ENVIRONMENT PROTECTION & HERITAGE COUNCIL

Co-operative Studies on Priority Air Quality and Health Related Issues

Report on Air Pollution and Asthma Workshop held at EPA Victoria on 29 and 30 January 2003

Attendees

Rob Joy, Chair, CSWG, Deputy Chairman EPA Victoria
Dr Lucas Neas, US EPA
Dr Michael Abramson, Monash University
Dr Ral Antic, Asthma Australia
Caroline Austwick, Ministry for the Environment, NZ
Dr Tom Beer, CSIRO, Atmospheric Research
K Bhatia, AIHW
Roger Bluett, NSW EPA
Dr Lyn Denison, EPA Victoria
Chris Forsey, Commonwealth Department of Health and Ageing
Dr Anne Geschke, Department of Human Services, Victoria
Leo Heiskenan, Commonwealth Department of Health and Ageing
Gary Irving, Asthma Victoria
Dr Bin Jalaludin, Liverpool Hospital, NSW
Dr Anne-Maree Kelly, Western General Hospital, Melbourne
Dr Alison Koschel, NETRU, Newcastle
Dr Andrew Langley, Sunshine coast Public Health Unit, Queensland Health
Dr Mike Manton, Bureau of Meteorology
Sue May, Environment Australia
Dr Arlie McQueen, CASANZ
Dr Geoff Morgan, NSW Health
Ian Newbery, NEPC Service Corporation
Dr Tim O'Meara, Woolcock Institute, CRC for Asthma, Sydney
Dr Bill Physick, CSIRO Atmospheric Research
Dr Louis Pilotto, Flinders University, Adelaide
Dr Shannon Rutherford, Queensland Health
Dr David Simon, Department of Human Services, South Australia
Dr Stephen Stick, Paediatric Health Unit, WA Health
Dr Jonathan Streeton, Respiratory Physician
David Wainwright, Queensland EPA
Dr Richard Wood-Baker, University of Tasmania

Introduction

At the May 2002 meeting of the Environment Protection and Heritage Council (EPHC), Council established an unfunded working to:

- identify priority areas of research into the relationship between air quality and health;
- develop a mechanism for achieving high quality, robust studies that generate information to support decisions on future air quality standards and management strategies; and
- identify options for funding priority areas of research.

In July 2002, a workshop was held with key stakeholders with the aim to identify priority areas of research. A number of priority areas were identified including studies into the impact of air pollution on asthma.

With respect to this area the Council, at its October 2002 meeting, resolved to:

- note the immediate priority research projects, ie the expansion of the Multi-City Mortality and Morbidity Study and the scoping of a national study of air pollution and asthma, recommended by the Working Group to support the review of the Ambient Air Quality NEPM scheduled to commence in 2005; and
- direct the Working Group to consult with key stakeholders to fully scope the asthma study and report to Council in April 2003 with a fully costed proposal.

To address the second issue in the Council resolution with respect to the scoping of an air pollution and asthma study, key stakeholders were invited to attend a two-day workshop in Melbourne on 29 and 30 January 2003. Dr Lucas Neas from the USEPA, Epidemiology and Biomarkers Branch, was also invited by EPA Victoria to attend as a guest speaker.

Day 1

The first day of the workshop was introduced by Rob Joy, Chair EPHC Working Group. Rob outlined the tasks of the EPHC Working Group and the purpose of the workshop.

Gary Irving, Asthma Victoria, gave a presentation on behalf of Asthma Australia outlining the situation with asthma in Australia. The National Health Survey in 2001 indicated that 2.2 million Australians are asthmatic. The incidence of asthma in Australia is increasing. Asthma is rated as the sixth highest national health priority and it is estimated that health costs associated with asthma exceed $750 million per annum. A number of triggers were identified including environmental factors, air pollution being one of them.

David Wainwright, Queensland EPA, gave an overview of air quality in Australia. Overall Australian cities experience good air quality, however there are still some days when there are exceedances of the ozone and particle standards. Main sources of particles are motor vehicles, wood smoke from domestic sources and bushfires. Issues raised through discussion included the timeliness of reporting of air quality

data so that the health agencies can provide health warnings in real time to asthma sufferers, and also whether it was the number of exceedances or the magnitude of the exceedance that was most critical for exacerbation of asthma.

Dr Lucas Neas, USEPA, provided an overview of international research into air pollution and asthma. Dr Neas is an epidemiologist with considerable experience in air pollution epidemiology. His presentation gave an overview of asthma as a chronic disease and the various causes and triggers. He posed three major questions with respect to air pollution and asthma:

- Is the prevalence of asthma associated with air pollution?
- Is the frequency of acute asthma exacerbations associated with air pollution?
- Is sensitisation to antigens associated with asthma?

Dr Neas gave an overview of a range of studies that have been undertaken worldwide to address these questions. The study designs required to investigate prevalence/causation differ from those designed to look at the acute exacerbation of asthma. Prevalence studies require following of cohorts for a period of several years in differing locations to identify any links between air pollution and the increase in the prevalence of asthma. These studies can be done retrospectively by 'piggy-backing' an air pollution component onto an existing cohort. This can be an inexpensive way of conducting such studies if an appropriate cohort can be identified.

Studies into the acute exacerbation of asthma are easier to do and can be done through time-series analysis or through panel studies. There have been many studies of this type conducted worldwide.

Overall, international research indicates that there is currently little evidence that air pollution is a major causative factor for asthma but there is fairly strong evidence that it can act as a trigger for acute exacerbation of asthma. In terms of finding a causative link between air pollution and asthma, birth cohorts were suggested as potentially the best way forward.

Following the international perspective, a range of speakers discussed research in Australia relating to air pollution and asthma.

Geoff Morgan presented an overview of research that has been undertaken by NSW Health. Previous studies have looked at the effects of air pollution on hospitalisations and respiratory symptoms in asthmatics. Studies are currently being undertaken into the effects of the Sydney bushfires on hospital admissions and emergency room attendances for asthma. Geoff also highlighted some research gaps in relation to ozone and NO_2 and their relation to asthma exacerbation. Discussion focussed on bushfire studies and attention was drawn to a recent study in the Northern Territory relating hospital admissions for asthma with exposure to bushfire smoke.

Lyn Denison, EPA Victoria, gave an overview of studies that had been conducted in Melbourne and an overview, on behalf of Rod Simpson, on the multi-city study currently underway. The Melbourne studies have shown a strong association between hospital admissions for asthma and air pollution, especially fine particles, ozone and NO_2. The effects were strongest in children under 14 years of age. Current studies are focussing emergency department attendances for children with asthma.

The multi city study, coordinated by Rod Simpson at the University of the Sunshine Coast, is using standardised statistical techniques and meta-analysis to look at the impacts of air pollution in Melbourne, Brisbane, Perth and Sydney on mortality and morbidity. Both mortality and hospital admissions for asthma are being investigated in this study.

Louis Pilotto presented the findings of a number of studies being conducted in South Australia. Studies in Port Adelaide have found an association between air pollution, particularly in one industrial precinct, and asthma. Other studies have included a cohort study looking at the effects of indoor NO_2 exposures on people with asthma and a randomised study into the replacement of unflued gas heaters on the respiratory health of asthmatic children.

Shannon Rutherford, Queensland Health, outlined a range of studies being undertaken in Queensland. These include a study looking at the impact of dust storms on hospital admissions for asthma, and a case control study comparing the association between air pollution and asthma in a coastal area compared with an inland area. Studies are also being undertaken into the association between asthma and pollens in Brisbane.

These overviews indicate that the focus to date has been on the association between air pollution and acute exacerbation of asthma. The results have indicated that even at the relatively low levels of air pollution in Australia, air pollution does exacerbate asthma. One issue that was raised in discussion was the importance of chronic obstructive pulmonary disease (COPD) in the elderly and how this should not be overlooked in studies into the effects of air pollution on respiratory health. COPD is the fourth highest cause of death in Australia and is strongly associated with asthma.

Chris Forsey, Commonwealth Health and Ageing, presented and overview of the Commonwealth Asthma Management Program. A National Asthma Reference Group was established in 2000. The National Asthma Action Plan is being implemented and includes the asthma friendly schools program, professional education, applied research and the establishment of the Australian Centre for Asthma Monitoring at the Woolcock Institute in Sydney. A position paper on asthma and air pollution is currently being prepared. This work is chaired by Michael Abramson.

Dr Jonathan Streeton gave a summary of the medical consequences of air pollution on asthma. Dr Streeton outlined the defence mechanisms in the respiratory system

and the consequences of long-term 'insult' to the airways. Irreversible damage can occur from long-term perseverance with symptoms or inappropriate treatment. Dr Streeton highlighted the difficulties in separating the impacts of the different pollutants when people are exposed to mixtures of pollutants and other aerosols. He also noted that reductions in air pollution would help to reduce the frequency of asthma attacks but that a 5% decrease in pollution would not necessarily translate into a 5% decrease in asthma attacks, as there are many triggers for asthma apart from air pollution. Michael Abramson stressed that quality of life is critical for asthmatics and that lost productivity can be significant.

Lucas Neas, USEPA, followed by presenting an overview of the USEPA's Asthma Research Strategy. He outlined the US regulatory context and how the strategy was developed within that context. He presented an overview of the identified research needs within the US, the approach to the research, the process for prioritisation of research and the timelines for delivery.

The triggers considered in relation to asthma included, combustion related products (particles, NO_2, O_3), bioaerosols (pollens, fungal spores and allergens; air toxics eg benzene, formaldehyde) and pesticides. In terms of prioritising the research areas, a range of criteria were considered. These included their public health importance, relationship to the USEPA 'mission' and their applicability to risk-based planning. The elements of risk-based planning included induction/exacerbation of asthma, susceptibility and risk assessment. All research proposals are considered against this matrix.

The general view of the workshop participants was that the USEPA model would be a useful model to be modified for the Australian situation in prioritising research into air pollution and asthma.

The first day concluded with a panel discussion based on the material presented throughout the day. The major themes emerging from Day 1 were the:

- desirability of mechanisms to ensure collaborative research;
- need to develop a National Research Strategy for Air Pollution and Asthma (and other respiratory diseases) based on a modified USEPA model;
- difficulties in accessing existing cohorts and routinely collected health data for air pollution research;
- potential to 'piggy back' air pollution research onto existing studies as a cost-effective means of conducting research;
- question as to whether air pollution and asthma research warranted the dollars, given that air pollution is likely to only play a small role in asthma exacerbation; and
- question of EPHC mission/objectives vs 'public good' research vs the priorities of other organisations.

The range of potential studies that were discussed included:

- Birth cohorts
- Panel studies

- Bushfire/woodsmoke studies
- Intervention studies
- Prevalence studies focussing on air pollution
- Dose response studies
- Motor vehicle pollutant studies
- Indoor air quality studies
- Causation vs exacerbation
- Studies looking at sensitive outcomes such as lung function, lost productivity, quality of life issues and health costs.

Day 2

The second day of the workshop started with a review of the major themes and outcomes of Day 1. This was followed by Caroline Austwick, Ministry for the Environment in New Zealand, who gave an overview of the current asthma research and air quality issues in New Zealand. Major air pollution issues relate to high levels of PM_{10} arising mainly from domestic wood heating. A number of studies are currently underway in New Zealand looking at the impact of air pollution on health. With respect to asthma there is a study being conducted looking at the prevalence of asthma and indoor air quality.

Lyn Denison gave an overview as to how epidemiological research is used to support the development of air quality standards. The development of the Advisory Reporting Standards for $PM_{2.5}$ was used as a case study. The critical information required for standard setting is the dose-response relationship or the identification of a LOAEL or NOAEL. Any studies conducted for the purposes of the Ambient Air Quality NEPM review must be designed to allow this to be determined. These data then allow an estimate of the number of adverse health effects that could be avoided if air pollution levels were reduced to meet any proposed standards.

Stephen Stick, Perth Paediatric Environmental Health Group, was linked by video conference to present a proposal that is being pursued in Perth to look at a birth cohort and the influence of indoor air quality on the prevalence of asthma. The study is focussed on initiation of asthma versus trigger factors. The study, which has a proposed budget of $12 million, will investigate a range of indoor pollutants including particles, formaldehyde, VOCs, NO_2 and allergens.

The workshop then featured panel discussions on study designs and on the requirements for the development of air quality standards. In terms of study designs, the need for large longitudinal studies was highlighted and the budget implications of these were noted. Lucas Neas cautioned against discarding time-series studies as they can provide useful information and are relatively inexpensive to conduct.

The critical role of exposure measures was discussed. Most air pollution epidemiological studies rely on data from air monitoring stations. The need for detailed personal exposure data or modelling data was discussed but no clear conclusions were reached. Both personal exposure monitoring and modelling can be

expensive to undertake, and only ambient air quality can be regulated by environment agencies.
The question of 'who should be protected' by air quality standards was raised. Discussion focussed around the more sensitive groups in the population including children and the elderly.

Rob Joy chaired the final session of the workshop that was aimed at getting agreement on priority areas of air pollution and asthma research. The discussion was broad ranging and there was consensus that participants needed to think through the outcomes of the two days and feed back any priority areas to the Working Group post the workshop.

The major themes arising from the second day of the workshop were:
- The usefulness of designing a long-term research agenda with a number of short-term priorities embedded into it, eg panel studies and intervention studies;
- Any proposed research needs to have a national focus to gain EPHC approval;
- Although the EPHC priority is research to support the setting and review of air quality standards, a broader research agenda should not be dismissed; and
- The need for collaboration to secure multiple funding sources to support the research. Environment agencies alone cannot fund research.

Potential study types arising from the workshop included:
- Birth cohorts (very expensive)
- Spatial variation in air pollution and health outcomes
- Longitudinal studies (apart from birth cohorts)
- Exposure assessment studies
- Studies looking at sensitive health outcomes (eg emergency department attendances, lung function)
- GP visits (although likely to be limited by availability of data)
- Studies using clinical trial data
- Rotating panel studies.

A broad range of study design issues were discussed. A separate workshop on funding issues was proposed.

It was agreed that workshop participants would be asked to provide their thoughts on priority research projects together with any other comments they wished to make outside of the workshop. Rob Joy highlighted the tight timelines that the Working Group were operating to and outlined the process until the October 2003 meeting of Council when he was expecting the Working Group to make their final recommendations to EPHC.

As tools to help participants frame their suggested research priorities, it was agreed that they would be supplied with:
- Copies of the workshop summary slides
- A copy of the USEPA research priority table (with a request for further suggestions as to how it should be refined for EPHC purposes)

- A copy of the Initial List of Priority Research paper, and
- A copy of the Air Quality in Australia presentation given by David Wainwright.

All documents except the Air Quality presentation were circulated the following day.

Suggested research priorities

Input following the workshop was received from many of the participants. The following is a table summarising the priority areas identified by those who responded.

The ranking of study types was derived using an optional preferential voting technique (explained below) and represents the priority areas identified by the 14 respondents to the questionnaire distributed following the workshop, rather than the views of a wider audience. There is a clear prioritisation from 1 to 5, followed by a close grouping in relation to 6 to 12, with less support for 13 to 17. This ranking may well have changed had the number of responses been greater.

Ranking of Study Types

The 14 respondents included two asthma specialists, three health agency representatives, five respiratory physicians, one academic, two environment protection agency representatives (one from Australia, one from New Zealand) and CASANZ.

Study Type	***Rank***	***Score***
Sensitive outcomes (lung function, lost productivity, quality of life, costs)	1	83
Indoor air quality	2	94
Panel studies	3	97
Asthma exacerbation	4	112
Intervention studies	5	114
Birth cohorts	6	140
Exposure assessment studies	7	143
Motor vehicle pollutant studies	8	145
Asthma causation	8	145
Woodsmoke studies	10	150
Dose response studies	11	151

Sensitive groups (who is affected, ED attendances)	12	155
Bushfire studies	13	165
Prevalence studies focussing on air pollution	14	170
Spatial variation in air pollution and health outcomes	15	185
Clinical trial data	16	188
GP visits	17	257

The Optional Preferential Voting Technique

- The technique allows for a range of propositions (in this case, 'study types') and for a range of options in the 'agree/disagree' columns in relation to each proposition (in contrast to a simple 'yes or no'/'in or out' vote).

- The 'priority' column provides further opportunity to weight those propositions considered both very important and least important.

- Each proposition is scored by multiplying together values assigned to the 'agree/disagree' columns and the 'priority' column:

agree strongly	= 1	top priority	= 1
agree	= 2	second top priority	= 2
no opinion	= 3	third top priority	= 3
disagree	= 4	blank	= 5
disagree strongly	= 5	third lowest priority	= 8
		second lowest priority	= 9
		lowest priority	= 10

- The scores for each proposition are then summed. The propositions accorded the highest priority by a group will be those with the lowest total scores.

- If propositions are grouped closely together, the rankings can be taken as a starting point and rearranged by debate (after discarding any propositions clearly rated as a low priority).