

Select Committee on Perth's Air Quality

Smoke Emissions from Open Burning

Discussion Paper 2

Presented by
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ORDERED TO BE PRINTED

Terms of Reference

The Legislative Assembly of the Parliament of Western Australia appointed on 29 May 1997 a Select Committee to investigate and report on air quality in Perth, with particular reference to the following:

- (1) (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.

Committee Members

Chairman

Mr Fred Tubby, MLA
(Member for Roleystone)

Members

Dr Judy Edwards, MLA
(Member for Maylands)

Mr Iain MacLean, MLA
(Member for Wanneroo)

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(Member for Fremantle)

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Preamble

It is the Committee's intention to release a series of five discussion papers in the near future, to be followed by a final report in April 1998.

Discussion papers will be released on the following issues:

- Smoke emissions from homes (tabled in the Legislative Assembly 11 September 1997);
- Smoke emissions from open burning;
- Industrial emissions;
- Vehicle emissions; and
- Integrated transport and urban planning.

Each discussion paper will be structured into two sections:

- Section 1 of each discussion paper will present background information on the status of Perth's air quality and the major contributing pollution sources. The content of this section will remain relatively consistent throughout the series of papers.
- Section 2 of the discussion paper will focus on suggested management strategies specific to that source and problem. The strategies are presented for public comment. They are not recommendations.

Section 1

Background

The Perth metropolitan area faces two distinctly different regional air quality problems: particulate haze and photochemical smog.

Evidence presented to the Committee to date suggests that Perth's air quality is relatively good for most of the year, experiencing only occasional events of particulate haze and photochemical smog. These polluting events largely result from local winds failing to disperse emissions into the environment, thereby accumulating and causing pollution. However, there is a fine balance between these occasional situations and that involving an increasing number of individual pollution events. Evidence suggests that the air pollution problems in Perth will increase unless action is taken now.

Public submissions received by the Committee to 30 June 1997 indicate that the community is acutely aware of this fine balance, and is demanding action from the Government to ensure that Perth's air quality does not deteriorate in the future.

The Committee recognises the need for the development of a long term Air Quality Management Plan for the Perth metropolitan area, and that any such plan needs to be based on strategies that target the key pollutant sources in an environmentally effective and economically efficient way.

Vehicle emissions, industrial emissions, and biomass burning including domestic wood heaters and open burns are all major contributing factors to reduced air quality in Perth. Each of these three subjects will be addressed in separate discussion papers to be released prior to November 1997.

Objective and scope

This paper outlines strategies designed to reduce smoke emissions from open burning, including prescribed burns conducted by the Department of Conservation and Land Management (CALM), and burns authorised under the *Bush Fires Act 1954* carried out by local authorities, land developers, land owners, orchardists and farmers. Naturally occurring fires such as wildfires caused by lightning strikes are not considered in this paper. CALM estimates lightning to be the ignition source for around 10% of the wild fires in this State.

Smoke emissions from open burning can be a major contributor to episodes of particulate haze, especially when Perth's weather pattern is not conducive to dispersing the smoke. Smoke is also a moderate contributor to the level of air toxics. The creation of photochemical smog in the Perth metropolitan area is influenced by the amount of smoke from a fire, where the fire is located and ultimately where the smoke travels to.

Depending on the amount of smoke from a fire, when the burning takes place and ultimately where the smoke travels to, can influence the creation of photochemical smog in the Perth metropolitan area.

The strategies presented are a compilation of those implemented in other cities within Australia and around the world, and include suggestions presented in oral and written submissions to the Committee.

The strategies listed are intended as illustrations of the type of action that could be implemented to ensure that Perth's air quality does not deteriorate in the future. The Committee is not suggesting that every strategy should be or needs to be implemented. Instead it is acknowledging the need for action across a variety of areas and is seeking your comment on: what do you consider to be the most effective measures, and what strategies you consider should be implemented for the Perth metropolitan area?

The Committee's initial evaluation of these suggested strategies has been facilitated by the investigative tour to Sydney and Canberra (4 - 9 August 1997), where specific strategies have also been proposed or are in various stages of implementation. The Committee has received 57 written submissions to date and has received oral evidence on 25 occasions. The Committee recognises the importance of community consultation, and the evaluation of these strategies will take into account all comment received in response to this paper. Therefore, the Committee is not presenting any recommendations at this stage.

This paper is the second in a series to be released by the Committee which will contribute towards the compilation of the Committee's final report and recommendations.

Perth's air quality now and into the future

The Perth metropolitan area faces two distinctly different regional air quality problems: particulate haze and photochemical smog. An additional concern is the community's exposure to air toxics, such as benzene, toluene and 1,3 butadiene, with research having recently shown that the levels currently considered safe may in fact be too high.

Haze

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. Particles that are ten microns in diameter (PM10 or "inhalable particles") and particles 2.5 microns in diameter (PM2.5 or "fine particles") are two measures of the concentration of these particles in the air, according to their size. These particles are small enough to be inhaled and are therefore important from a health aspect.

The Committee acknowledges the extensive amount of scientific research that has been undertaken around the world linking particulate matter, especially fine particles, with a variety of health problems, including premature death, aggravated asthma, acute respiratory symptoms including aggravated coughing, chronic bronchitis and decreased lung function. An estimated 70 premature deaths a year are related to particulate haze.

*The Perth Haze Study 1994-1996*¹ found that haze levels are highest in winter and lowest in summer. The most significant contributor to winter and spring haze is smoke particles from domestic wood heaters. Vehicle emissions are the second largest contributor of which diesel vehicles are estimated to cause two-thirds of this emission. Summer haze formation is influenced more by the presence of soil, sea salt and the chemical reaction of other pollutants that may be present in the air at the time, such as smoke from wild fires.

Relative contribution of smoke to causing particulate haze during winter months. (Source: Gras J L, 1996 A report to Department of Environmental Protection of Western Australia on fine-particle haze in Perth).

Prolonged events of haze during autumn and spring are sometimes caused by smoke from open burning. These fires are not all necessarily in close proximity to the Perth metropolitan area. Under certain weather conditions smoke generated from open burning in the south west has been known to drift offshore and then be carried into the metropolitan area causing an air pollution problem.

In general terms, the number of days per year when haze is experienced in the Perth metropolitan area is expected to increase. Particles from domestic sources, such as home fires and wood heaters, are expected to increase over the short to medium term, mainly as a result of the number of wood heaters installed in the Perth metropolitan area that do not meet Australian Standards designed to reduce emissions.

¹ Department of Environmental Protection, 1996, *The Perth Haze Study 1994-1996*

Seasonal peak haze levels in the Perth metropolitan area due to particulate matter. (Source: *The Perth Haze Study 1994-1996 Summary and Major Findings* November 1996, Department of Environmental Protection, Western Australia).

Particles from motor vehicles are also predicted to rise over the short to medium term, principally because of the growth in diesel vehicle use, with only those diesel engines manufactured from the mid 1990's required to meet the Australian Design Rules' lower particulate emissions level.² This growth in vehicle use is evidenced by the upward trend in the number of diesel vehicles registered in Western Australia, and in diesel fuel consumption.

The Department of Conservation and Land Management (CALM) have indicated that fuel loadings in some areas of the forest estate are increasing to levels which can be considered critical from a fire management point of view. This is similarly important from the perspective of smoke management.

The burning of orchard prunings and agricultural stubble burning tend to be a local problem. However, smoke from these activities can become a regional issue particularly if the fire is large enough and the weather conditions are not suitable for dispersing the smoke quickly.

This is also the case for burning on development sites but with the additional problem of dust generation once the soil has been exposed. Dust is one of the main contributors to spring and summer haze formation.

Photochemical smog

Photochemical smog is a pollution cocktail caused by the reaction of nitrogen oxides (NO_x) and reactive organic compounds (ROCs) in the presence of heat and sunlight. Ozone is a product of this reaction, and the monitoring of ozone concentration at ground level is used as an indicator of photochemical smog.

Since heat and sunlight are essential components to the generation of photochemical smog, it tends to be a summer problem for the Perth metropolitan area.

Bushfire smoke, be it from a controlled burn or wild fire, contains high concentrations of ROCs and significant smog events have been recorded in Perth when the ROCs react with the urban area emissions.

Estimates in *The Perth Photochemical Smog Study* indicate that the level of non-methane hydrocarbon generated from a prescribed burn of 5000 hectares is similar in size to a full day's emission from human activity. Individual controlled burns conducted by CALM vary in size from 10 hectares to 8000 hectares, with the aim of achieving between 60 and 80 percent removal of combustible material lying on the forest floor.

Relative source contribution to NO_x and ROCs generation. (Source: *The Perth Photochemical Smog Study*, Perth Western Australia, Department of Environmental Protection, Western Australia and Western Power).

²

Real, John 1997, *Vehicle Emissions and Air Quality in Australia*, paper presented to the Professional Short Course Road Transport Engine Emissions University of Melbourne, 23-25 July 1997

*The Perth Photochemical Smog Study*³ found smog events in Perth to be closely linked to the weather pattern. The highest smog concentrations occurred on those days during spring through summer and into autumn when a weak low pressure trough was situated very close to the coast and subsequently crossed the coast in the afternoon (morning easterly winds, afternoon sea breeze).

However it is believed that the high concentration and high reactivity of the ROCs in bushfire smoke can produce ozone levels of concern when smog would otherwise not occur. Given that these events tend to be of a longer time duration, the potential health effects are considered greater.

Photochemical smog formation in the Perth metropolitan area (Source: Airwatch, A Monitoring Program for Schools, Department of Environmental Protection, Western Australia, Main Roads Western Australia).

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

Over the past four years, the Perth metropolitan area has experienced on average 10 days per year when photochemical smog levels were unacceptable from a health perspective. These events, except when associated with bushfire smoke, tend to be of short duration (around two hours) and are not necessarily experienced across the entire metropolitan area.

Number of days in the month when peak 1-hour ozone concentration exceeded 80 ppb somewhere in the Perth metropolitan area. (Source: *Air pollution and You - A Booklet About Air Pollution in Perth*, Department of Environmental Protection, Western Australia, and Main Roads Western Australia).

To put Perth's air quality into context, it is useful to compare it to other Australian cities that have similar airsheds and similar sources of both NO_x and ROCs.

Comparison of relative contributions of NO_x and ROCs from sources in Perth, Sydney, Brisbane and Melbourne. (Source: *Australian Academy of Technological Sciences and Engineering*).

On a per capita basis, the Perth metropolitan area has a relatively high loading of pollutants when compared to Sydney and Melbourne. The key factor is the influence that emissions from the Kwinana industrial area are having on Perth, in particular NO_x emissions resulting from power generation.

Air toxics

The United States Environmental Protection Agency has identified one hundred and eighty nine air toxic substances. This list includes benzene, 1,3 butadiene and polycyclic aromatic hydrocarbons (PAHs). These come from a wide variety of sources but, in the Perth metropolitan area, the greatest source is vehicle emissions, unless one is a smoker or is regularly exposed to passive smoking.

Each air toxic has a different level at which it will pose a health risk to people. Recent research highlights the need for concern about the effects of long term low level exposure, particularly as some air toxics attach themselves to fine particles (those present as haze) which can be taken in by our bodies. Wood smoke has a toxic component which contains traces of a number of air toxics including carcinogens, such as PAH which adsorb onto particles in the air.

There is no regular monitoring of air toxics in the Perth metropolitan area.

Section 2

Community perception and opinion of Perth's air quality and smoke emissions from open burning

Written and oral submissions received to date have come from individuals, community groups and associations, businesses, industry, academics, health professionals, and Government agencies. A complete list of submitters will be provided in the Committee's final report.

The general perception presented in the submissions is that:

- Perth's air quality is relatively good on most days;
 - but it is getting worse, and
 - it is causing health problems.
- the key pollution sources in the Perth metropolitan area are considered to be;
 - motor vehicles, especially those with smokey exhausts,
 - backyard burning of waste,
 - smoke from home wood fires and heaters,
 - industrial emissions close to the city, and
 - smoke from bush fires and controlled burns of bush land, development sites and agricultural land.

Whilst the nuisance impact of smoke from development sites and the burning of orchard waste and agricultural stubble was raised in some submissions, greatest comment was placed on the potential impact of bushfire smoke versus the virtues of conducting controlled burns.

In support for the retention of controlled burning as a management tool, some submissions stated that fire and therefore smoke is natural to our environment and should therefore be accepted as normal. As the incidence of smoke in the Perth metropolitan area from these burns is only occasional, some submissions suggested that the residents of Perth should accept this inconvenience, particularly given the devastation, destruction and financial losses that can result from wild fires. Some submissions considered controlled burns to be an important training ground for fire fighters that must attend wild fires.

The Committee was concerned with a number of comments made in some submissions that highlighted a number of misconceptions or misunderstandings that the community has. These misconceptions include:

- *there are no controlled burns carried out during winter (the Committee wishes the reader to note that controlled burns are carried out during winter); and*
- *controlled burns are the only means available to reduce fuel loading in bush areas (the Committee wishes the reader to note that other methods are available).*

Smoke from all sources was considered in a number of submissions to be a pollutant, and was suggested to be included in this State's pollutant inventory. Some submissions stated that Perth did not have an extensive air monitoring network and that the lack of monitoring of air toxics was of particular concern.

The possible health effects from exposure to smoke emissions and in particular the relationship to asthma attack was raised in a number of submissions. Concern was expressed at the apparent lack of knowledge about the concentration and health effects of ROCs, especially when bound to airborne particles. This is of particular concern if smoke from any fire affects a populated area. Another concern raised in submissions was that no health risk assessment had been undertaken to evaluate the effect of exposure for residents in Western Australia, nor for fire officers.

An underlying theme from the community submissions was that no individual has the right to pollute the air everyone has to breathe. There is also a general perception that, whilst there are technical fixes to improve Perth's air quality, the community is not convinced that the Government is committed to fixing the problem.

Strategies to improve Perth's air quality by reducing smoke emissions from open burning

There are a number of strategies that could be introduced to reduce smoke emissions from open burning. Those listed here are a range of actions that could be implemented to ensure that Perth's air quality does not deteriorate in the future. The Committee is not suggesting that every strategy as listed here should be or needs to be implemented. Instead, it is seeking your comment on what you consider to be the most effective measures and those which you consider should be implemented for the Perth metropolitan area.

The strategy options have been classified as either *educational*, *technical*, *regulatory* or *market based* where:

- *educational* strategies aim to improve the actions of individual people which may be leading to the creation of smoke;
- *technical* strategies involve making changes to existing technology and implementing technologies;
- *regulatory* strategies are those which require some form of legal enforcement such as local council By-Laws or state regulations or legislation; and
- *market based* strategies which are direct financial incentives or disincentives.

Educational Strategies

1. Implement education programs explaining the reasons why controlled burns are undertaken, and how the burn is planned, implemented and managed.
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.
3. Implement an education campaign on the dangers and harm caused by the illegal lighting of fires.
4. Educate the community about open burning.

Technical Strategies

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.
6. Research and improve smoke plume dispersal modelling to better predict whether smoke from controlled burns will drift over Perth or other populated areas.
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.
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 area.
9. CALM should investigate and implement alternative methods to control burning.
10. Estimates of pollutant emissions from controlled burns should be included in Western Australia's pollutant inventory.
11. Provide greater resources to CALM so that better use is made of those days when controlled burning will not cause pollution in Perth.
12. Review the value of controlled burning to establish optimal practices.
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.
14. Undertake further research on the health effects of exposure to smoke.

Regulatory Strategies

15. Ban backyard burning in the Perth metropolitan area and other urban areas.
16. Improve management controls and enforcement action where land developers do not cooperate in preventing offsite smoke impacts.
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.
18. Monitor the frequency of deliberately lit fires to controlled burns in fire prone areas.
19. Restrict the implementation of controlled burns during periods of decreasing air quality.
20. Ban burning on development sites and require developers to chip vegetation on site for use as mulch.
21. Require CALM to give advanced warning to the community of their intention to carry out controlled burns.
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.
23. The responsibilities of the Bush Fires Board to be transferred to CALM to allow better utilisation of existing resources.
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.
25. Use provisions under the *Environmental Protection Act 1986* to ban all forms of burning on certain days when air pollution is likely to occur.

Market Based Strategies

26. Provide planning and financial concessions for urban development sites that retain vegetation on the site.
27. Place a rates or other surcharge on agricultural land where stubble burning is carried out.
28. Introduce financial penalties to CALM, developers and land owners if their burning activity causes pollution in the Perth metropolitan area or any other populated area.

Criteria for assessing strategies designed to reduce smoke emissions from open burning

The Committee will assess the strategies outlined in this paper by giving consideration to the eight measures outlined below.

Measure 1: Emission reduction potential

- What is the unit reduction in pollution per year, per capita?
- What total emission reduction is possible?

Measure 2: Timing of effectiveness

- What time frame is needed for the strategy to have an effect?
- How long will it take to fully implement the strategy?

Measure 3: Equity

- Are there individuals or groups within the community who will be disadvantaged by the strategy?
- Is the original source of pollution being targeted?
- Will the polluter pay?

Measure 4: Technical feasibility

- Is the technology currently available?
- Are there administrative or public perception barriers to the introduction of the strategy?
- Is there a high likelihood of new technology being developed in the future to solve the problem?

Measure 5: Enforceability

- Are regulatory mechanisms in place to support the strategy?
- Is there a need to enhance the mechanism?
- Is there a need to create a new mechanism?
- Is the mechanism enforceable?

Measure 6: Cost effectiveness

- What is the cost to the individual?
- What is the cost to the community?
- What is the cost to industry?
- What is the cost to Government?

Measure 7: Public acceptance

- What is the community's opinion of the strategy?

Measure 8: Additional social, economic or environmental impacts and benefits

- Does the strategy support any other federal, state or local Government strategy (eg Greenhouse Strategy)?

How to have your say

This paper is one in a series of five to be released which will contribute towards the Committee's final report and recommendations. These papers are being developed to not only bring information to the community, but for the community to bring information to the Committee.

To have your say on the strategies presented in this paper, written comments can be sent to:

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Submission period closes 30 November 1997.