by formalising the procedures for liaison between the agencies.

Recommendation 77

The State Government should formalise the procedures for the Department of Conservation and Land Management to liaise with the Bureau of Meteorology.

It was also stated in evidence that the Department of Conservation and Land Management was being restricted to a very small window of opportunity in which to carry out the planned hazard reduction program after it had taken into account periods when smoke accumulation was likely to occur, in addition to those days when other concerns, such as when fuel moisture and wind conditions were not conducive. The department presented data of a statistical or predictive nature to support this. However, no actual data for previous burning seasons was presented. In order to facilitate the department's ability to maximise the use of appropriate burning times so that smoke accumulation does not result to the extent that it impacts on the community's health, it may be necessary to provide additional resources to the department. The type and extent of the additional resource needs to be investigated further.

Recommendation 78

The Department of Conservation and Land Management should prepare a technical report on how the department's fire section can be better resourced to use seasonal workforces to maximise burning activities during suitable weather conditions.

The Committee also heard evidence reiterating the importance of acknowledging that there are a variety of wood smoke sources within the Perth metropolitan region and, that under certain weather conditions, other smoke sources outside the region can cause an impact. The difficulty in accounting for all the key sources of wood smoke during periods of poor air quality was also outlined to the Committee, with only the Department of Conservation and Land Management routinely reporting to the Department of Environmental Protection where hazard reduction activities were being or had been undertaken. The Committee believes that this reporting requirement should be extended to include all agencies and groups carrying out controlled burning activities.

Similarly, the Department of Conservation and Land Management is the only agency routinely expected to take into account the Bureau of Meteorology's advice, yet it is known that, within the Perth metropolitan region, controlled burns are carried out by local and volunteer bush fire brigades as well as by individuals, though obviously not on the same scale as the department. The potential exists for a number of controlled burns to be lit during times when the weather conditions favour smoke accumulation, thereby leading to concentrated levels of wood smoke in the region. The Committee believes it is important that the occurrence of this should be minimised.

Recommendation 79

Voluntary "no burning days" should be promoted in the community to minimise the number of private or bush fire brigade controlled burns lit during periods when smoke accumulation is likely to occur due to weather conditions.

To complement the planning process for those intending to carry out controlled burns, and to improve community awareness generally, the Committee believes that the Bureau of Meteorology should be providing advice to the broader community on the likelihood of wood smoke dispersion or accumulation under the expected weather conditions. The Committee was briefed on similar approaches used in Canada and the United States of America. Television, radio, internet and facsimile messages were used to disseminate the information into the community on a routine basis.

Recommendation 80

The Bureau of Meteorology should publish its advice on the likelihood of smoke dispersion or accumulation as part of the weather forecast.

Recommendation 81

The media's weather reports should include advice on the likelihood of wood smoke dispersion or accumulation.

Local government controls the use of fire through a permit system during the times of highest fire hazard (restricted and prohibited burning times), generally from around October to April each year. Permit burns can

be carried out by anyone for a variety of purposes including agricultural clearing and hazard reduction¹³¹. Local governments often use the Volunteer Bush Fire Brigades to carry out strategic fuel reduction in their local areas.

The Committee considers it appropriate for both the Volunteer Bush Fire Brigades and officers issuing permits to have access to and be required to heed the Bureau of Meteorology's predicted forecasts on smoke dispersion. Similarly, members of the community who intend to act upon an issued permit should seek advice on the predicted conditions for smoke dispersal. The provision of a dedicated telephone line to serve this function of disseminating forecast information may be beneficial. The regional forecast should be provided in simple terms as to the likelihood of smoke dispersion or accumulation.

Recommendation 82

The Bureau of Meteorology, Department of Conservation and Land Management, the Bush Fires Board and the Department of Environmental Protection should establish a dedicated telephone service advising on regional (or municipality) smoke dispersion capabilities.

Recommendation 83

All controlled burns should only be carried out under suitable weather conditions as advised by the Bureau of Meteorology.

With regard to the use of fire to dispose of debris on development sites, the Committee acknowledges the guidelines put in place by the Department of Environmental Protection, indicating that the use of fire on development sites would be banned at the end of 1997. The Committee considers it appropriate for this ban to now be enforced through legislative processes.

Recommendation 84

The State Government should legislate to ban all burning on development sites in the Perth metropolitan region, and establish penalties for breaches of this ban.

As a matter of practice and an alternative to burning activities, developers should be encouraged to retain native vegetation on all development sites, and to adopt mulching activities where vegetation must be removed.

Recommendation 85

State and local government should together provide planning and development concessions to those sites where native vegetation is retained.

The Committee believes that the practice of burning stubble on agricultural land and the burning of debris associated with horticultural pursuits in the metropolitan region must be subject to the same controls as those proposed for other organised burning activities.

131

Bush Fires Board of Western Australia (1997). Submission 42, 30 June 1997.

3.4 Air toxics

In the context of this report, the Committee considers an air toxic to be any air pollutant that causes an adverse health effect. The health effect may be as extreme as causing cancer, but also includes non-cancer health effects such as impacts on reproduction.

The Committee acknowledges that scientific work is continuing to investigate, evaluate and identify individual air toxics and their health effects. It is unrealistic to expect that air quality planning decisions be delayed until such time as the research shows a definitive outcome. The Committee believes that it is appropriate for a precautionary approach to be adopted by Government. The adoption of other strategies recommended in this report addressing industrial and vehicle emissions will assist to some degree in reducing the likely emission of these materials. Therefore, the Committee has also considered possible air toxics, being those pollutants which have been scientifically assessed and are probable human carcinogens, or which are currently being assessed for possible health effects.

Air toxics and possible air toxics come from a variety of sources, including the industrial manufacturing processes, fuel refining and vehicle emissions. The USEPA has drafted a list of 40 of these as part of the *Urban Air Toxics Study and Strategy*. This draft list includes acetaldehyde, acrolein, benzene, 1,3-butadiene, carbon tetrachloride, formaldehyde, lead compounds, nickel compounds, and styrene. Diesel exhaust is also currently under review for consideration as a toxic air contaminant under the Californian Legislature¹³².

Benzene, a known human carcinogen, is present in petrol and becomes more concentrated in fuel through the refining process when producing high octane petrol. Benzene will therefore be emitted at the fuel refinery, during fuel transfer processes at the petrol station and from the vehicle, both through evaporative processes and in exhaust emissions when fuel is unburnt or incompletely combusted. Possible air toxics of diesel (particulate, formaldehyde and 1,3-butadiene) while not being present in fuel, are present as by-products of incomplete combustion, with formaldehyde also being formed via a secondary process in the air through reactions with other pollutants that are present.

The adoption of best practice principles by industry will itself be a positive move toward reducing the emission of this type of pollutant.

The Committee considers it important that within the air quality management plan for the region, provisions be provided for the ongoing consideration of the air toxic issues, and that public awareness and education programs be in place advocating "prevention" and "minimisation" of the potential creation of these emissions.

Recommendation 86

The Department of Environmental Protection should investigate and report to the State Government on the status of indicator air quality toxics in the Perth metropolitan region and the need for monitoring.

Recommendation 87

Main Roads Western Australia should expand its investigative road side monitoring program to determine cyclist and pedestrian exposure to air toxics throughout the Perth metropolitan region, particularly within the central business district and main suburban intersections, shopping and other areas of intense periodic vehicle use such as school car parks and fast food zones.

132

Office of Environmental Health Hazard Assessment, California Environmental Protection Agency (1997). *Health Risk Assessment for Diesel Exhaust*. Public and Scientific Review Panel Review Draft. United States of America.

Recommendation 88

Main Roads Western Australia should initiate an in-vehicle monitoring program to determine bus driver exposure to air toxics associated with vehicle emissions, particularly during periods of traffic congestion.

3.5 Indoor air quality

The quality of indoor air is influenced not only by outdoor air intruding indoors but also by the range of materials, products and fuels found and used indoors. Of the product sources, the most obvious are chemicals contained in cleaning agents, paints and pesticides. "Hidden" chemicals include those contained in some adhesives used in conjunction with furniture and carpet. Open fire places, natural gas cooking stoves and unflued natural gas and kerosene heaters are sources of NO_x and moisture. As discussed previously, while some moisture is beneficial, excessive moisture can encourage microbial growth.

While specific indoor air quality issues, such as exposure to tobacco smoke and asbestos, have been studied extensively, the Committee's investigations indicate that the consideration of indoor air quality is an important emerging issue. Concern is increasing with respect to the possible impact that indoor air quality has on human health, especially considering estimates which show up to 90% of our time is spent indoors. The Committee was impressed with the research work being undertaken at Murdoch University. Key points and issues of concern presented in evidence by Dr Peter Dingle¹³³ included -

- the importance of building design and air exchange;
- "sick building syndrome" being a composite issue of indoor air quality; and
- the importance of communicating risk to the community.

The Committee recognises that the issue of indoor air quality is broad. We are in the early stages of developing an understanding of the standard of indoor air quality in Perth and the possible effects of poor air quality. For these reasons, the Committee considers it important that, within the air quality management plan for the region, ongoing consideration of the issues be given, and that public awareness and education programs be in place advocating "prevention" and "minimisation" of the potential creation of poor indoor air quality.

Recommendation 89

The State Government should maintain a "watching brief" on the issues pertaining to indoor air quality in Perth through the regional air quality management plan.

Recommendation 90

The State Government should include educational material on indoor air quality as part of a broader and ongoing community awareness and education program.

3.6 Education

The Committee cannot over emphasise the importance of community education and support, and the need to not only support the community in adopting changes but to facilitate and support the community's actions. Submissions received in response to the five discussion papers indicate a general acceptance of air quality strategies that are educational-based rather than those which are enforced or regulated. The advice of Mayor Doug Drummond¹³⁴ was to "create the atmosphere before creating the change". The importance of this was highlighted with the introduction of vehicle emissions testing in the Greater Vancouver Regional District where initially there was a great deal of resistance to the program and parts of the community sought ways around the scheme. The introduction of emission testing at the time was seen as politically bold, but now, eight years after the initial announcement of emissions testing, there is a great deal of support within the community. If the population is sensitised to the problems then they are prepared to participate if education and support is provided¹³⁵.

As the results of the various *Travelsmart* programs have highlighted, the community is open to considering changes to its behavioural patterns and inducements are not necessarily required to bring about the changed action. Instead assistance, guidance and support in making the change is required. The Committee believes that this understanding should be used as the basis for targeting future community awareness and education programs.

Similarly, the Committee considers that educational campaigns need to consider a variety of methods of information dissemination. Information distributed through schools and letter drops have traditionally been adopted. Perhaps an advertising type of approach will capture the attention of a wider audience. A regional public education program aimed at bringing about sustainable changes in public perception and action is essential and it needs to be ongoing in the same way that the QUIT campaign has been designed. Funding will therefore need to be guaranteed on an ongoing basis. The Committee also believes that the ongoing program should be based around a simple series of messages about air quality and that seasonal campaigns be introduced under this overall theme on an as-needed basis.

Submissions and evidence also indicated that teachers need to be familiar with the current issues relating to air quality. This could be achieved through both teacher training and in service courses. Evidence suggested that curriculum space was already crowded with educational prerequisite areas and therefore the most effective means of incorporating messages about air quality in schools was through integrating air quality issues as part of existing subject areas. It is important for educators to realise that air quality issues can be incorporated through much of the traditional subject areas, and should not necessarily be seen as an isolated subject.

Recommendation 91

The Department of Environmental Protection should to continue to facilitate the production of resource material and teacher notes on air quality issues, for distribution to all schools.

¹³⁴ Mayor of Burnaby, Vancouver, British Columbia, Canada. *Pers comm* Monday 3 November 1997.

¹³⁵ Mr Hu Wallis Ministry of Environment, British Columbia. *Pers comm* Friday 31 October 1997.

3.7 Monitoring, modelling and pollutant inventories

The importance of air quality monitoring was continually highlighted to the Committee throughout its investigations. Monitoring is needed to allow assessment of potential problems and to measure the improvements to air quality over time. It is also essential for maintaining and proving the regional air quality models for Perth. The Committee acknowledges that the Department of Environmental Protection has developed and maintained an effective air quality monitoring network in the Perth metropolitan region and that the program is being extended to include a broader selection of air toxic monitoring and PM₁₀. Table 18 summarises the existing air quality monitoring network currently operating in the Perth metropolitan region.

Table 18 Ambient air quality monitoring stations and pollutant monitored in the Perth metropolitan region

Site	Parameters measured								
	CO	Lead	NO _x	O ₃	PM _{2.5}	PM ₁₀	SO ₂	TSP	Vis
Abercrombie Road, Kwinana						✓ ^B	✓		
Caversham	✓		✓	✓	✓	✓ ^A			✓
Duncraig	✓		✓		✓	✓ ^{A,B}			✓
Henderson Road							✓		
Hope Valley			✓				✓		✓
Leeming	✓		✓		✓				✓
Miguel Road, Kwinana							✓		
Queens Building, Perth	✓	✓	✓			✓ ^A		✓ ^C	✓
Quinns Rocks			✓	✓					✓
Rockingham			✓	✓					
Rolling Green			✓	✓					
Swanbourne			✓	✓		✓ ^A			✓
Wattleup							✓		

A - High volume sampler with a PM₁₀ head (run every sixth day).

B - TEOM continuous particle sampler.

C - High volume sampler with a TSP head (run every sixth day).

Submissions raised a number of issues relating to the monitoring network directly. This included -

- an air quality monitoring station should be located at either Rottnest Island or Garden Island;
- there is a need to monitor for air toxics in the local environment; and
- tertiary institutions should be involved in air quality monitoring and research.

Recommendation 92

The Department of Environment Protection should review and report to Government on the need to increase the number of mobile and/or stationary air quality monitoring stations in the Perth metropolitan region.

Recommendation 93

The Department of Environmental Protection should include the monitoring of air toxics at strategic locations within the Perth metropolitan region.

Recommendation 94

The State Government should encourage the community, business and industry sponsorship of air quality monitoring stations in the Perth metropolitan region.

Recommendation 95

The Department of Environmental Protection should make greater use of mobile air quality monitoring stations in determining "hot spots" in the Perth metropolitan region.

Recommendation 96

The Department of Environmental Protection should establish and maintain a publicly accessible pollutant inventory for the Perth metropolitan region.

The Committee also believes that much can be gained in future by developing stronger ties between the Western Australian universities and government agencies. The Committee believes that a grants, scholarship or award system for research that is directly related to improving the knowledge around Perth's air quality should be developed.

It is important to note that decision-making for maintaining Perth's air quality is at the crossroads. Pollution modelling and projected trending of population and pollutant sources suggests that "to do nothing" will guarantee declining air quality in future years. While the decline is unlikely to happen rapidly, changes need to be adopted progressively to ensure air quality is improved and maintained. As part of this progressive approach, the Committee considers that short, medium and long term strategies need to be planned. Short term strategies (achievable within five years) may not necessarily bring about immediate improvements, but should set the framework for future improvement, particularly if the emphasis is on education and improving awareness and understanding within all sections of the community. Medium (achievable in five to 10 years) and long term strategies (beyond 10 years) should be reviewed for effectiveness throughout their implementation. The degree of acceptability of these strategies within the community can be greatly enhanced by adopting short term community awareness and educational strategies.

The Committee acknowledges that much of the evidence presented is predictive in nature and, since the air quality of Perth is a function of both emissions and meteorological conditions, the predictions cannot be definitive. The Committee therefore considers it essential that the Government allow for this uncertainty to be accommodated within the strategies adopted as part of an air quality management plan. On the basis that air quality monitoring and modelling work will continue, the Committee believes that the Government's adoption of long term strategies should allow flexibility and adaptability to take account of the results from future analysis. Improvements or additions to the current knowledge base need to be taken into account at the appropriate time. The Committee recommends that the Government be mindful of this when considering the recommendations of this report.

Chapter Four

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Appendices

A - Submissions	80
B - Evidence	116
C - Intrastate investigations	118
D - Interstate investigations	121
E - International investigations	125
F - Statement of actual (or estimated) costs	133

A - Submissions

Public

	<i>Submission number</i>
Adams, Mr C A B	126B, 199
Allan, Mr J B	47-1
Bagini, Ms T R	80
Barnett, Ms J	37
Beaverstock, Mr & Mrs J	97C
Bennett, Mr K D	47-2
Bishop, Mr S R	139, 160
Blatch, Mrs S	113
Bowman, Mr & Mrs R	92
Briard, Mrs B	144
Brindley, KB, CC, BS & LJ	134
Broadbent, Mr G	202P
Brock, Ms C	47-3
Buchanan, Mr W G	47-4
Caterer, Mr J	152, 215
Chadwick, Mr P	46
Chapman, Mr C	47-5
Charchalis, Mr I R	47-6
Cilli, Mr	149
Clark, Mrs J	192
Clark, Mr	16
Clark, Mr T	89
Clarke, Mr J D	81
Clifford, Mr G J	142
Cocker, Mr & Mrs	64
Coffey, Mr P	173
Cole, Mr G A	47-7
Collins, Mr F	100
Collins, Mr A N	141
Colyer, Mr	12

	<i>Submission number</i>
Conlan, Mr P	47-8
Cornelius, Mr V	202S
Cornelius, Mr J	202Q
Cornelius, Mr M	202R
Cowley, Mr R	35
Crisp, Mrs	65
Croxford, Mr M E	47-9
Cullane, Mr J M	191
Cuthbert, Ms E	202E
Davidson, Mr G J	47-10
Delaporte, Mr C	47-11
Devereux, Mr J A	190
Donnelly, Mr R P	128
Doyle, Mr & Mrs	79
Edmonds, Mr	8
Elliott, Mrs V	138
Evans, Dr R N	14
Everest, Mr & Mrs	202D
Fancott, Mr H M	185
Flacks, Dr	3, 76, 94
Fletcher, Mr P J	67
Flint, Mrs R	189
Forbes, Mr & Mrs	10
Gaynor, Ms A	146
Gilbert, Mr C	47-12
Graham, Mr & Mrs	150, 226
Gunn, Mr S	47-13
Haggerty, Mr M H	138
Harris, Mr T A	66
Hey, Mr G	59
Hine, Mr P	103, 204
Holz, Mr J	135
Horne, Mr & Mrs G K & J	126C

	<i>Submission number</i>
Horsfall, Mr M	223I
Howe, Mr J	223J
Ilich, Mr C	223U
Inglis, Mr	29
Jarvis, Mr L	47-14
Jones, Mr N	223N
Jones, Mr G	202M
Keppel, Mr P	54
Lamb, Mr G	36
Lathwell, Mr P	155
Laws, Ms D	202H
Laws, Mr M	202G
Lesslie, Mr & Mrs D J	61, 187, 205
Liddiard, Mr & Mrs	1, 73
Lumb, Ms	188
Lyford, Mr B R	202K
Lyford, Mr M	202L
Maas, Ms J	202B
Maas, Mr G	202A
MacColl, Ms E	69
MacLean, Mr C	5
MacRae, Mr I	11
Mansell, Mr & Mrs G	90
Masters, Mr & Mrs P & S	112
Matson, Mr G	158
Maverick, Mr R	223R
McCaw, Mr L	34
McDonald, Mr J	33
McGowen, Mr B D	222
McKenna, Mr B	223
McKernan, Mr C	47-15
McLaren, Mr I	223B
Mead, Mr	15

	<i>Submission number</i>
Metcalf, Mrs H	157
Milhalj, Mr A	202F
Monday, Mr J	47-16
Morris, Mr P	47-17
Mullen, Mr J	47-18
Newbon, Mr A R	133
Noonan, Mr D	47-29
O'Connell, Ms	30
Opie, Mr N	131
Paratore, Mr M	223V
Perry, Mr D	223H
Phillips, Mr	9
Phillips, Mr B B	108
Pisano, Mr D	223E
Poor, Mr J	223F
Price, Mr L	47-19
Proct, Mr L	47-31
Ranzetta, Mr & Mrs G & P	156, 221
Reinsma, Mr J	202C
Reynolds, Mr S J	122
Roberts, Mr B	72
Roberts, Mr A	97B
Roberts, Mr & Mrs C	97A
Roberts, Mr T	47-20
Rosenberg, Mr M	68, 193
Ross, Mr	28, 111
Roux, Mr	6
Sasin, Mr M	102
Scantlebury, Mr M	47-21
Schnattler, Mr	19
Serafino, Mr G	47-22
Shaw, Mr R J	88, 206
Sheahan, Mr S	202N

	<i>Submission number</i>
Shell, Mr & Mrs B & W	137
Shields, Mr C	223S
Singh, Dr K R	53
Smith, Mr A	223G
Steffensen, Mr J	223P
Stephens, Mr I	223C
Sturges, Mr R	47-23
Summerfield, Mr T	145
Supardi, Mr R	223Q
Syczurowski, Mr S	223A
Tamigi, Mr J	223D
Tate, Mr S	47-24
Taylor, Mr B	223L
Telfer, Mr	25
Thibert, Mr A	171
Thurstan, Mr	4, 101
Trouyn, Mr B	47-30
Turner, Mrs	148
Urlings, Mr C J	107
Urlings, Mr	182
Van Beekum, Mr & Mrs	63
Ventrice, Mr C	47-25
Ward, Mr D J	48
Watkins, Mr R L	143
Wellwood, Ms	33
Whaling, Mrs J	126A
White, Mr H T	136
Widmer, Mr M A	153
Wilkinson Cox, Mr & Mrs	71
Wilson, Mr	2
Wilson, Mr K	223T
Winfield, Mr R	47-26
Winton, Mr C E	99, 184

	<i>Submission number</i>
Withnell, Ms E	202I
Withnell, Mr G D	47-27
Withnell, Mr G	202J
Wittenbaker, Mr W	223M
Wood, Mr T	47-28
Wooldridge, Mr B J	119
Wright, Ms S	139
Wylie, Mrs M	162
Zuccarino, Mr A	223K
Zwart, Mr & Mrs	13, 24

Educational Institutes

	<i>Submission number</i>
Edith Cowan University, Dr L Knight	7
Murdoch University, Prof P Newman	52

Business, Industry and Associated Organisations

	<i>Submission number</i>
Bullsbrook Volunteer Bush Fire Operations Brigade, Mr D J Moore	78, 198
Candlelight Farm Permaculture, Mr R Mars	87
Chamber of Automotive Industries of WA (Inc.), Mr C Osborne	175, 176
Chamber of Commerce & Industry of Western Australia, Mr M Taylor	235
Conservation Council of WA, Ms R Siewert, Dr P Jennings	18, 159, 209
Delta Heat, Mr S D Craig	129
Energy House, Mr B Siddons	125
Environment Centre of WA, Ms S Copeland, Ms Skinner	180, 231
Firesafe, Mr D Nicholls	132
Flo-Kleen Products & Balcatta Radiators, Mr J Palmer	211
Forest Industries Federation (WA) Inc, Mr C Kneen	116
Glen Forrest Volunteer Bushfire Brigade, Ms C Spatcher	166
Heat Charm, Mr G Davis	130
Heat Shops, Mr James	147
Institute of Foresters, WA Division, Mr D Spriggins	170

	<i>Submission number</i>
J.K. Williams & Co., Mr T Williams	151
Jarraah Firewood Co., Mr T Lucich	124
Jarrahdale Heating and Cooling, Mr T Clerk	140
Jet Set Life Technologies, Mr Apel, Mr Byng	23
Kara-Kara Stud, Mr N P Reynolds	98, 186, 201
Mundaring Volunteer Fire Brigade, Mr J Sobczyk Mr T Clear	115, 194
Oakford Firewood, Messrs MC & JH Rogers	163
Pollution Action Network, Dr S Graham-Taylor	20
Puraclene Products, Mr A C Clarkson	77, 93
Renewable Energy Network, Mr I Quail	117
Roofspan Industries (WA) Pty Ltd, Mr L Vose	154
Royal Automobile Club of WA Incorporated, Mr D Moir, Mr M Upton	183
Swan Region Operations Advisory Committee, Mr Pestell	26
Tiwest Joint Venture, Mr D J Charles	207
Top Link Pty Ltd - Western Recovery, Mr R Young	123
Transcom International Limited, Mr P Malone, Mr F Malone, Mr Middleton, Mr Noon	45, 174
Transport Action Coalition (TRAC), Mr A Petersen	40
Urban Energy, Mr B Milligan	120, 213
Wanneroo Woodyard, Mr G Trinket	168
Wattleup Citizen's Association Inc, Ms H Duggan	31, 210
Wellington Mills Volunteer Bushfire Brigade	55
West Swan Volunteer Bush Fire Brigade, Ms M de Winter	167

Local Government Authorities and Associations

	<i>Submission number</i>
City of Armadale, Mr D P Meyrick	86, 110, 195
City of Canning, Mr I F Kinner	82
City of Cockburn, Mr D Walsh	43, 121, 208
City of Fremantle, Mr D Nicholson	214
City of Perth, Mr C M Higham, Mr G G Hunt, Mr G J Ryan, Mr D J Paton,	58, 177, 237
City of South Perth, Mr Burrows	164, 169
City of Subiaco, Mr M Simms	85
City of Wanneroo, Mr C Hall, Mr M L Austin	74
City of Wanneroo, Mr R Fischer	196
Shire of Dardanup, Mr P S Jas	91
Shire of Donnybrook, Mr J Attwood	109
Shire of Manjimup, Mr G Lush	83, 127
Shire of Mundaring, Mr N I Williams	84
Town of Bassendean, Mr K Goldsworthy	165, 197
Town of Cambridge, Mr G D Partridge	96
Town of Claremont, Mr K Pond	174
Town of Kwinana, Mr R Sousa	56, 57
Town of Kwinana, Mr B Smillie	56, 57
Local Government Association of WA & WA Municipal Association, Mayor R Stubbs	86, 110

State and Federal Government

	<i>Submission number</i>
Australian Fire Authorities Council, Mr R J Sneeuwjagt	49
Bush Fires Board of WA, Mr G Pobar, Mr M Cronstedt	42
Chemistry Centre (WA), Dr Hosking	17
CSIRO, Mr J C Radcliffe	95
Department of Conservation and Land Management, Mr T Batten	47-32
Department of Conservation and Land Management, Mr R P Hagen	60
Department of Conservation and Land Management, Dr N Burrows	44
Department of Conservation and Land Management, Mr J Evans	75
Department of Conservation and Land Management, Dr S Shea	21, 50, 104

	<i>Submission number</i>
Department of Conservation and Land Management, Mr C Taylor	118
Department of Environmental Protection, Dr B Jenkins, Dr P Vogel	234
Department of Resources Development, Mr J Limerick	232
Office of Energy, Energy Innovation Division, Dr L Farrant	230
Main Roads Western Australia, Mr K C Michael, Mr R Drabble, Dr M Goldstone	38, 178, 227
Member for South Metropolitan Region, Hon Jim Scott, MLC	114
Ministry for Planning, Mr D Nunn, Mr Frewer	22, 200
Transport WA, Mr G Martin, Mr C Whitaker, Mr R McKellar, Ms K Stanley, Mr G Brown	39, 228, 229
Water Corporation, Mr R Nelson	220
Western Australia Police Service, Mr Hay	181

Summary of submissions received up to 30 June 1997.1. *R W Liddiard, The Vines*

- (a) Private and commercial vehicles with smoky (defective) exhausts are major contributors to Perth's air pollution. Current Smoky vehicle program is a band aid measure.
- (b) Supports the implementation of a Vehicle inspection system requiring all vehicles above a defined aged to be licensed as roadworthy. Automotive service providers to be licensed to carry out inspections and issue licences with required work to be carried out at the vehicle owners expense. Administration of the scheme to be self funding, and the responsibility for maintaining the vehicle remains with the vehicle owner.

2. *Mr N H Wilson, Woy Woy, New South Wales*

- (b) Has developed an apparatus called the magnetic well that produces energy from hydrogen. The magnetic well can be used as an energy source by injecting atomised water and gases into a magnetic field thereby transmitting the water molecules to eventually form helium and energy.

3. *Dr L M Flacks, Armadale*

- (a) Atmospheric pollution is the most vital issue affecting everyone. Personal experience of asthma attack occurring at the time of CALM burn off. Effects last days after the event. Considers these burn offs to be extremely dangerous and that they should stop. The meteorological advice even when taken is not entirely reliable.
- (b) Solid fuel heaters should be entirely phased out within three years. Cars should be banned from the city centre for at least two years, which would also encourage the growth of the taxi service. CALM fires to be stopped with alternative means to be found. Tobacco smoking to be banned entirely from public places.

4. *Mr B Thurstan, Nedlands*

- (a) Perth has a serious air pollution problem and that private urban motor vehicles is the largest and most toxic contributor. Curbing vehicle use and changing Perth's urban planning could lead to significant improvements in air quality.
- (b) Suggests that a moratorium on all major urban road developments be put in place. Redress the massive imbalance in transport funding by decreasing direct and indirect government spending on the private vehicle and increase in areas relating to walking, cycling and public transport. Stronger action is needed to counter the increasing ignorance of the law and general aggression of motorists towards pedestrians and cyclists. There are diminishing future returns to be gained from technological improvements to vehicles and therefore should not be relied upon as the immediate solution.

5. *Mr C Maclean, Cottesloe*

- (a) Perth has an air quality problem. Comparison to living in country area is that the children's bronchial problems have increased. Wood fires are a major pollution source and the problem needs to be contained.
- (b) Suggested phasing out by the year 2000 and that no new building should be approved with a wood fire. Fines for using wet wood or storing where it can get wet should be introduced. Rates on homes with wood fires with the surcharge funding environmental programs. Government subsidy for conversion to gas and electricity. Rebate for trading in a wood fire. Transport emissions also a major problem. Vehicle policing is inadequate for vehicles with excessive emissions. Government policies should encourage more use of bus and rail. Increase all day parking fees in the CBD. Increase truck charges. Continue strategies to optimise transport flow and enhance efficient transport. Air quality should be monitored. Universities to be encouraged to monitor pollution and quantify the savings from reducing pollution.

6. *Mr J Roux, Mandurah*

- (b) The Switzerland "Exchangeable Number Plate" program should be investigated. The motorist can drive two or more vehicles with the same number plate which is transferred from one car to the other. Motorist pays tax and insurances on the largest most powerful of the vehicles plus a small fee to cover the administration cost. Only one car can be on the road at any one time. This allows the motorist to have a large car for family recreation purposes, and a smaller vehicle for everyday use.

7. *Dr L Knight, Edith Cowen University*

- (a) Ongoing action is needed. Population is increasing rapidly and people travelling greater distances in private vehicles, new industrial sources are being established and there is an ongoing problem with wood fire haze both domestic heaters and CALM prescribed burns.
- (b) DEP to maintain emission inventory of all mobile and stationary sources, including CALM burns, and to be updated every 5 years. DEP to undertake speciated air quality monitoring. Vehicle emission inspection and maintenance program to be developed where vehicles are required to conform with the ADR guidelines. Integrated transport strategy to be developed that aims to reduce distance travelled in private motor vehicles and encourage cycling, walking and public transporting, and encouraging telecommuting. DEP to work with industry to implement clean technology and waste minimisation, and adopt a polluter pays approach to emission charges. Adequately fund the DEP and associated agencies to ensure that the work needed to improve air quality can be implemented.

8. *Mr S Edmonds, Port Kennedy*

- (a) Perth's air quality is progressively getting worse and poses more of a health problem. It is an urban and global problem. Motor vehicles are the biggest contributing factor. Burning off (CALM, private developers) are a smaller factor.
- (b) Burning off by developers should be banned. Frequency of CALM prescribed burns to be reduced. Fossil fuels are not being used efficiently in the motor vehicle engines and or emission vehicles are the only medium to long term solution to improving Perth's air quality.

9. *Mr B B Phillips, Duncraig*

- (a) Government needs to impose positive controls over the use of all wood burning heaters in use in all urban areas, in much the same way that the use of backyard incinerators was controlled. Residents should not be allowed to inflict smoke and odour on neighbours.
- (b) Suggested a total ban on the use of all types of wood burning heaters, or the introduction of restricted times for use. Assistance to be provided in cases of hardship to install alternative heating appliances, such as natural gas.

10. *KM & EE Forbes, Mt Barker*

- (a) The need to improve Perth's air quality should not be to the detriment of those living outside the metropolitan region. Prescribed burning is relied upon to ensure that the area is maintained in a manageable fire hazard situation. Continuing controlled burns is vital.
- (b) There should be no reduction in the amount of burning carried out in the southwest of the State

11. *Mr I MacRae, West Leederville*

- (a) Perth's air quality has deteriorated when it should not have, but it can be improved even if the population continues to grow. Issues of concern include, ozone, particles, greenhouse gases. Vehicle emissions need specific targeting. No person has the right to pollute the air of another. The benefits to air quality from influencing urban form need to be balanced against the benefits of a low density lifestyle.
- (b) Introduce free or inexpensive compulsory vehicle emission testing. Introduce on the spot fines for trucks, buses and cars that have visible emissions. Provide vehicle owners with incentives to trade in pre 1986 vehicles, or to have catalytic converters fitted. Regulate wood heater design to minimise emission potential. Monitor CALM's prescribed burning activities.

12. *Mr F A Colyer, Australind*

- (a) Fire in the natural environment is essential for the survival of native plants and animals, and is also essential to help Bush Fire fighters. CALM has refined its burning regime, and the continuation of the burning regime is required if the bushfire experienced in Karridale and Dwellingup in 1961 are not to be experienced again.
- (b) There should be no radical modification or change to CALM's current burning regime.

13. *Mr & Mrs Zwart, Kirup (including submission 24 also)*

- (a) Smoke from home chimneys and fumes from cars and trucks are the key areas to be considered for solving smoke haze problems over Perth. CALM is wrongly blamed for causing this problem. As a resident living adjacent to a forested area, the prescribed burning regime carried out by CALM and the Volunteer Bush Fire Brigades is fully supported.
- (b) More research needs to be carried out on the effects on the atmosphere from wood burning heaters, vehicle exhausts and industry emissions.

15. *R D Mead, Byford*

- (a) The quality of Perth's air is decreasing. As an asthmatic, has noticed that car exhaust and smoke from smouldering home and garden fires burning green wood or refuse triggers bouts of asthma, but has not experienced this when being exposed to smoke from prescribed burns. fumes. The ability to carry out prescribed burning should eliminate the need for the community to be exposed to smoke from bushfires.
- (b) Need to upgrade the availability of public transport (location and frequency) using more buses and to provide security on the train at nighttime. Backyard burning of waste should be banned with provision made for the mulching of woody material at refuse disposal sites. Future industry with potential to pollute should be located away from the Perth metropolitan region. Research into air circulation and dispersion of pollutants needs to continue.

16. *Mr T Clark, Kensington*

- (a) Wood heaters have contributed to the deterioration in Perth's air quality. During winter the neighbouring area is smokey. Family members have experienced sore eyes, headaches and nausea thought to be linked to this smoke. Person experience over the last six years indicates that relying on people to use wood heaters correctly is fruitless. Stronger requirements are needed.
- (b) Ban the use of wood heaters (incinerators have been) and both are a source of smoke. Inspection and certification to be provided for the installation of heaters and flues. Stricter guidelines to be introduced on approved materials that can be used in a wood heater. A reporting method for wood heaters causing a smoke problem.

17. *Chemistry Centre (WA), Dr J W Hosking*

- (a) The adsorption of toxic pollutants onto airborne particles is a key area needing further investigation in Perth. Preliminary studies carried out at the Chemistry Centre indicate the possibility of atmospheric pollutants including sulphur dioxide, hydrogen cyanide, PAHs, ketones and other VOCs adsorbing onto airborne particles, which could be a pathway to more serious effects.
- (b) Initiate local research to characterise the nature of the adsorbed chemical species on common air-borne dusts in the Perth metropolitan region.

18. *Conservation Council of Western Australia Inc, Ms R Siewert*

- (a) Receive many complaints from the community on haze, smog and lead levels. Government to date has failed to adequately deal with the air quality issues. Concerns include vehicle emissions, conducting prescribed burns during periods of smog and haze, monitoring of air toxics, the health effect of air pollution and the expansion of the Kwinana industrial area. Copy of *Policy No 46 Air Pollution* provided.
- (b) Uniform national air quality standards are supported. Suggests the development of an air quality management plan, including additional monitoring and publishing of results. Introduction and enforcement of standards for vehicle emissions and wood burning heaters. Stop the construction of major city roads and allocate this money to the development of cycle ways and public transport. Introduce regular vehicle inspection and control smokey vehicles and trucks. Educate the public about smog and haze. Reformulate fuel and provide incentives for old vehicles using leaded fuel to be scrapped.

19. *Mr F F Schnattler, Doubleview*

- (a) Influencing the community's attitude will be the key to addressing Perth's air quality.
- (b) Extend and strengthen the public transport service with a higher level of quality. Every residential home should have a solar hot water system as part of council By-Laws. Active and passive solar technologies should be facilitated by the design of new buildings and homes.

20. *Pollution Action Network, Ms S Graham-Taylor*

- (a) Main concerns are a lack of State Government response to climate change issues, health effects and the lack of local expertise and Perth based research, lack of air quality monitoring in the metropolitan region and the south west, prescribed burning carried out during unfavourable meteorological conditions, the possible danger from indoor air pollution, the amount of funds being spent on road projects, the proposed expansion of the Kwinana industrial area and the absence of legally enforceable air quality standards in the metropolitan region other than those established for the Kwinana area. Support the development of an air quality management plan that involves the community and local government authorities.
- (b) Suggestions include air quality considerations being incorporated into the planning process and as an integral part of planning and transport policies, increase funding to the development and promotion of public transport which could be part funded from the fuel levy, introduce vehicle emissions testing for vehicles older than 10 years, random road side emission testing and spot checks, reformulation of fuel to lower sulphur content, the functions of Main Roads WA to become a part of the Department of Transport, burning of coal at the Kwinana Power Station to be phased out, and the establishment of an air quality monitoring station on Garden Island.

21. *Department of Conservation and Land Management, Wanneroo, Mr J McKenzie*

- (a) Supports the Australian Fire Authorities Council's *Position on managing smoke during prescribed burning*. Fire prevention and saving lives is far more important than the slight inconvenience to the public which occurs on only a few days when smoke is apparent over the urban sprawl. Since fire is natural, man caused pollution and the dirtiness of it are far more health debilitating than the clean smoke produced by most bush fires whether wild or controlled.
- (b) Need to finger print the smoke source as CALM is not the only agency that creates smoke. If the Government bans prescribed burning it should do likewise for burning on private property and limit vehicle movements and home heating as well.

22. *Ministry for Planning, Environmental Planning, Mr D Nunn*

- (a) The draft *State Planning Strategy* determines that the impact of population growth be managed rather than curtailing growth. Polluter pays principle should apply to the emissions from individual vehicles and wood heaters. Future trend is for growth in population, vehicle numbers and emissions.
- (b) The draft *State Planning Strategy* recommends that an air quality monitoring network be maintained with strategies developed to address pollution from the burning of vegetation, wood heaters and vehicles, legislation to adopt higher emissions control for motor vehicles, introduce higher levels of emission control in the south west urban system, to prepare a develop a predictive air quality model, and to develop a Metropolitan Transport Environmental Strategy. Encourage the removal of old vehicles from the WA fleet. Adopt vehicle emissions checking and testing.

23. *Jet Set Life Technologies, Mr G Byng & Mr R Apel*

- (a) The Perth Photochemical Smog Study has shown Perth to experience levels occasionally that exceed guidelines
- (b) Suggestions include improving the chemical content of unleaded and diesel fuel, improving the efficiency level of catalytic converters in older vehicles, bringing about greater use of public transport, car pooling, dedicated cycling lanes, investigating emission reduction and fuel saving technologies and addressing industrial emissions.

25. *Mr B M Telfer, Mundaring*

- (a) When forecasted conditions are suitable, hazard reduction burning should be undertaken to protect community values and our bush environment, due to forest litter layer buildup which does not break down rapidly. Hazard reduction burning is a necessary tool to reduce the effects of damaging wild fires.
- (b) Acknowledges the need for authorities to use weather conditions wisely, however, the population of Western Australia should accept some haze from time to time if conditions are incorrectly forecast, or a hazard reduction burn is essential. Would ask the Committee to assess the number of respiratory complaints resulting from the NSW bushfire disaster of a few years ago. Were there any increases over the normal levels?

26. *Shire of Swan, Swan Region Operations Advisory Committee, Mr A J Pestell*

- (a) Group supports air pollution control while recognising the need to ensure that forest fuel loading management is an essential part of fire protection. Fire hazard reduction by burning is a logical and necessary operation to provide a reasonable level of safety to the community and the firefighters. These burns also provide essential training to ensure we understand potential wildfire behaviour to ensure we can achieve the best results at major fire disasters.
- (b) Retain current controls.

27. *Automotive Preventative Maintenance Systems, Mr P R Coniglio*

- (a) Business is dedicated to the reduction of emissions from diesel powered vehicles, through the use of a cost effective fuel system and soot dissolution service. Awareness of vehicle emission servicing needs to be heightened, especially with diesel powered vehicles, due to the fact that motor vehicles are the second largest contributor to the winter haze and emissions from diesel powered vehicles comprise approximately two thirds of the particle contribution from all motor vehicles.
- (b) Improve community understanding and awareness of the importance of vehicle emission servicing, especially of diesel vehicles.

28. *Mr W Ross, Perth*

- (a) Perth's air quality is deteriorating year-round - in winter, smoke from wood fires lingers at ground level; in spring, smoke from CALM's prescribed burning regularly is blown over Perth; and between October and

April, the buildup of motor vehicle emissions results in a level of photochemical smog which exceeds National Health and Medical Research Council and World Health Organisation recommendations on a growing number of days per year. Also details the components of vehicle induced air pollution, and health effects of vehicle-induced air pollution.

- (b) Need to address those sectors which are the major cause of air pollution. Recommends a preventative approach, aimed at limiting traffic growth. Suggests - mass transit and car pooling on large scale; assess major road projects for possible side-effects, including deteriorating air quality, increased congestion and social impacts.

29. *Mr B Inglis, Wanneroo*

- (a) Forest Officer with CALM and supports the need for air pollution control. However, it is paramount that the Committee understands the fuel reduction burning is a major component of successful wildfire suppression in this State.
- (b) Considers it of utmost and paramount importance to retain strategic hazard reduction burning in this State.

30. *Ms M O'Connell, Duncraig*

- (a) Has noticed smutty grey-brown haze tinged with yellow over Perth, and the deterioration over the last 20 years as the population has grown. Is concerned with the detrimental effect on human health.
- (b) Suggests looking at best practice and developing a policy and principles for overall improvement; starting an awareness campaign, similar to water conservation; inviting industry to put forward proposals for self regulation; and implementing strategies without delay.

31. *Wattleup Citizens' Association Inc, President Ms H Duggan*

- (a) Group considers that adding more industry to the metropolitan region shows shortsightedness on the part of planners. Rather than compounding the existing problems, new industrial developments must be sent to regional industrial areas. The "development at any cost" attitude is not acceptable.
- (b) Suggests the Fremantle/Rockingham Industrial Area Regional Strategy (FRIARS) be scrapped as it puts forward proposals to increase heavy industry in the Kwinana Industrial Area and to industrialise the air quality buffer zone. Decentralising the location of industry, and increase the accountability of industries.

32. *Bicycle Transportation Alliance Inc, Convenor Mr R Stallard*

- (a) This group believes the aim is to protect and enhance the environment by advocating the increased use of personal transport and recreation in lieu of motorised vehicles given the advantages of bicycles in terms of - reduced air pollution; increased energy efficiency; lower noise emissions; reduced land requirements; and ecological sustainable. It is clear that radical changes in thinking, policy and funding are required if we are to address the problems of air pollution attributable to car usage. Unbridled growth in traffic is untenable and decisive action is required.
- (b) Change Government policy and funding to reduce air pollution attributable to the use of motor vehicles.

33. *Mr J McDonald & Ms H Wellwood, Floreat Park*

- (a) Expecting first child and consider that Perth's poor air quality is one of our most serious and all pervading environmental problems.
- (b) Would like the Committee to include measures which include education so that people cannot complain that they did not know the gravity of the situation when they are forced to comply with new regulations.

34. *Mr L McCaw, Manjimup*

- (a) Is concerned with the air quality in the Perth region and in particular, the issue of contribution of smoke from bushfires and prescribed burning. Suggests smoke management is a regional issue and the application

of stringent restrictions on smoke from prescribed burning will inevitably impact upon the use of fires as a tool in agriculture and forestry. This could have serious and economic consequences for the State.

- (b) The views of rural communities, local authorities and land managers to be sought before proposing any new legislation that may restrict the prescribed burning.

35. *Mr R Cowley, Forrestfield*

- (a) Industry and smoke from wood heaters and fireplaces and firewood, and open burning are the main contributors to pollution. Submission includes various articles from newspapers and other references.
- (b) Suggests - guidelines be provided for the appropriate use and maintenance of wood heaters, fire places and chimneys; CALM's prescribed burning activities to be conducted when weather conditions are appropriate; industry should be subject to strict controls and if cannot comply then should be shut down until the problems are fixed.

36. *Mr G N Lamb, Dwellingup*

- (a) CALM employee (forester) who considers the importance of maintaining a manageable balance between the necessity to carry out fuel reduction burning and air quality. Smoke created from prescribed burning will always be a problem to the heavily populated areas of Perth.
- (b) Recommends a sensible and well managed controlled burning regime under mild and well researched conditions, as used by CALM.

37. *Ms J Barnett, Pemberton*

- (a) Pemberton resident concerned with dangers of fire, and that controlled burns of the forest areas are a necessity.
- (b) There should be no change or restriction on CALM's burning activities.

38. *Main Roads Western Australia, Commissioner of Main Roads K C Michael*

- (a) Submission considers the most appropriate transport control options for reducing air pollution. Covers a wide range of air pollution issues, including greenhouse, regional air pollution (ozone and haze), local air pollution (carbon monoxide, nitrogen dioxide and lead) and air toxics (benzene, 1,3-butadiene, oxygenated compounds and polycyclic aromatic hydrocarbons). Roads will continue to be the backbone of transport in Perth, and the issues of congestion relief, network efficiency and maintenance cannot be overlooked when considering air quality issues. Photochemical smog strategies should focus on reducing hydrocarbon levels, particularly from vehicle exhausts and evaporation. Haze management should focus on the direct contribution of diesel emissions to haze levels. Copies of Main Roads Western Australia's draft strategies documents provided.
- (b) Suggests that - an integrated transport system be developed that takes into account land use planning options and transport options; reduce the number of vehicles on the road network during congested periods by increasing car pooling and the use of public transport, and encouraging more walking and cycling and persuading people to travel during off-peak periods, and the use of intelligent transport systems; introduce in-service vehicle emissions testing and maintenance programs where testing in the least form could be requiring a receipt at the time of re-registration to prove servicing has been carried out; introduce a buy-back scheme to accelerate the benefits of new emission control standards in vehicles on the road; education program to encourage vehicle owners to replace fuel caps regularly to prevent evaporative emissions; introducing phase I and II vapour recovery at fuel stations; introduce new diesel engine standards that are world's best practice for new vehicles.

39. *Department of Transport, Acting Director General of Transport Mr G Martin*

- (a) Transport is vital to Perth, and Perth needs an accessible and equitable transport system to support urban life, an efficient transport system to meet industries' needs, and a system that is environmentally responsible and sustainable.

- (b) Need to make planning decisions on the basis of social, economic and environmental sustainable. Need to reduce total vehicle use by- decreasing travel distances, increasing the range of efficient transport options and providing improved access through electronic communications. Improve vehicle emissions technologies including alternative fuels and zero emission vehicles. Reduce and manage traffic congestion but not necessarily by increasing the amount or capacity of the road network. Promote non-motorised travel by improving cycling and pedestrian facilities and adopting medium and high density mixed use residential and business areas. Plan for long term sustainable in land use allocation. Ensure road network efficiency by minimising peak period road demand, implementing travel demand management and coordinating transport policy with long term planning.

40. *Transport Action Coalition, Convenor Mr A Peterson, Mr M Hingston*

- (a) The building or extension of major highways will contribute to the generation of photochemical smog and other air borne pollutants that are implicated with asthma and other health problems. All transport projects should aim to improve air quality and reduce greenhouse gas emissions. Immediate controls for photochemical smog are required. Enclosed copy of Stanley J, Armstrong G and Buxton M (1997) Green Cities in *National Economic Review*, March 1997.
- (b) Need to balance mode of transport with an emphasis on passenger rail in the south west metropolitan region. Strengthening of emission standards for all vehicles. Moratorium on the construction of new highways and extensions until epidemiological studies have been completed on the impacts of photochemical smog on human health. Develop a new site for industry. Introduce mandatory regulations that prevent CALM from carrying out prescribed burns close to Perth during meteorological conditions that don't assist smoke dispersion.

41. *E J Hatherley*

- (a) Supports CALM's prescribed burning policy. Smoke from fires is a relatively minor issue compared with the protection from the threat of wild fires to life, property and flora and fauna.
- (b) Do not restrict CALM's prescribed burning activities further.

42. *Bush Fires Board of WA, Fire Safety Officer - Policy Development, Mr M Cronstedt*

- (a) The need for protection of life and property must be carefully balanced against the avoidance of potential low level smoke accumulation in urban areas. The provision of smoke accumulation advice to fire agencies and Local government authorities and their brigades should improve air quality.
- (b) Do not restrict the provisions for prescribed and controlled burning activities.

43. *City of Cockburn, Manager Environmental Services, Mr D Walsh*

- (a) Air quality issues affecting the City of Cockburn include - the impacts of the Kwinana industry and the restraints on development resulting from the buffer zone in place; odour and smoke complaints; and smoke and dust from development sites.
- (b) Need for - ongoing implementation of best practice pollution control and reduction of pollutant emissions in the Kwinana industrial area; development of efficient passenger rail links to the south west corridor; improved mechanisms for Local government to resolve local air quality complaints particularly those of smoke form wood heating; improved mechanisms under the *Environmental Protection Act 1986* for the resolution of odour complaints; and improved controls and enforcement action where smoke and dust arises from development sites.

44. *Department of Conservation and Land Management, Director Science and Information Division, Dr N D Burrows*

- (a) Fire is a natural environmental factor in WA ecosystems. It is not a question of whether or not have to have prescribed burning but an issue of when, where, how much and how often. The community needs to accept

that smoke will occur from time to time, and that CALM is attempting to minimise the chance of smoke drifting over the city area.

- (b) Action needs to be taken to address other sources of air pollution, such as smoke from wood heaters and vehicle emissions.

45. *Transcom International Limited, Group Managing Director, Mr P Malone - and 179*

- (a) Increasing the use of natural gas as an alternative transport fuel needs to be an integral part of the Government's sustainable energy and environmental policies. The use of natural gas as an alternative fuel will generate economic, environmental and social benefits.
- (b) State Government purchasing policies should require the purchase of natural gas fuelled vehicles for public transport and government agency use.

46. *Mr P Chadwick, Walkaway*

- (a) Leaded petrol causes health dangers and vehicles using leaded petrol should no longer be on the road. More community information needs to be given in the use of alternative power sources and making buildings more energy efficient.
- (b) Eliminate leaded petrol from the market within 10 years. Develop By-Laws and increase funding to support greater energy efficiency in buildings and use of renewable energy sources, in both the domestic and industrial arenas. Increase penalties for causing pollution and increase the inspection provisions for industrial sites. Ban wood burning and subsidise solar powered water heating.

47. *Form letters (parts 1 to 32) J B Allen, Collie; K D Bennett, Collie; Ms C Brucx, Collie; W G Buchanan, Bunbury; C Chapman, Collie; I R Charchalis, Harvey; G A Cole, Harvey; Mr P Conlan, Collie; M E Croxford, Brunswick; G J Davidson, Australind; Mr C Delaporte, Harvey; C Gilbert, Collie; Mr S Gunn, Collie; Mr L Jarvis, Bunbury; Mr C McKernan, Harvey; Mr J Mowday, Eaton; Mr P Morris, Park Field; Mr J Mullen, Harvey; Mr L Price, Collie; Mr T Roberts, Myalup; Mr M Scantlebury, Eaton; Mr G Serafino, Harvey; R Sturges, Collie; Mr S Tate, Collie; C Ventrice, Harvey; Mr R Winfield, Collie; G D Withnell, Harvey; Mr Dovel, Harvey; Mr D Noonan; B Trouyen; L Proct; Mr T Batten, Harvey.*

- (a) Even though smoke from CALM's burning activities may affect Perth under certain weather conditions, these burns must continue in order to protect life, property and forest values. The smoke is a small inconvenience for Perth residents when you consider the devastation, destruction and financial losses to communities and the State when areas are ravaged by bush fires.
- (b) Retain CALM's fuel reduction burning program without further restrictions.

48. *Mr J Ward, Roleystone*

- (a) Fire and smoke are natural to our environment, and most of Perth's air quality problems are due to the internal combustion engine, not smoke from CALM's burning activities.
- (b) Retain CALM's fuel reduction burning program without further restrictions.

49. *Australian Fire Authorities Council, Vice President, Mr R Sneeuwagt*

- (a) Fire and smoke are natural to our environment, and the forest and woodland ecosystems are reliant on fire for the maintenance of ecological processes. The safety, welfare and economic interests of rural communities and industries must be given consideration in any proposal to change the burning policy. The occasional inconvenience to the public of low smoke haze must be compared with the high probability of increased incidences of large, destructive fires that produce vast quantities of smoke. Enclosed copy of the Australian Fire Authorities Council's *Position on Managing Smoke During Prescribed Burning (March 1996)*.
- (b) Retain CALM's fuel reduction burning program without further restrictions. Compare the relative risks associated with current practices and exposures of the Perth community to fire related haze levels, and those

associated with changes in (reducing) fire management practices (increases wildfires) by conducting a risk assessment.

50. *Department of Conservation and Land Management, Executive Director, Dr S Shea*

- (a) Outline of smoke management guidelines and procedures adopted by CALM, the relationship of smoke from hazard reduction fires to the occurrence of haze and photochemical smog, and enclosed a variety of information supporting the submission. The contribution of fuel reduction burning to the safety and welfare of the community and their assets, and natural resources has proven to be outstanding. Any further tightening of the air quality controls or limiting the opportunity for CALM to achieve an effective fuel reduction program will result in dire consequences to community safety, forest management and air pollution from intense summer wildfires.
- (b) Retain CALM's fuel reduction burning program without further restrictions.

51. *Mrs V McDonald, East Busselton*

- (a) Smoke from wood heaters and fires makes the air polluted and as a person who has respiratory problems, the smoke makes the situation worse.
- (b) Improve community education to ensure chimneys are left clean and that only dry wood is used.

52. *Professor P Newman, Professor of City Policy, Murdoch University*

- (a) Information presented is based on the data collected by the Sustainable Transport Research Group, examining vehicle emissions, and places Australian urban air emissions in the international context and their relationship to transport and land use, considers the international trends and provides a perspective on the economics of car dependence.
- (b) Recommended - requiring better vehicle inspection and tightening of regulations on acceptable emissions particularly from older vehicles; simultaneous improvement in the community's access to employment centres and urban services so that use of the private car is not relied upon; reurbanisation of areas; and need for road planning to be fully integrated into transport planning where consideration is given to land use and environmental planning.

Summary of submissions received after 30 June 1997 (but not referencing the discussion papers).

53. *Dr Kunwar Raj Singh, Tourism Development Consulate, Templestowe, Victoria, NSW*
- (a) Poor air quality may have a negative impact on Perth being able to attract the growing tourism business.
 - (b) Ensure planning for the future considers growth of industry, business and the population without a growth in air pollution.
54. *Mr P Keppel, Manjimup*
- (a) Prescribed burning is needed, and it is not the only contributor to air pollution.
 - (b) Retain CALM's fuel reduction burning program without further restrictions, and give full consideration to all sections of the communities, including country areas.
55. *Wellington Mills Volunteer Bushfire Brigade*
- (a) Fire and smoke are natural to our environment, and most of Perth's air quality problems are caused by industry, motor vehicles and poorly managed home heating fires, not smoke from CALM's burning activities.
 - (b) Retain CALM's fuel reduction burning program without further restrictions.
56. *Town of Kwinana, Chief Bush Fire Control Officer, Mr R Sousa*
- (a) Plans are being developed to conduct necessary fuel reduction burns under the climatic conditions that will minimise pollution.
 - (b) Retain CALM's fuel reduction burning program without further restrictions.
57. *Town of Kwinana, Chief Executive Officer (Mr B Smillie)*
- (a) The complex association of legislative provisions within the *Environmental Protection Act*, the *Health Act* and the new *Local Government Act* means that no one agency has a clear mandate for action and there is no coordinated method of addressing the air quality problems in Perth.
 - (b) Suggests that - State Government should ensure funding of further studies to better quantify the emission sources of NOX and ROCs, and that modelling of the Perth shed continues. Review the need for periodic or random vehicle emission testing. Emphasis should be placed on urban planning strategies including encouraging greater use of electrified public transport, increasing residential densities along side public transport routes, nodes and interchanges.
58. *City of Perth*
- (a) The City is involved in a number of projects that will facilitate the improvement in Perth's air quality including the *Central Perth Parking Policy Review 1996*, the *Draft City Planning Scheme II*, supporting inner city living developments, the *Central Area Transit System (CATS)* and the preparation of a draft plan for *Access to the City For People*, allocation of week day car pooling bays in two city car parks, the *Travel Smart Trial* and the preparation of the *City Environmental Management Plan*.
 - (b) The Committee needs to address metropolitan land use and transport planning and subdivision development to reverse trends towards longer trips, and to investigate strategies that reduce haze problems that detract from the city's appearance and tourism values.

60. *Department of Conservation and Land Management, Regional Fire Coordinator Southern Forest Region (Mr P Hagan)*
- (a) The recent escalation in the reported concern about Perth's air quality has had a significant and detrimental effect on CALM's ability to manage forests of the south west. It is the communities' wish that prescribed burning is planned to provide a range of outcomes including minimum environmental and visual disturbance. Any reduction in prescribed burning activities will place increased reliance on the fire preparedness and suppression capabilities which is likely to result in fires that are difficult and dangerous to control.
 - (b) Suggests management of - the level of motor vehicle use; the level of maintenance of motor vehicles; the level of use of public transport and planning for public transport systems; and methods and options for domestic heating must be looked at.
68. *Mr M Rosenberg, Murdoch*
- (a) Submission emphasises the contribution of vehicle emissions to air quality and that road transport is the major contributor. Motorists do not pay the full costs of air pollution or the infrastructure to support the use of the vehicle. Use of public transport is a more efficient means of moving people around.
 - (b) Suggestions include - road toll for the use of the Northbridge tunnel; make less parking available in the city centre to encourage greater use of public transport; promote the use of buses and the cost and time savings; introduce competition to the public transport system; legislate for non-polluting vehicles to be in use by the year 2005; allocate 5% of petrol tax to the investigation of alternative non-polluting means of transport; and remove the car allowance to senior executives particularly in the Department of Transport.
75. *Department of Conservation and Land Management, Regional Fire Protection Officer Southern Forest Region, Mr J Evans*
- (a) The reduction or manipulation of CALM's burning program is not the answer to smoke accumulation problems in Perth. The problem is primarily vehicle and industrial emissions with smoke from CALM ad private burning operations being a minor component.
 - (b) Prescribed burning must continue to be undertaken without serious constraints. Suggest that Government puts in place a computer based car pooling register; reassess air quality standards to reflect Perth's special needs; implement a comprehensive public education program to reverse some of the incorrect and irresponsible distortion of the facts about prescribed burning based on video and printed material for curriculum and public information and a media campaign.
80. *Mrs T Bagini, Embleton*
- (a) Vehicle emissions are of greatest concern.
 - (b) State Government to lobby the Federal Government to make bus fares for transit to and from the work place to be tax deductible as it is an expense incurred against earnings. Improve public transport links to the industrial areas, similar to the old "Clipper" service that operated in the Perth central area.
83. *Shire of Manjimup, Manager Environmental Services, Mr G Lush - also 127*
- (a) Invitation to the Committee to visit the south west forest region surrounding Manjimup to gain an appreciation of the value of CALM's prescribed burning activity.
84. *Shire of Mundaring Bush Fire Advisory Committee, Chief Executive Officer, Mr M N Williams*
- (a) The Bush Fire Advisory Committee is constitutes as an advisory to Council on all matters relating to prevention, controlling and suppression of bush fires within the district of the Shire of Mundaring. Committee supports air pollution control while recognising the need to ensure that forest fuel loading management is an essential part of fire protection.
 - (b) Use of fire as a control and management measure should continue without further constraint.

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91. *Shire of Dardanup, Manager Finance & Administration, Mr P S Jas*
- (a) There are dangers in adopting a “no burn policy”.
 - (b) The Committee to consider the safety of all fire fighters be considered along with any consideration of smoke from burning activities.
95. *CSIRO Australia, Environment and Natural Resources, Deputy Chief Executive, Mr J C Radcliffe*
- (a) The community consistently ranks urban air quality as the number one environmental concern, and that the primary cause of this poor air quality is the conjunction of emissions from motor vehicles and occasional adverse meteorological conditions.
 - (b) Suggestions include - the continuation and support for air quality monitoring should be a priority; support for the proposed National Pollutant Inventory should be a priority; research must continue into the study of human exposure to air pollutants, particularly that of exposure to PM_{2.5}, detailed daily forecasts of air quality (suburb by suburb) should be provided by the Bureaus of Meteorology; introduce new “clean” motor vehicle technologies over the next 5 to 15 years; support the introduction of effective particle emission controls on passenger and commercial diesel vehicles and reduce sulphur content in the diesel so that the efficiency of catalysts can be achieved.
98. *Mr N P Reynolds, Armadale*
- (a) Vehicle emission are a major contributor to poor air quality and is as much a function of commuting behaviour as is the technological standard of vehicle and engine design.
 - (b) Suggestions include - staggering the start and finish time for workers in the city; require regular checks of fuel quality; and regular checks of vehicle operating condition.
109. *The Shire of Donnybrook Balingup, Chief Executive Officer, Mr J Attwood*
- (a) Fire is a major threat to rural communities and therefore prescribed burning activities are essential.
 - (b) The Committee should give consideration to rural community needs and safety when considering actions about air quality.
112. *Mr P M Masters, Walpole*
- (a) The constraints currently placed o CALM are too sever and are placing threats on the safety of fire fighters and the community. There appears to be no restriction on the smoke and fumes emitting from the Kwinana industrial area and from Perth’s aging vehicle fleet.
 - (b) There should be no constraints on the prescribed burning activities.
117. *The Renewable Energy Network WA, Convenor, Mr I Quail*
- (a) Community based network that promotes the use of renewable energy and energy conservation, and believes that changes need to be made now to change the unsustainable consumption patterns and production methods.
 - (b) Recommendations include - Government policy to favour the use and development of less polluting renewable energy options; change the Building Codes of Australia to require energy efficient design measures as a standard; control urban sprawl by encouraging the consolidation through economically viable public transport; and provide economic incentives to purchasers of energy efficient vehicle; introduce a carbon tax; restrict cars from entering the city centre by issuing parking permits.
118. *Department of Conservation and Land Management, Manjimup Division, Mr C P R Taylor*
- (a) Prescribed burning is needed, and it is not the only contributor to air pollution. Copies of poems provided.

- (b) Retain CALM's fuel reduction burning program without further restrictions, and give full consideration to all sections of the communities, including country areas.

153. *Mr M A Widmer, East Victoria Park*

- (a) Perth's visible air pollution has increased dramatically over the last few years, mainly because the city has become too large.
- (b) Suggestions include - managing the spread of the city; Government to encourage people to use alternative heating devices to wood heaters and fire places; run education campaigns on the pros and cons of gas, air conditioning or wood; Councils to offer a rates reduction where less polluting heating sources have been adopted; building guidelines to require all new homes to be built with insulation and or gas ports fitted; fire places should be subject to Australian Standards for design and operation; buses and trains should run more frequently particularly at night; diesel vehicles should be banned in the smaller vehicle range and four wheel drives unless actually being used for this purpose; construct more cycle ways and revise the mandatory laws on wearing helmets.

166. *Glen Forrest Volunteer Bushfire Brigade, Secretary, Ms C Spatcher*

- (a) Controlled burning is a valid activity in the Brigade for the purposes of protecting the lives and property of residents in the area. No other method of fuel reduction is possible in the area without devastating the environment
- (b) Controlled burning should continue.

172. *Australian Institute of Environmental Health, State President, Mr O Ashby*

- (a) Domestic wood heaters are not an appropriate form of heating to be used in densely populated urban areas, and the use of such should be progressively phased out.
- (b) Issue needs to be tackled at a State level by incorporation of an Environmental Protection Policy under the *Environmental Protection Act 1986*. If Environmental Health Officers employed by the local government are expected to manage and deal with the issue of smokey domestic wood heaters then they should be empowered, either by delegation of authority under the *Environmental Protection Act 1986* or through revisions of the *Health Act 1911*.

Submission summary - Discussion Paper 1 - Smoke emissions from homes (September 1997)

Submission numbers: 59, 61, 62, 63, 64, 65, 67, 69-74, 76, 77, 79, 82, 85, 86, 87, 88, 89, 90, 92, 93, 96, 97, 99, 100, 102, 103, 106, 107, 108, 113, 114, 116, 119, 121, 122, 124, 125, 126, 128- 151, 154, 155, 156, 157, 158, 159, 160, 161, 162, 163, 164, 165, 168, 169, 171-174, 177, 180, 185-192, 202, 205, 210 & 234.

	<i>99 submissions</i>	<i>Agree</i>	<i>Disagree</i>
<i>Educational Strategies</i>			
1.	Implement an education campaign for the community, including brochures, to inform the public on how to use their heaters correctly. This information needs to focus on what to burn, how to burn, how to store wood correctly.	42	0
2.	Develop or improve guidelines and procedures for the correct use and maintenance of wood combustion heaters. Councils to provide buyers of homes with wood combustion heater user guidelines for the correct use and maintenance of the wood combustion heater.	30	3
3.	Implement an education campaign aimed at sellers and installers of wood heaters, focussing on flue height design and positioning, and the advantages of units complying with Australian Design Standards.	33	1
4.	Develop or improve wood selling, wood purchasing and wood storage guidelines.	33	2
5.	Implement education programs about haze creation and prevention, similar to the Waterwise campaign. Particular emphasis should be placed on school based programs.	33	8
6.	Develop guidelines for the correct use of backyard BBQ's.	19	8
7.	Implement voluntary "no burning" days and nights when the weather forecast suggests conditions are likely to produce haze, such as the "Don't light tonight" campaign operating in Sydney.	21	10
8.	Implement a major education campaign focussing on energy efficient design for buildings, including houses. Target audience would need to include builders, architects and education system.	35	4
<i>Technical Strategies</i>			
9.	Provide green waste collection and mulching services as an alternative to burning waste in the backyard.	35	4
10.	Improve wood heater design to achieve optimum burning environment and to reduce pollutant generation potential.	31	2
11.	Provide the technical support, including data on Australian Design Standards and best design and installation parameters, to sellers and installers of wood heaters.	31	2
12.	Ensure that sellers have access to the newest and cleanest wood heaters.	29	2
13.	Encourage the use of suitable fuel substitutes, such as the use of compressed fuel logs as sold at Bunnings.	22	10
<i>Regulatory Strategies</i>			
14.	Ban the selling and installation of new wood combustion heaters (phase in by winter 1998, or within three years).	11	58
15.	Phase out the use of all wood combustion heaters by banning their use by winter 1998, or within three years.	12	62
16.	Require home owners to replace wood combustion heaters with an alternative and cleaner heating device before selling the property.	8	30

	<i>99 submissions</i>	<i>Agree</i>	<i>Disagree</i>
17. Control the times when wood combustion heaters can be used, such as allowing use during the months from May to August during the hours of 6pm to 11pm, and banning the use outside of these times.		9	30
18. Restrict the use of wood combustion heaters during periods of decreasing air quality.		15	19
19. Provide a mechanism for the reporting of smokey wood heater chimneys, similar to the current Smokey Vehicle Program run by the Department of Environmental Protection.		18	17
20. Improve mechanisms for the resolution of local air problems caused by wood smoke from homes, such as penalties to those who operate wood heaters in a polluting way.		20	11
21. Increase inspection capabilities for authorities (such as the Department of Environmental Protection and local council officers) to investigate events of pollution coming from homes with wood heaters.		21	9
22. Introduce standard council By-Laws controlling the installation of wood heaters and chimneys.		18	13
23. Introduce standard council By-Laws requiring energy efficiency in building design.		19	11
24. Introduce standard council By-Laws requiring the use of renewable energy sources for heating purposes.		11	16
25. Ban backyard burning of waste.		33	4
26. Require all new wood heaters sold to conform to Australian Design Standards.		45	1
27. Prevent the sale of wood with unacceptably high moisture content.		35	6
28. Require wood to be stored under cover and protected from any water or moisture source.		21	7
29. Ban the burning of all materials other than dry wood and appropriate kindling.		24	6
30. Ban the removal of firewood from the forest estate from June to October.		12	13
<i>Market Based Strategies</i>			
31. Place a surcharge on the rates of those houses with wood combustion heaters. The surcharge collected could be used to fund an environmental education program.		6	31
32. Offer an incentive scheme to encourage residents to convert from wood heaters to alternatives, such as gas, oil, or solar heating sources.		20	20
33. Offer incentives or rewards for those who meet all recommended burning practices and where no smoke problem is generated.		16	14
34. Provide planning concessions for buildings incorporating energy efficient design and therefore not needing wood heating at all or requiring less use of wood heating.		19	10

Submission summary - Discussion Paper 2 - Smoke emissions from open burning (September 1997)

Submission numbers: 63, 65, 73, 76, 78, 81, 86, 87, 103, 104, 108, 113, 114, 115, 121, 127, 142, 150, 159, 165, 167, 170, 180, 194, 202, 205, 210, 216, 224 & 234.

	<i>30 submissions</i>	<i>Agree</i>	<i>Disagree</i>
<i>Educational Strategies</i>			
1.	Implement education programs explaining the reasons why controlled burns are undertaken, and how the burn is planned, implemented and managed.	13	2
2.	Implement voluntary "no burning" days and nights for bush fire brigades and land owners when the weather forecast suggests conditions are likely to produce haze.	12	2
3.	Implement an education campaign on the dangers and harm caused by the illegal lighting of fires.	14	0
4.	Educate the community about open burning.	15	0
<i>Technical Strategies</i>			
5.	Review and revise the Department of Conservation and Land Management's (CALM) method of developing the 10 year plan, with particular emphasis of incorporating risk evaluation of impact on human health (from exposure to smoke) and risk of loss of biological diversity.	14	2
6.	Research and improve smoke plume dispersal modelling to better predict whether smoke from controlled burns will drift over Perth or other populated areas.	15	1
7.	Expand Perth's air quality monitoring network both in the number of the sites where monitoring is undertaken, and in the parameters measured. Monitoring for air toxics should be included.	15	1
8.	Improve the scheduling of controlled burns such that they are only undertaken during periods when smoke will not drift across populated areas or the Perth metropolitan region.	16	0
9.	CALM should investigate and implement alternative methods to control burning.	18	3
10.	Estimates of pollutant emissions from controlled burns should be included in Western Australia's pollutant inventory.	13	0
11.	Provide greater resources to CALM so that better use is made of those days when controlled burning will not cause pollution in Perth.	13	1
12.	Review the value of controlled burning to establish optimal practices.	13	3
13.	Investigate the need for an independent body to assess the effectiveness of CALM's method of decision making in determining when to light fires, especially during periods when haze alerts have been issued.	10	3
14.	Undertake further research on the health effects of exposure to smoke.	14	3
<i>Regulatory Strategies</i>			
15.	Ban backyard burning in the Perth metropolitan region and other urban areas.	13	5
16.	Improve management controls and enforcement action where land developers do not cooperate in preventing offsite smoke impacts.	14	3
17.	Increase the penalties for those who light fires during periods of high and extreme fire danger periods, especially where there is loss of life, property or smoke impacts on populated areas.	14	0

	<i>30 submissions</i>	<i>Agree</i>	<i>Disagree</i>
18. Monitor the frequency of deliberately lit fires to controlled burns in fire prone areas.		10	3
19. Restrict the implementation of controlled burns during periods of decreasing air quality.		13	4
20. Ban burning on development sites and require developers to chip vegetation on site for use as mulch.		15	2
21. Require CALM to give advanced warning to the community of their intention to carry out controlled burns.		13	3
22. Provide a mechanism for ensuring that a burning activity of any sort, including agricultural burning, does not take place during periods when smoke will not be dispersed quickly.		11	3
23. The responsibilities of the Bush Fires Board to be transferred to CALM to allow better utilisation of existing resources.		2	11
24. CALM, the Department of Environmental Protection and the Bureau of Meteorology to investigate and determine those weather conditions under which small or isolated controlled burns can take place without significantly impacting on Perth's air quality.		14	5
25. Use provisions under the <i>Environmental Protection Act 1986</i> to ban all forms of burning on certain days when air pollution is likely to occur.		11	5
<i>Market Based Strategies</i>			
26. Provide planning and financial concessions for urban development sites that retain vegetation on the site.		<i>13</i>	2
27. Place a rates or other surcharge on agricultural land where stubble burning is carried out.		4	9
28. Introduce financial penalties to CALM, developers and land owners if their burning activity causes pollution in the Perth metropolitan region or any other populated area.		<i>10</i>	7

Submission summary - Discussion Paper 3 - Vehicle emissions (November 1997)

Submission numbers: 94, 101, 103, 105, 108, 110, 111, 114, 117, 120, 123, 146, 150, 152, 153, 159, 175, 176, 177, 178, 179, 180, 181, 183, 197, 198, 199, 200, 201, 205, 210, 211, 212, 228, 229, & 234.

		<i>36 submissions</i>	<i>Agree</i>	<i>Disagree</i>
<i>Educational Strategies</i>				
1.	Implement vehicle owner education programs on the importance of regular vehicle maintenance.		16	1
2.	Implement voluntary "no driving" days combined with free or reduced rate public transport fares on days when air pollution is likely to occur.		10	2
3.	Implement a driver education campaign relating driver actions to vehicle emissions.		17	0
4.	Implement a community education program about the importance of regular inspection and servicing of vehicles.		18	0
5.	Educate the service and repair industry on approved and desired practices.		15	1
6.	Promote the use of alternative but cleaner fuels, such as LPG, CNG and cell battery vehicles.		17	0
7.	Incorporate emission and pollution information as part of the mechanical and servicing trade courses.		16	0
8.	Encourage vehicle and driver trade magazines to incorporate air quality issues in their articles.		16	0
9.	Implement school based education programs on air quality issues.		18	0
10.	Provide education information to driving instructors and traffic police.		16	0
11.	Continue the Department of Environmental Protection's "Smokey Vehicle" Program.		14	0
12.	Provide free or inexpensive vehicle testing facilities in Perth as a part of an education campaign.		13	0
<i>Technical Strategies</i>				
13.	Improve vehicle technology such as better engine design and aim for zero emission targets.		17	1
14.	Improve fuel (petrol and diesel) quality, such as lowering the sulphur content of diesel.		17	0
15.	Expand Perth's air quality monitoring network both in the number of the sites where monitoring is undertaken, and in the parameters measured. Monitoring for air toxics should be included.		12	0
16.	Estimates of vehicle emissions should be included in Western Australia's pollutant inventory.		13	0
17.	Examine the usefulness of "remote sensing device" or "radar" to detect vehicles with excess emissions.		7	2
18.	Examine the effectiveness of in-service maintenance of vehicle emission control equipment.		11	1
19.	Undertake further research on the health effects of exposure to vehicle emissions. Consideration should be given to determining driver exposure during periods of traffic congestion, cyclist and pedestrian exposure, and contribution to indoor air quality of homes and schools along major roads.		8	1

	<i>36 submissions</i>	<i>Agree</i>	<i>Disagree</i>
20. Improve road design, both existing and planned, to integrate into a network with traffic management techniques designed to reduce the likelihood of traffic congestion, such as integration of pedestrian crossing with traffic light changes, and left turning against the red light on a "give-way" to pedestrians and traffic basis.		14	2
21. Encourage business to make more efficient use of light commercial vehicles for deliveries in the Perth metropolitan region by developing "just in time" inventory systems for delivery of goods.		8	4
<i>Regulatory Strategies</i>			
22. Introduce an annual or biennial vehicle emission inspection program requiring all vehicles over a defined age to be licensed as road worthy from an emissions (exhaust and evaporative) perspective. To include testing of cars, trucks, buses, light commercial vehicles and motorcycles.		9	6
23. Introduce a random road side vehicle exhaust inspection program for all vehicles, regardless of the age of the vehicle.		11	3
24. Introduce a radar vehicle emission identification program requiring all those vehicles detected to undergo an exhaust and evaporation emission test.		9	1
25. Introduce standards for vehicle emissions to comply with during the life of the vehicle. To include cars, trucks, buses, light commercial vehicles and motorcycles.		11	1
26. Reduce Government spending and subsidisation of the private vehicle, such as reducing expenditure on constructing freeways, and divert these monies to education programs and supporting alternative travel modes.		10	3
27. For a trial period, ban private vehicles from the Perth CBD during peak hours and encourage the use of alternatives, including taxis and public transport.		8	6
28. Provide powers to the police and other authorised persons (under provisions of the <i>Environmental Protection Act 1986</i>) to issue on the spot fines to trucks, buses, motorcycles and cars that are visibly emitting excessive smoke from the exhaust.		11	3
29. Introduce an interchangeable number plate system for vehicles, such as that used in Switzerland, where two vehicles may be registered to a household but only one vehicle can be in use at any time.		2	10
30. Amalgamate the roles and responsibilities of the Department of Transport and Main Roads Western Australia to streamline the integration of road design and construction with the priority provision of facilities for public transport and non-private vehicle mobility options.		10	3
31. Reduce vehicle speeds (during peak traffic times) within the metropolitan region to balance the relationship between vehicle speed and emissions to a practical minimum.		9	4
32. Introduce (stage II) vapour recovery processes in fuel systems and petrol stations to reduce evaporation of fuel and release of air toxics during vehicle refuelling.		13	0
33. Require the introduction of two-way catalysts in diesel vehicle emission control systems.		12	1
34. Require fuel imported and produced in the State to comply with specified standards.		13	0
35. Regulate the number of light commercial vehicles that can operate within the CBD and the Perth metropolitan region.		5	3

	<i>36 submissions</i>	<i>Agree</i>	<i>Disagree</i>
<i>Market Based Strategies</i>			
36.	Provide incentives to owners of pre-1986 vehicles without catalytic converters to convert the exhaust system to a cleaner alternative or trade the vehicle for scrapping.	11	2
37.	Government and agency fleet vehicle purchasing and hiring policies to include preference for cleaner emission vehicles. Cradle to grave analysis methods of true costs to be used in comparing the cost of alternatives, including contribution to air pollution.	12	0
38.	Provide car owners with incentives to trade in old vehicles, such as a Government funded buy-back program.	12	3
39.	Introduce incentives for the use of less polluting vehicles, particularly commercial vehicles.	13	2
40.	Review the vehicle licensing system to incorporate incentives for new vehicle owners.	9	1
41.	Review the vehicle licensing system to incorporate incentives for vehicle owners with cleaner emission vehicles.	14	1

Submission summary - Discussion Paper 4 - Industrial emissions (December 1997)

Submission numbers: 59, 184, 193, 195, 196, 197, 199, 206, 207, 208, 210, 215, 218, 220, 221, 222, 223, 226, 230, 231, 232, 233, 234, 235 & 237.

		<i>25 submissions</i>	<i>Agree</i>	<i>Disagree</i>
<i>Educational Strategies</i>				
1.	Implement a community education program on the health effects and causes of haze and photochemical smog, and the actions needed to reduce or prevent the problem.		9	0
2.	Encourage the use of energy efficient processes, design features and fuel sources in all aspects of the community, particularly at the detailed planning level.		13	0
3.	Encourage Universities to be involved with air pollution monitoring and research		11	0
4.	Provide the community with easy access to all air pollution monitoring data and industrial emission data, including an interpretation of the results.		13	0
5.	Undertake an education program aimed specifically at senior staff of Kwinana based industries to ensure that they fully understand and appreciate the impact of their industry on Perth's air quality, and the need for the discharges to be acceptable.		11	1
6.	Encourage Perth's media to include air quality reports and predictions as part of the weather reports.		10	1
7.	Request the Environmental Protection Authority and the Department of Environmental Protection to inform industry of new technical developments in emission reduction and process technology.		12	2
8.	Government must clearly articulate its industry development policies and must promote and support these within the community. Need to be more consistent in public education.		10	0
<i>Technical Strategies</i>				
9.	All industry, including existing and future proposed industry, to adopt quality assured processes and procedures for best practice, waste minimisation, clean technology and pollution prevention principles in their operations.		14	0
10.	Conduct a review of the future need for air quality buffer areas around all current and proposed industrial sites.		13	0
11.	Develop an Air Quality (Clean Air) Management Plan for Perth in conjunction with local government to include components for education, monitoring and reporting of results.		14	0
12.	The Department of Environmental Protection to expand the air quality monitoring network throughout the metropolitan region by increasing the number of sites and including the monitoring of air toxics.		11	1
13.	Government to carry out research to determine the health impact of air pollution on the Perth community, including quantifying both short term and long term risk and exposure impacts.		9	1
14.	Carry out research to determine the nature of adsorbed chemical species on air-borne particles in selected areas throughout the Perth metropolitan region.		11	1
<i>Regulatory Strategies</i>				
15.	Increase the severity of penalties for breaches of the <i>Environmental Protection Act 1986 (as amended)</i> particularly for causing pollution.		9	1
16.	Set higher emission standards and limits for industry to achieve.		11	2
17.	Implement planning policies that locate industrial sites away from the metropolitan region, and away from the prevailing wind direction of regional populations.		12	2

	<i>25 submissions</i>	<i>Agree</i>	<i>Disagree</i>
18. Require the Kwinana Power Station to install appropriate air pollution control equipment and processes to reduce the discharge of NO _x and SO ₂ from the site.		11	3
19. Require the Kwinana Power Station to phase out the use of coal and/or fuel oil as fuel sources for power generation.		9	5
20. Introduce requirements such as regulations or By-Laws for industry to make greater use of renewable energy sources.		9	3
21. Improve the mechanisms under the <i>Environmental Protection Act 1986 (as amended)</i> for resolving odour complaint issues.		10	1
22. Enforce the air quality standards proposed in the draft <i>National Environment Protection Measure for Ambient Air</i> .		8	2
23. Establish guidelines for the use of the <i>Environmental Protection Act 1986 (as amended)</i> to declare air pollution alerts.		9	2
24. Prevent any increase in the amount of emissions from the Kwinana industrial area.		12	2
25. Require air quality considerations to be included as part of the planning process.		11	1
26. Introduce By-Laws requiring energy efficiency in building design.		11	2
27. Introduce By-Laws requiring domestic use of renewable energy resources to reduce the reliance on power station energy supply.		8	4
28. Require all industrial emissions to be included on a statewide pollutant inventory.		12	1
29. Plan to locate any future power station away from the Perth metropolitan region, or other residential area in the State.		9	5
<i>Market Based Strategies</i>			
30. Provide planning concessions for buildings incorporating energy efficient design features.		10	2
31. Introduce a tradeable pollution rights scheme to facilitate the influence of market forces on the more significant industrial discharge sources.		10	3
32. Request the Federal Government to provide taxation incentives to industries that plan to incorporate new and cleaner technologies as replacements for old technology.		12	1
33. Introduce a pollution tax or levy on all industry within the Kwinana area in recognition of the influence it has collectively on the regional air quality of the Perth metropolitan region.		7	5

Submission summary - Discussion Paper 5 - Transport and urban planning (December 1997)

Submission numbers: 59, 68, 182, 184, 196, 198, 199, 200, 204, 206, 208, 209, 210, 212, 213, 214, 215, 217, 219, 220, 221, 222, 223A-V, 225, 226, 227, 229, 230, 231, 233, 234, 236 & 237.

		<i>54 submissions</i>	<i>Agree</i>	<i>Disagree</i>
<i>Educational Strategies</i>				
1.	Implement a community education program on the health effects and causes of haze and photochemical smog, and the actions needed to reduce or prevent the problem.	17	0	
2.	Encourage Universities to be involved with air pollution monitoring and research.	12	0	
3.	Implement school based education programs on air quality issues.	14	0	
4.	Encourage the use of energy efficient processes, design features and fuel sources in all aspects of the community, particularly at the detailed planning level, including the design of individual buildings, and the design and layout of subdivisions and blocks.	15	0	
5.	Promote to the community the benefits of integrating a variety of housing densities and compatible land uses within new subdivisions and redevelopments, and encourage the community to live and work locally (urban village concept).	15	1	
6.	Organise seminars in conjunction with the Urban Development Institute to inform developers of new trends and urban design initiatives occurring internationally.	10	2	
7.	Encourage key government planning staff to visit international cities that are aiming toward, or have already achieved, a high level of integrated urban development.	8	2	
8.	Develop a government officers exchange program for key government staff to visit international cities that are aiming toward, or have already achieved, a high level of integrated urban development.	8	2	
9.	Implement voluntary "no driving" days combined with free or reduced rate public transport fares on days when air pollution is likely to occur.	15	5	
10.	Increase funding to campaigns that promote the use of public transport, walking and cycling.	18	1	
11.	Implement workplace education programs to encourage employees to walk, cycle, car pool or use public transport to commute to work.	16	1	
<i>Technical Strategies</i>				
12.	Undertake further research on the health effects of exposure to vehicle emissions. Consideration should be given to determining driver exposure during periods of traffic congestion, cyclist and pedestrian exposure, and contribution to indoor air quality of homes and schools along major roads.	9	1	
13.	Improve road design, both existing and planned, to integrate into a network with traffic management techniques designed to reduce the likelihood of traffic congestion, such as integration of pedestrian crossing with traffic light changes, and left turning against the red light on a "give-way" to pedestrians and traffic basis.	11	4	
14.	Develop an Air Quality (Clean Air) Management Plan for Perth, including area specific local air quality management plans, in conjunction with local government. Plans need to include components for education, monitoring and reporting of results.	9	0	
15.	The Department of Environmental Protection to expand the air quality monitoring network throughout the metropolitan region by increasing the number of sites and including the monitoring of air toxics.	11	2	

	<i>54 submissions</i>	<i>Agree</i>	<i>Disagree</i>
16. Government to carry out research to determine the health impact of air pollution on the Perth community, including quantifying both short term and long term exposure impacts.		8	2
17. Carry out seasonal research throughout the Perth metropolitan region, analyse the ambient dust monitoring samples for the nature of adsorbed chemical species on the particles, and therefore the source.		7	2
18. Undertake a detailed economic analysis of the public subsidies provided to various form of public and private transport modes and facilities.		13	0
19. Create an Economic Advisory Committee of mainly non-transport economists to review and advise Government on all new major transport and urban projects.		9	2
20. Undertake a cost benefit analysis of the impacts of air quality on human health and the expenditure required to meet desirable air quality standards.		11	1
21. Build a light rail system in appropriate parts of the Perth metropolitan region with land zoning of higher density along the rail route and around the stations, and without the car parking requirements.		15	1
<i>Regulatory Strategies</i>			
22. Increase the severity of penalties for breaches of the <i>Environmental Protection Act 1986 (as amended)</i> particularly for causing pollution.		14	2
23. Implement planning policies that require the integration of public transport, walking and cycling facilities as part of the overall development plan for all new subdivisions.		9	1
24. Implement planning policies that locate industrial sites away from the metropolitan region, and away from the prevailing wind direction of regional populations.		13	1
25. Require dedicated public transport access ways and high occupancy vehicle lanes in all new major road, highway and freeways that are planned or in the development stage.		14	2
26. Require dedicated public transport access ways and high occupancy vehicle lanes in all existing major road, highway and freeways that are planned for expansion.		13	2
27. Require dedicated bicycles lanes to be built along all existing major roads and future proposed major roads.		11	1
28. Implement planning policies that require a mix of urban density dwellings combined with compatible land use zoning within new subdivisions and for proposed redevelopment areas.		12	1
29. Commission a study to investigate the feasibility and infrastructure requirements of constructing a radial light rail system to link all major public venues within the suburban area, such as Universities, hospitals, major shopping centres and corporate locations.		12	3
30. Reduce Government spending and subsidisation of the private vehicle, such as expenditure on constructing freeways, and divert these monies to education programs and supporting alternative travel modes.		8	4
31. For a trial period, ban private vehicles from the Perth central business district during peak hours and encourage the use of alternatives, including taxis, public transport and bicycles.		12	7
32. Commission a study to investigate the feasibility and infrastructure requirements for constructing light rail in the vicinity of the Kwinana Freeway to connect the southern suburbs with the central business district.		11	2
33. Amalgamate the roles and responsibilities of the Department of Transport and Main Roads Western Australia to streamline the integration of road design and construction with the priority provision of facilities for public transport and non-private vehicle mobility options, such as bicycle and pedestrian paths and vehicle free zones.		10	2
34. Amalgamate the roles and responsibilities of the Department of Transport and Main Roads Western Australia with the Ministry of Planning to streamline the integration of road design and construction with the priority provision of facilities for public transport and non-private vehicle transport options and with the overall planning for the State.		7	3

	<i>54 submissions</i>	<i>Agree</i>	<i>Disagree</i>
35.	Reduce vehicle speeds (during peak traffic times) within the metropolitan region to balance the relationship between vehicle speed and emissions to a practical minimum.	9	4
36.	Enforce the air quality standards proposed in the draft <i>National Environment Protection Measure for Ambient Air</i> .	9	2
37.	Establish guidelines for the use of the <i>Environmental Protection Act 1986 (as amended)</i> to declare air pollution alerts.	10	2
38.	Amend legislation to require increased urban densities in the vicinity of existing and planned future rail stations.	19	1
39.	Implement a review of the bus and train transport systems to ensure maximum integration of connecting services and the enhancement of peak hour services. Consideration to be given to expanding the hours considered to be peak, and the running of limited stop services on routes connecting major centres with the central business district.	13	1
40.	Require air quality considerations to be included as part of the planning process.	13	2
41.	Introduce By-Laws requiring energy efficiency in building design.	11	1
42.	Introduce By-Laws requiring domestic use of renewable energy resources.	8	2
43.	Require all industrial emissions to be included on a statewide pollutant inventory.	13	2
44.	Amend legislation to allow the revenue raised from parking fees to be used in programs other than maintaining and increasing parking facilities.	12	2
45.	The environmental impact assessment of planning proposals to include consideration of predicted traffic flows and transport options, and the subsequent estimate of emissions to the atmosphere.	11	1
46.	Increase security patrols on public transport at night as a deterrent to anti-social behaviour, and increase penalties for those behaving in an anti-social manner as a means of increasing patronage on public transport.	12	2
47.	Require all new building developments or redevelopments to incorporate free or minimal cost facilities for people who walk and/or cycle to work. This could include secure bicycle lock up areas, lockers and showering facilities.	9	1
48.	Amend or introduce legislation to provide local government with local pollution control powers and air quality control powers.	11	2
49.	Local government be required to develop local public transport plans that also integrate with neighbouring authorities.	10	2
50.	The State Government to assist local government by developing model By-Laws for the development of energy efficient housing.	10	2

	<i>54 submissions</i>	<i>Agree</i>	<i>Disagree</i>
<i>Market Based Strategies</i>			
51.	Provide planning concessions for buildings incorporating energy efficient design features.	12	0
52.	Government and agency fleet vehicle purchasing and hiring policies to include preference for cleaner emission vehicles. Cradle to grave analysis methods of true costs to be used in comparing the cost of alternatives, including contribution to air pollution.	13	0
53.	Increase private development and funding of rail and public transport systems through enhancing development opportunities along the transport routes.	11	1
54.	Provide planning concessions to developers that incorporate pedestrian and cycling facilities as a priority to cars in new developments or redevelopment areas.	9	3
55.	Increase government funding of the public transport system to ensure that fees for using public transport do not increase as a means of cost recovery.	16	1
56.	Significantly increase parking fees in the central business district for all day parking.	14	3
57.	Reduce the amount of parking space in the central business district progressively over the next 5 years and divert the funds to support public transport, cycling and walking modes of transport.	15	2
58.	Encourage the style of urban planning that incorporates energy efficiency in all forms, such as the Leichhardt, New South Wales model.	9	0
59.	Encourage developers through various mechanisms (such as provision of Crown land, attractive land zoning) to construct light rail/heavy rail or parts there of in key new development areas within the Perth metropolitan region.	10	0

B - Evidence

The Committee has taken approximately 395 pages of formal evidence from -

<i>Name</i>	<i>Affiliation</i>	<i>Date</i>
Dr Brian Jenkins	Department of Environmental Protection	18 June 1997
Dr Paul Vogel	Department of Environmental Protection	18 June 1997
Dr Ken Rayner	Department of Environmental Protection	18 June 1997
Mr David Pitt	Department of Environmental Protection	18 June 1997
Dr Ray Steadman	Environmental Protection Authority	26 June 1997
Mr Greg Martin	Transport WA	9 July 1997
Dr Richard McKellar	Transport WA	9 July 1997
Mr Mike Upton	Royal Automobile Club of WA (Inc)	1 September 1997
Mr Alan Peterson	Transport Action Coalition	1 September 1997
Ms Kate Barnett	Transport Action Coalition	1 September 1997
Mr Mike Kingston	Transport Action Coalition	1 September 1997
Ms Jan de Vries	Bike Transport Alliance	1 September 1997
Mr Bruce Robertson	Bike Transport Alliance	1 September 1997
Mr John Seaton	Bikewest, Transport	1 September 1997
Prof Peter Newman	Murdoch University	1 September 1997
Mr Ian McRae	Ministry for Planning	2 September 1997
Mr Matthew Tweedie	Asthma Foundation of WA	2 September 1997
Dr Sue Graham-Thomas	Pollution Action Network	2 & 22 September 1997
Mr Don Martin	Department of Resources Development	2 September 1997
Mr Roger Stubbs	Western Australian Municipal Association & Local Government Association	2 September 1997
Mr Greg Probar	Bush Fires Board	3 September 1997
Mr Mal Cronstedt	Bush Fires Board	3 September 1997
Dr Les Farrant	Office of Energy	3 September 1997
Dr Mark Goldstone	Main Roads Western Australia	3 September 1997
Mr Otto Hilhorst	Main Roads Western Australia	3 September 1997
Mr Rick Sneeuwagt	Department of Conservation and Land Management	3 September 1997
Dr Syd Shea	Department of Conservation and Land Management	3 September 1997
Mr Peter Meyrick	City of Armadale	4 September 1997
Mr John Smith	Shire of Kalamunda	4 September 1997
Mr Daniel Del Costa	Shire of Mundaring	4 September 1997
Mr Brian Watkins	Shire of Mundaring	4 September 1997
Mr Mick Austin	City of Wanneroo	4 September 1997

<i>Name</i>	<i>Affiliation</i>	<i>Date</i>
Mr Les Float	City of Stirling	4 September 1997
Mr Laurie Crouch	City of Stirling	4 September 1997
Mr Gary Hunt	City of Perth	5 September 1997
Mr Clayton Hirie	City of Perth	5 September 1997
Mr Doug Smith	Town of Kwinana	5 September 1997
Mr Paul Rokkich	Town of Kwinana	5 September 1997
Mr Darren Walsh	City of Cockburn	5 September 1997
Mr Graeme Marshall	Department of Environmental Protection	22 September 1997
Ms Jennie Anderton	Department of Environmental Protection	22 September 1997
Mr Greg Allen	Department of Environmental Protection	22 September 1997
Mr Paolo Coniglio	Automotive Preventative Maintenance	22 September 1997
Dr Phil Jennings	Conservation Council	22 September 1997
Ms Rachel Siewert	Conservation Council	22 September 1997
Mr David Wake	Smogbusters	22 September 1997
Mr Doug Riley	Association of Australasian Diesel Specialists	23 September 1997
Mr Max Barton	Woodheaters Association	23 September 1997
Mr John Cook	Energy Equity Corporation	23 September 1997
Mr Peter Dingle	Murdoch University	23 September 1997
Mr Peter Malone	Transcom	23 September 1997
Mr Allen Noon	Transcom	23 September 1997
Mr Antony Middleton	Transcom	23 September 1997
Dr Nicholas de Klerk	University of Western Australia	2 February 1998
Dr Andrew Musk	Sir Charles Gardiner Hospital	2 February 1998
Dr Quentin Summers	Royal Perth Hospital	2 February 1998
Mr Iain Cameron	Kinhill Group	2 February 1998
Mr Nenad Ninkov	Western Power Corporation	2 February 1998
Mr Adrian Chegwiddden	Western Power Corporation	2 February 1998
Mr Pelham Weir	Western Power Corporation	2 February 1998

C - Intrastate investigations

The Committee met with the following persons, organisations and companies in Western Australia -

Department of Environmental Protection

Mr David Pitt, Manager Environmental Systems Division

- Ambient air quality monitoring network

Kwinana Industries Council

Mike Baker, Executive Officer

Mr Martin Taylor, Environmental Coordinator, Chamber of Commerce and Industry of Western Australia

Mr Ian Pound, Tiwest Joint Venture

- 27 members of the council. A number of committees established to facilitate implementation of various strategies such as those dealing with emergency situations, community education and environmental management.

Kwinana Power Station

Mr Kerry Roberts

Dr Roman Mandyczewsky

- Station capable of using coal, oil and natural gas as fuel source for power generation. Major source of SO₂, NO_x and CO₂.
- Coal use annually would contribute between one third to one half of the SO₂ emissions into the Kwinana airshed. Long term coal contracts are in place. Access to natural gas supply is limited and continuity of supply from the suppliers is not guaranteed therefore making the daily and weekly planning of fuel use difficult. Space limitations and cost of retrofitting of pollution control scrubbers to reduce emissions considered prohibitive by Western Power.
- Due to power station proximity to the metropolitan area the cost of delivery of power is relatively negligible.

BP Refinery, Kwinana

Ms Kellie Barne, Senior Business Analyst

Mr Graeme Fraser, Distillation

Mr Ian Jackson, Process Manager

Mr Brian Mumme, Products Manager

Dr Rod Lukateliich, Environmental Manager

- Refinery activities major source of ROCs and SO₂.
- Management programs in place to reduce emissions, particularly sources of fugitive emissions.
- Consider that there will be a natural phase out of requirement for leaded petrol. Estimate that to minimise distribution costs, use of leaded fuel would be phased out by 2004-2005.
- Demand for diesel increasing. Metropolitan and country area demand balanced 50:50. Some flexibility to reduce sulphur content in diesel. Expectation is for sulphur content in diesel to meet maximum 2000 ppm in year 1999 and 500 ppm by year 2002 however would need to be legislatively driven as there is currently no financial gain to be made.
- Fuel quality of imports questionable.

Bureau of Meteorology

Mr Len Broadbridge, Director, Western Australia

Mr Gary Foley, Manager Forecasting

Mr Alan Scott, Deputy Regional Director

- Smoke management liaison group (Bureau, CALM, DEP, Bush Fires Board) routinely meet twice per year (prior to start of burning season and at conclusion of burning season).
- Bureau provides dedicated advisory service to CALM and Bush Fires Board during burning season.
- Working on dispersion modelling of smoke - complicated and dependent on fire intensity.
- Tension in the past between the players. Liaisons are based on good will rather than requirement and Bureau role advisory there is no requirement on CALM or BFB to acknowledge or heed advice. Other contributors to smoke in Perth ie shires issuing permits are not seeking the advice.

Suggestions:

- Public alerts - prediction is a part of the Bureaus' normal service but it is the advertising of the alert that is the key. Bureau could provide info to DEP and then DEP be responsible for issuing the alert via the Minister for the Environment.
- Quantitative risk assessment at a national level - do you get more deaths from wildfires if no controlled burns are carried out or more from smoke effects on health (premature deaths).

Clean Air Society of Australia and New Zealand Inc, Western Australian Branch

<i>Name</i>	<i>Affiliation</i>
Mr Patrick Coffey	Alcoa Australia Ltd
Mr R Monk	BBG Consultant
Dr Sue Graham-Taylor	Conservation Council
Mr Jack Apgar	Consulting Engineer
Ms Shelley Edwards	Department of Environmental Protection
Ms Sally Narvaez	Department of Environmental Protection
Mr Steven Price	Department of Environmental Protection
Dr Ken Rayner	Department of Environmental Protection
Mr Glenn Sowerbutts	Department of Environmental Protection
Mr Fred Tromp	Department of Environmental Protection
Ms Sophie Wallis	Department of Environmental Protection
Mr Guy Watson	Department of Environmental Protection
Mr John Dombrose	Department of Transport
Mr Bruce James	Department of Transport
Mr Gary John	Department of Transport
Mr Iain Cameron	Kinhill Pty Ltd
Dr Mark Goldstone	Main Roads Western Australia
Mr Steve Lang	Steven Lang and Associates
Mr David Charles	Tiwest Joint Venture
Mr Trevor McDonald	Transport Vehicle Safety

<i>Name</i>	<i>Affiliation</i>
Mr David Pitt	Welker Consulting
Mr Tasman Graham	Wesfarmers CSBP
Ms Spencer	West Australian Newspapers
Ms Lorie Jones	Woodward Clyde

D - Interstate investigations

The Committee met with the following persons, organisations and companies in New South Wales -

New South Wales Environment Protection Authority

Dr Leslie Lynch, Project Manager

Mr Steve McPhail, Manager, Air Quality

Ms Vera Ballantyne, Manager, Mobile Sources

Ms Anita Shuhevych, Manager, Stationary Sources Air Strategies (MASU)

Mr Steve Brown, Acting Manager Motor Vehicles

Mr Andrew Graham, Manager, Motor Vehicle Enforcement Unit

- Development of regional air quality management plan, with integrated strategies projecting to the year 2021.
- Clean Air Regulations
- Land use and planning strategies promoting public transport and aiming to reduce the community's reliance on the private vehicle.
- Importance of pollutant inventory, monitoring and modelling.
- Industrial emission management strategies.
- Domestic and commercial management strategies
- Vehicle inspection and maintenance - proposed program.
- Smokey vehicle program.
- There are no silver bullets left - a wide range of strategies and actions across a broad spectrum of sources and activities is required.

New South Wales Health Department

Dr Steve Corbett, Health and Air Research Program

- Relationship between air quality and health effects and impacts.
- Research project highlighted sulphate aerosols or sulphuric acid attaching itself to particles to be a main concern.
- Indoor air quality issues a growing concern.
- Exposure to drivers in traffic may be an area requiring investigation.
- Need for Environmental Protection Agencies and Health Agencies to work together in investigating and addressing air pollution issues.

Inner Metropolitan Regional Organisation of Councils

Ms Susan McHattie, Executive Officer

Ms Tanya Ritchie, Projects Manager

Mr David Tower

- Local air quality management plan model, 50% of councils committed to developing a plan.
- Regional transport strategy
- Urban area planning - need to move away from the culdesac design and back to a grid pattern, with provision of pedestrian and cyclist access.
- Energy and water efficiency policy.

- Development of energy efficiency model for housing design based on the work of Leichhardt City Council.
- Local government perspective that State Government needs to focus on regional issues or those issues which go beyond the boundary of a shire. Essential that State Government support the steps that local government are taking, such as developing enabling legislation rather than bans.

Roads and Traffic Authority, New South Wales

Ms Annette Ross

Ms Jay Stricker, General Manager, Environment and Community Policy

Mr Steve Esles, Corporate Division

Mr Frankie Lee, Senior Policy Officer, Environment and Community Policy Branch

Mr Bruce Dowdell, Manager Vehicle Standards

Mr Phil Margison, General Manager, Network and Bus Efficiency, Traffic Management Branch

Mr Paul Forward, Director Road Network Infrastructure

Ms Kerrie Kelly, Director Corporate Secretariat

- Support for vehicle emission testing program including annual testing of vehicles over 4 years of age. Contract basis with State Government responsible for auditing.
- Ongoing research and development programs including vehicle wake turbulence and benefits of alternative fuels.
- Need for improvement of standards applicable to heavy duty vehicles.
- Traffic management program emphasis on “moving people not vehicles”.
- Pedestrian crossings - parallel cross versus scramble mode.
- Teleworking pilot project, policy and manual.
- Car pooling initiative “EasyShare”.

Leichhardt Municipal Council

Ms Sophie Handley, Acting Manager Environmental Planning

Mr David Eckstein, Environment Officer

Mr Graham Foster, Manager

- Council's plan for air quality.
- Integrated transport strategy brings together land use and transport options, including parking code amendments, bike plans and provision of a light rail commuter service.
- Energy efficient housing policy prevents new dwellings from installing a fire based heater. Emphasis on use of passive solar heating design.

Environment Australia, Canberra

Ms JoAnn Di Sano, First Assistant Secretary, Environment Protection Group

Ms Christine Schweizer, Director Air Quality, Air Pollution and Climate Changes Branch, Environment Protection Group

Mr Ian Carruthers, Assistant Secretary, Air Pollution and Climate Changes Branch, Environment Protection Group

Ms Gillian Savage, National Environment Protection Council, Environment Protection Group

Mr James Shevlin, Director, National Pollutant Inventory, Environment Protection Group

Mr Gene McGlynn

Mr Brian Hobsbawn, Air Quality Section, Air Pollution and Climate Changes Branch, Environment Protection Group

- Greenhouse strategy.
- Ozone strategy (stratospheric ozone).
- Air quality continually tops the list of community concerns.
- Motor Vehicle Standards Act defines Australian Design Rules for motor vehicles. Standards traditionally 10 years behind USA standards. National in service testing standards being considered.
- State of the Environment reporting process.
- Federal funding allocation for community support programs.
- Role and enabling legislation of the National Environment Protection Council (NEPC).
- National Pollutant Inventory.
- Proposal for development of a National Environment Protection measure for Diesel.

Australian Academy of Technological Sciences and Engineering - Independent Inquiry into Urban Air Pollution

Dr Alan Reid, Company Director

Ms Bettye Dixon

- Overview of process undertaken by the Inquiry and the format of the final outcomes.
- Report theme highlights the essential need for involvement of all tiers of government, industry and the community. Equitable and efficient outcomes essential as is long term planning and implementation.
- Management options include a suite of technological based options that might be used to remedy pollution levels that are not meeting community standards, with economic or social instruments used if technical solutions are insufficient.

Federal Office of Road Safety, Canberra

Mr John Real, Manager Vehicle Emissions, Policy and Emissions

- Overview of the National In-service Emission Study process and outcomes.
- Basic tuning found to be beneficial from an emissions reduction point of view, but at varying degrees.
- Most of the available improvement in reducing emissions is derived from a small proportion of vehicles.
- Evaporative emissions consistently high and needs to be reduced as a priority.

Australian Automobile Association

Mr Brian Wells, Engineer Executive

- Linking of vehicle safety and emissions testing.
- Fuel quality issues and true cost of fuel. Estimate that cost of reducing fuel sulphur content from 0.5% to 0.05% is 1-2 cents per litre. Reduction in volatility of fuel may be essential for urban areas.
- Diesel production increasing (petrol produced as a by-product).
- Onboard diagnostics the future of emissions controls

E - International investigations

The Committee met with the following persons, organisations and companies during the investigations in Denmark (Copenhagen), United Kingdom (London), Canada (Victoria and Vancouver) and the United States of America (Seattle and San Francisco) -

Denmark

Danish Ministry of Environment and Energy

Mr Soren Bukh Svenningsen, Advisor to the Minister

Structure and responsibilities of the Ministry.

Danish Environment Protection Agency

Mr Jorgen Nielsen, Head of Section (Economics and Political Science)

Mr Brian Kristensen, Head of Section (Traffic)

Mr Erik Iversen Senior Engineer

Mr Peter Schaarup, Head of Section (Air)

- Cleaner technology legislation, future action to shift the change from cleaner processes to cleaner products.
- Financial support to the municipal Urban traffic project aimed at strengthening the planning basis through the development of local plans. Examples include - *City-Bikes* program in Copenhagen where bicycles are made available for use for a refundable deposit of 20 DKK; Cyclebusters in Aarhus where 187 families were provided with bicycles for a trial period, and if use was sustained over the trial then the bikes were retained; amalgamation of the various plans (traffic and momentum plan, municipality plan) in Hasleve into the Local Agenda 21 plan, a more holistic planning basis for the area; and the improvement of bus and bike links to the Danish railway system in Hilleroed where research has shown that approximately two thirds of commuting time is spent getting to the train station and waiting for the train, and the final third of the time being spent on the train.
- The State's role is as "mid-wife and sparring partner" providing part of the financial support and technical guidance. Sustainable transport planning is therefore about creating openings for change.
- Vehicle policy based on the directives from the European Union. Tax system also used including - tax incentives to industry for producing low sulphur diesel; tax incentives for fuel stations to install vapour recovery on bowsers ahead of the compulsory installation by year 2000 (incentives induced 50% installation in the first year); passenger cars taxed on initial registration plus an annual registration based on the energy consumption of the vehicle and on fuel tax.
- Vehicle emission testing to start 1 January 1998. Periodic inspection of vehicle after 4 years, and then testing every second year. Expect cost to be US\$45 to 50 with a test time of 15 minutes. Centralised testing with new testing facilities to be constructed. Garages in country areas to be contracted to provide facilities but testing will be carried out by the Department of Transport.

Spatial Planning Department

Mr Axel Thrige Laursen, Head of Section

Mr Peter Hartoft-Nielsen, Head of Section

Air quality problems in the city centre.

- Vehicle kilometres travelled in private vehicles has declined since 1970.
- Around 30% commute by cycling during summer periods dropping to 10% in winter, 30% also commute by public transport (bus or train) increasing to 45% during winter, so majority of shift from cycling in winter is to public transport.
- New bike policy to encourage more cycling, particularly over longer distances.

- Traffic and Environment Plan for Copenhagen aims to have no increase in car traffic with public transport and cycling

Danish Energy Agency

Mr Jens H Laustsen, Head of Section (Architect)

- Building codes set specifications on heating, ventilation and insulation requirements for achieving energy conservation and consumption in all buildings, and has applied since 1972. Small buildings currently covered by a different code but becoming the same. Code applies to all new buildings and aims for improvement in existing buildings, and are required (if possible) as part of urban renewal projects.
- Small buildings required to be energy labelled (consumption requirements) and to provide an energy plan, required I connection with the sale of the property. One quarter to one fifth of the cost of living in a house is related to the use of water, heat and electricity. Therefore energy efficient housing can reduce costs (and hence the use of the labelling system).
- Large buildings also to be energy labelled with an energy plan and to provide a system for energy management in the building, required to be updated annually.
- Approximately US\$1 to 2 million spent annually on public education, including locating energy and environment offices in each city, TV advertising campaigns, schools program, and tradesman campaigns aimed at getting tradesmen to become ambassadors for energy efficiency.

City of Copenhagen

Mr Bjarne Eir, Senior Adviser City Engineer Directorate Road Division

- Planning needs must take into account commuters from Sweden - tunnel plans.
- Public transport needs under review. Construction of new light rail under way. Capacity for cars within city area being reduced. High capacity public transport system needed - one that will not be effected by road traffic.
- Road pricing being considered on priority basis - higher pricing on more sensitive areas.

United Kingdom

The Department of Transport

Mr David Briggs, Head of Branch, Vehicle Roadworthiness and Enforcement

Ms Kathy Jenkins

- Vehicle emissions testing in conjunction with vehicle safety testing. First test on vehicle after 3 years, then every year after that for cars and light commercial vehicles. Overall a 35.5% failure rate of the test, with between 6 to 10% failure rate due to vehicle emission component of the test. Test is carried out to the manufacturers specifications by private sector (at garages). Test fee set by Department of Transport designed to allow for equipment cost recovery with a reasonable time frame with provision for delayed purchasing agreement for garages.
- Smokey vehicle reporting program in place, including that for diesel trucks.
- Roadside emission testing of heavy duty vehicles, where testers operate in conjunction with police officers who have the jurisdiction to pull vehicles off the road. 20% of heavy duty vehicles are road side tested in addition to the annual testing requirement.
- Failure of tests results in prohibition on use of vehicle until problem is corrected. Takes ten days for a prohibition to become effective.

London Transport Buses

Mr Andrew Thompson, Senior Policy Analyst

Mr Steve Atkins, Planning

- Established 1994 following privatisation where role shifted from bus and underground operator to now being the overseer of service provision and infrastructure management. Bus routes tendered by route every 5 years, essentially all diesel powered. Services an area of 25 kilometre radius around London with a population of 7.1 million. Traffic congestion continues throughout the day essentially from 7 am to 7 pm.
- In response to poor local air quality during the summer of 1995 with local councils threatening to prevent bus access specific street unless improvement to emissions occurred, policy introduced for all contractors to run on ultra low sulphur diesel (0.01% sulphur). Emission improvement is PM₁₀ 30% and NO_X 10%. No improvement of hydrocarbon or carbon monoxide emissions.
- Local distribution initially a problem and a cost premium of 3 pence per litre (now 2 pence per litre).
- Subsequent actions include retrofitting some buses with oxidising catalysts and regenerating catalyst traps. Future actions may involve conversion to a diesel electric system, and later still the use of fuel cells.
- Essential that buses be given allocation of road space if use is to be sustained, and that the use of low sulphur fuel be in conjunction with vehicles equipped with exhaust treatment to maximise emission reduction.

British Lung Foundation

Dr Simon Taggart, Lung Specialist, Royal Free Hospital Hampstead, London

- There is a degree of acceptance by the community in the level of pollution that is acceptable. Essential that strategies focus on managing the problems, that is episodic or continual pollution events.
- The results of epidemiological studies showing links between particle exposure and health effects are most likely transferable from location to location, but remains important to characterise where the particles are coming from as much as the size and number.
- In UK the Expert Panel on Air Quality Standards has allowed a safety margin in setting standards to account for uncertainties.

Shell International Petroleum Company Ltd

Mr R (Bob) MacKinven, Special Projects - Fuels (Oil Products, Strategy and Business Services)

Mr Howard J Shields, Vice President Development (OAD) (Oil Products, East Zone)

Mr David Johnston, Project Advisor, (Oil Products, East Zone)

- Local solutions are essential as the solution must fit the local problem.
- Reformulated fuels may have limited applicability in improving air quality, for example the addition of MTBE to petrol only improves the carbon monoxide emission.

Canada

British Columbia Ministry of Environment Lands and Parks

Mr Hu Wallis, Manager Air Quality Assessment, Air Resources Branch

- Establishment and maintenance of a pollutant inventory essential to developing and implementing air quality management strategies. Also a valuable tool to be used to persuade groups where action is needed. Also a prediction tool for future management needs.
- The introduction of vehicle inspection and maintenance was seen a politically bold, and education of the community was essential especially when leading up the start of the first testing period. Program now has a high level of community support. Testing carried out by private contractor and breaks even after 5 years. Mobile testing facilities for heavy duty vehicle commencing - was initially a voluntary program.

- Wood heater regulations specify manufacturer standards as USEPA requirements. No controls for heaters that are already in use. Episode abatement program in place seeking voluntary reduction in use in specified local areas via announcements over local radio announcements.
- Open burning smoke control regulations in place permitting burning in periods when meteorological conditions are suitable. The Forestry Department has meteorological modelling capabilities and requirements are based on management and preventative approach. Backyard burning is controlled at the municipal level with a two tier regulation based on the size of the property and the distance to sensitive land uses.
- If the population is sensitised to the problems, then the community will often be prepared to participate - if education and support is provided.

British Columbia Ministry of Health

Dr Ray Copes, Risk Assessment and Toxicology Public and Preventive Health Division

- Particles are highly correlated to the health regardless of the city where results are obtained.
- Important to note that if studies were replicated for the Perth situation, then the outcomes may confirm the results of other studies, but the statistical base may not.
- Major issue to the region is the health impact from exposure to smoke in areas beyond the metropolitan area.
- Essential to have better land use planning and a recognition that air masses move across boundaries.

Greater Vancouver Regional District

Mr J Barrie Mills, Manager Air Quality Department

Mr Kamal Bhattacharyya, Senior Engineer Air Quality Department

Mr Dale R Budlong, Senior Officer Air Quality and Source Control Department

Ms Ysa Luz, Education Coordinator Communication and Education

Mr Morris Mennell, Administrator, Program Planning and Development, Air Quality Department

Ms Marie-Christine (Chris) Dornhecker, Program Planning and Development, Air Quality Department

Mr Ken Cameron, Manager, Strategic Planning Department (transport)

Ms Barbara A Dabrowski, Senior Engineer Air Quality and Source Control Department

Mr Bob Paddon, Manager Communications and Education

Mr Bob Smith, Senior Officer Air Quality and Source Control Department

- Air quality program for the region consists of monitoring stack emissions and ambient air quality (30 stations), regulating emissions and emission forecasting for planning purposes.
- Education of the community is the key, and without the public support the achievements in improving air quality would not have been realised.
- The air quality management plan took 5 years to develop and involved consulting with industry and the community (a 50 person working group involved). Aim is to reduce 1985 total emissions by 50% by the year 2000, and to pursue an air quality and transportation strategy. Cost benefit analysis for the period 1994 to 2020 estimates control costs to be CA\$2.9 billion with total benefits to be \$5.3 to *\$8.0 billion.
- Integration of regional growth planning and transportation planning where a high priority is given to transit as an investment in the future. The growth management challenge is automobile dependency.
- Use of light rail to contain growth where it is installed only in the growth concentrated areas - it would not be installed in green field sites.
- Major actions also undertaken to manage backyard burning, pollution control for power stations, refuelling vapour control, vehicle emission testing, car scrapping and the road testing of the Ballard cell in electric vehicles.

City of Burnaby

Mayor Doug Drummond, Director GVRD, Chair of the Air Quality , Communications and Education Committee

- Essential to create the atmosphere for change, before creating the change, therefore education of the community is essential.

BC Transit

Mr Glen Leicester, Executive Director, Strategic Planning

- BC Transit is a Crown corporation created by an Act of the legislature and operates in cooperation with local government jurisdictions to provide transit services over an area of 1800 km², to a population of 1.8 million. Achieves 122 million revenue riders per year with 11% of peak period travel and 30% cost recovery.
- Services include commuter rail, sea buses (ferries), electric trolley buses, Skytrain (light rail) and current testing 25 natural gas fuel buses.
- Funding from 3 areas - fares (30%), provincial government (47%) and Transit Commission (23% where CA\$0.04 per litres fuel tax, \$1.90 per month levy on property water accounts and a proportion from non-residential property tax).
- Essential that services integrate and link - examples include bus routes feeding into Skytrain stations and SeaBus location, and private funding for the construction of Stadium Station entrance at the new (privately constructed) arena.
- The ten year plan targets urban development which will involve conventional light rail and an extension of the rapid bus systems (dedicated bus lanes) linking major centres.

University of British Columbia

Dr Sverre Vedal, Respiratory Division

- Health effects from exposure to particles (PM10) do occur, and levels do not need to be high.
- Total costs to the community may be higher than initial estimates based on the wide range of effects.
- Research and studying continuing but policy can be based on observation data with the understanding of mechanisms to come later.

AirCare®

Mr M A (Martin) Lay, Manager AirCare Program, Insurance Corporation British Columbia

Mr David Gourley, Emissions Standards and Testing, Insurance Corporation British Columbia

- Compulsory testing of vehicle emissions commenced 1992, fee of CA\$18.
- Approximately 1 in 10 fail, with average cost of repairs to pass retest \$150. Multiple facilities, with several tests in the test line. Average test time 10 minutes.
- Testing carried out by contractor. Maintenance can be carried out by any repair facility, but waivers only available if repairs undertaken by certified mechanic and facility.
- Program breaks even for the operator after 5 years with the return of funds to the government after 3 years. 12 test sites throughout region (200 x 60 kilometre area) with average distance of 10 to 15 kilometres for resident to travel.
- Heavy duty vehicle tested by 2 mobile units, initially an 18 month voluntary program through liaison with truck operators. Fines will be introduced in legislation. Contribution of heavy fleet considered to be small in total compared to the private vehicle fleet.

United States of America

United States Environmental Protection Agency - Region 10 (Seattle), Office of Air Quality

Ms Anita Frankel, Director, Office of the Director

Ms Lee A Otis, Environmental Scientist International Outreach Coordinator

Ms Lorinda M (Rindy) Ramos, Environmental Engineer, State and Tribal Programs Unit

Mr Steven K Body, Senior Engineering Officer, TIPs/FIPs, State and Tribal Programs Unit

Ms Regina Thompson, EPS, State Implementation Plan, State and Tribal Programs Unit

Ms Polly Hunter, Outreach, Enforcement and Program Support Unit

Ms Brooke Madrone, Indoor Air/Radon, Federal and Delegated Air Programs Unit

Mr Wayne Elson, EPS, Modeling/Mobile Sources, State and Tribal Programs Unit

Ms Misha Vakoc

- Secondary aerosols and PM_{2.5} of greatest concern. Federal rulings requiring five years of monitoring of PM_{2.5} before the introduction of control strategies.
- Wood heater controls include certification of models, a two stage burning ban, fines for use during bans, opacity standards.
- Prescribed burning controls. Ambient standards are all health based, and underlying message is that there is no threshold that is safe for exposure to particles. Issues of particular relevance to tribal communities.
- Vehicle emissions subject to Federal standards. Growth in number of vehicles and kilometres travelled greater than the technological gains from new standards. Federal *Clean Air Act* requires link between air quality and transportation planning.
- Indoor air quality guidelines developed. Emphasis on school environs since children asthma levels are rising incrementally. Possible link to time spent in doors. Multiple chemical sensitivities in the community and the need for education within the medical community. CO emissions of concern from unvented natural gas heaters (now banned in Oregon).

Washington State Department of Ecology, Office of Air Quality

Douglas J Brown, Manager, Air Quality Program, North West Region, Office of Air Quality

Ms Deborah Burgess, Office of Air Quality

- Vehicle emissions testing has public acceptance, therefore can now focus on improving the system rather than selling the program.
- Requires staffing and good technicians. Repair industry works together and education and training considered important to the program, and as a business benefit to the industry. Program efficient from government perspective since private contractor implements testing.
- Maintenance costs capped at US\$450 with waiver of \$100. Despite waiver, review shows that on average \$250 spent to correct failures. Waiver requires that emissions must be reduced but not necessarily to the level of the standard. Assistance program also for vehicle owners who are low income earners.

South Seattle Vehicle Testing Station (Emission Check)

Mr Tom Olsen

Mr Glen Turner

Mr Micky Phillips, Envirotest (contractor)

Ms Kim Stevens, Manager

- Testing initially in 1982 with 6 stations (idle test) and only in the Seattle area.
- Program expanded 1993, including implementation of public outreach and education and diesel testing. Test cost US\$12 payable at test site.

- Testing is to the vehicle's model specifications. Failure rates amongst earlier models equipped with catalytic converters have higher failure rates. Statistics maintained by model years and emission levels.

City of Seattle. Seattle Office of Management Planning

Mr Henry E Sharpe, Manager

Mr Dennis Meier, Land Use Strategies

- Emissions inventory.
- Wood heater demonstration project - Government and industry buy-out of old models.
- *Growth Management Act 1990* establishes areas of restricted growth or urbanisation, and County wide Planning Policy aims to protect and preserve industrial areas for this future use and to prevent encroachment of other non-compatible use. Five urban centres targeted for growth. Challenge is to increase density of low density areas.
- Urban villages (hub and residential) - provision of public transport essential, encouraging walking, and reducing parking requirements.

Puget Sound Air Pollution Control Agency

Ms Margaret Pageler, Chair Puget Sound Air Pollution Control Agency Board

Ms Alice J Collingwood, Manager Communications and Education

Mr David S Kircher, Manager Engineering

Mr Dennis J McLerran, Air Pollution Control Officer

Mr James L Nolan, Director Compliance Division

- Wood heater restricted use program in place. 250 000 wood heaters in region with a population of 3 million. Higher particulate concentrations recorded during night in suburban areas. 10 year period required for cultural change in practices. Violations determined by visual opacity (20%). Wood price is now much higher than that of natural gas or propane.
- Vehicle emissions testing - compulsory and expanding.
- Winter oxygenated fuel program is an interim solution and kept as a backup measure in the event that CO levels are not achieved in the area.
- Agency role has shift from enforcement to education - emphasis on workshops with stakeholders including trade associations and encouraging the development of associations where they do not already exist.
- High occupancy vehicle lanes preferred by the community rather than the provision of light rail.
- Restriction on outdoor burning activities.
- Education and outreach programs by direct access - no more advertising.
- Requirement for Stage II vapour recovery at petrol stations will be phased out with the mandatory requirement for vehicles to have on board recovery now in place. On board diagnostics is the future for management of vehicle emissions. Now required on all new models

Bay Area Air Quality Management District (Air District)

Ms Lucia Libretti, Public Information Officer

Joseph Steinberger, Environmental Planner

- Transportation Fund.
- Smokey Vehicles reporting (10 second smoke rule, passenger vehicle fine US\$100 and US\$250 for trucks and buses.
- Vehicle Buyback program (US\$500).

- Vehicle registration surcharge (US\$4).
- Proposed Final '97 Clean Air Plan.
- Smog Check records vehicle kilometres therefore performance over 2 year period can be determined.

Spare the Air program

Ms Grier McCurdy, Community Focus, Program Director

- Trip linking
- Community attitudes to the program

United States Environmental Protection Agency - Region IX (San Francisco)

Julia I Barrow, Chief, Office of Air Planning

David S Mowday, International Activities Coordinator, Office of Communications and Government Relations

Ms Sylvia Dugre, Office of Air Planning

Mr Mark Brucker, Office of Air Planning

Ms Karina O'Connor, Office of Air Planning

Ms Pam Tsai, Coordinator, Enforcement

Ms Christine Hawk, Rule Making (VOC's)

Ms Lily Wong, Economic Incentive Programs

Ms Christine Vineyard, (Vapour Recovery Systems) Office of Air Planning

Mr Mark Simms

Mr Andrew Steckel

- Use of focus and task groups including industry representation to develop actions to achieve targets.
- Vehicle emissions and transport planning - greatest influence is to change population movement patterns. No transit hub in area and costs of owning and running private vehicle relatively inexpensive.
- Emphasis on educational programs to bring about community behaviour changes - very few regulatory tolls in place. Umbrella program is Spare the Air.
- High occupancy vehicles and lanes a mixed blessing since it is a capacity enhancer and no evidence to suggest that it actually changes the community's behaviour.
- Stage II vapour recovery at fuel stations required with facilities needing to be tested and certified to achieve 95% effectiveness. On board vapour recovery in vehicles now mandatory for all new models.
- Reformulated fuel program in place for reducing ground level ozone concentrations. Health research on the effects of MTBE currently being undertaken. Leaded fuel no longer on sale, last model year is 1975. Lead additives available over the counter.
- Vehicle buyback (accelerated scrappage) program - target 1000 vehicles a year. Would take removal of 25 000 vehicles to achieve target emissions reduction but cost prohibitive (US\$500 per vehicle paid per vehicle that is scrapped). \$39 paid to program managers who have 90 days to remove certain parts from the vehicle for reuse, however the engine block must be destroyed immediately.
- Economic incentives program gives credit for emission reduction. Audit and reconciliation process essential to determine if program is achieving goals. Must determine baseline.

F - Statement of actual (or estimated) costs

In accordance with Standing Order 378(b) -

Travel Expenses

Investigative Tour -Sydney/Canberra
(5 - 9 August 1997)

Members	Air Travel	12 800	
	Allowances	11 600	
Staff	Air Travel	5 100	
	Allowances	4 600	
Incidental Expenses		<u>1 800</u>	\$35 900

Investigative Tour - Denmark/London/Canada/USA
(25 October - 11 November 1997)

Members	Air Travel	31 800	
	Allowances	30 200	
Staff	Air Travel	12 800	
	Allowances	11 600	
Incidental Expenses		<u>3 000</u>	\$89 400

General expenses

Advertising		8 000	
Consultancy		39 000	
Printing Discussion Papers (5)		6 900	
Printing Final Report		10 000	
Postage		4 500	
Stationery & photocopying		700	
Refreshments		<u>600</u>	\$69 700

\$195 000