Submission to the Senate Standing Committee on Community Affairs

Inquiry into the impacts on health of air quality in Australia

Australian Medical Association

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Introduction

The Australian Medical Association (AMA) welcomes the opportunity to contribute to the inquiry into the impacts on health of air quality in Australia.

As the peak professional organisation representing medical practitioners in Australia, the AMA recognise that air quality has significant implications for human health. Over the past two decades, there have been general improvements in air quality in Australia due to a mix of regulatory and non-regulatory approaches applied at local, state and national levels. Despite this, considerable challenges remain. As an accumulating body of evidence refines our understanding of the health effects of air pollutants, various developments have called into question the effectiveness of current air quality management in Australia, including an increasing reliance on road transport, the expansion of mining and industries producing hazardous air pollutants, and the compounding effects of climate change and extreme weather on poor air quality.

The AMA believes that the policy and regulatory responses to these challenges need to be strengthened. Current air quality standards in Australia lag behind international standards and have failed to keep pace with scientific evidence. Insufficient monitoring and poor compliance mechanisms, fragmentation between different sectors and tiers of government, and the lack of exposure targets are but some of the areas requiring review and reform. As the effects of climate change and extreme weather on air quality become increasingly apparent, the current inquiry into air quality provides a timely opportunity to review air quality management in Australia and identify areas where improvements can be made.

It is beyond the scope of this submission to provide a comprehensive analysis of the complex array of policies and regulations that impact on air quality, and that cross various government tiers and portfolios. This submission focuses instead on the effectiveness of current national air quality standards and monitoring, and identifies some of the critical areas that require strengthening. Underpinning the recommendations made in this submission is a commitment to an approach that is based on the best available scientific evidence; that applies the precautionary principle to take into account uncertain or irreversible threats to human health; and that prioritises the health needs of vulnerable groups, including children. While these principles are ostensibly enshrined in current environmental legislation, they are not necessarily realised in the implementation of current air quality policies and regulations.

The health impacts of air pollution

Although there have been significant improvements to air quality in Australia over the past two decades, the health costs arising from air pollution remain considerable. It has been estimated that, each year, urban air pollution accounts for significantly more deaths than the nation's road toll.[1] The economic costs of these premature deaths and the chronic and acute health effects of air pollution are substantial. The estimated health costs associated with outdoor air pollution are up to $8.4 billion per annum[2] and, across Australia, the costs associated with motor vehicle emissions alone are estimated to be between $600 million and $1.5 billion per annum.[3] The CSIRO have estimated that the cost of poor indoor air quality in Australia may be as high as $12 billion per year.[4]

The adverse health consequences of air pollution range from acute and chronic effects, such as restrictions in physical activity, to emergency room visits for asthma and hospitalisations for respiratory and cardiovascular causes, to premature mortality.

The nature and severity of these effects are a function of the type and concentration of pollutant, the duration of exposure, and the sensitivity of the individual. The key health effects of the criteria pollutants and air toxics are summarised below (table 1).

Table 1: selected outdoor air pollutants and their effects on health*

Pollutant	Sources	Known health effects	Vulnerable populations
Particulate matter (PM_{10} and $PM_{2.5}$)	Motor vehicle emissions (particularly diesel engines), industry emissions, mining activity, agricultural practices, wood-burning; unflued gas heating and cooking, bushfires, wind-blown dust, cigarette smoke	Upper respiratory tract irritation and infection; exacerbation of asthma; decreased lung function; exacerbation of, and increased mortality from, cardiorespiratory diseases; myocardial infarction; premature mortality; atherosclerosis; adverse birth and neurodevelopment outcomes	Elderly people with respiratory and cardiovascular conditions; children with asthma
Ozone (O_3)	Reaction of sunlight and vehicle or industrial emissions; hydrocarbons and oxides of nitrogen	Decreased lung and pulmonary function; upper respiratory tract infection (especially in children); exacerbation of chronic respiratory conditions, including asthma, emphysema and chronic bronchitis; increased airway reactivity	People with chronic respiratory conditions (especially children with asthma)
Oxides of nitrogen (NO_x)	Motor vehicle emissions; energy generation; mining and other industrial emissions; unflued gas appliances	Upper respiratory tract infection (especially in children); exacerbation of chronic respiratory conditions, including asthma; eye irritation; reduced immunity to lung infection;	People with respiratory conditions (especially children with asthma)
Sulfur dioxide	Fossil fuel combustion; metal smelting or photochemical industries	Throat irritation; exacerbation of cardiovascular diseases, including asthma	People with respiratory conditions (esp. children with asthma); elderly people with respiratory and/or cardiovascular diseases
Carbon monoxide	Biomass and fossil fuel combustion; vehicle exhaust emissions; cigarette smoke	Reduction of oxygen-carrying capacity of the blood, resulting in headache, nausea, dizziness, breathlessness, fatigue, visual disturbance; angina, coma; death; low birth weight (after maternal exposure during pregnancy)	People with ischaemic heart disease; pregnant women
Lead	Smelting	In children, neuropsychological & cognitive effects; in adults, hypertension & classic lead poisoning.	Children and pregnant women
Air toxics (hydrocarbons, aldehydes, volatile organic compounds, asbestos)	Motor vehicle and industry emissions; biomass; occupational exposures; smoking	Increase in the incidence of cancer; reproductive and developmental effects; eye irritation; genetic damage; central nervous system defects; immunodeficiency; and disorders of the respiratory and nervous systems.	Smokers; people with respiratory conditions (especially children with asthma);

* Adapted from World Health Organisation air quality guidelines

The health impacts and sources of particulate matter

In terms of potential to harm human health, particulate matter (PM) is one of the most important pollutants as it penetrates into sensitive regions of the respiratory system, contributing to significant acute and chronic health problems and, potentially, premature mortality. Despite a substantial and compelling body of evidence

demonstrating the short- and long-term health impacts of particulate matter (PM), Australia standards and regulations relating to particulates lag behind international best practice and reveal significant shortcomings. Existing epidemiologic evidence indicates that *there is no lower limit of exposure to particulates below which there is no impact*. The accumulation of recent evidence documenting the health impacts of fine particulate matter (with a diameter less than 2.5 μm), has led to the WHO to revise down the recommended levels for air quality standards, and the United States Environment Protection Authority has similarly revised its air quality standards to lower the threshold standard for $PM_{2.5}$.[11,5]

Coarse particulates ($PM_{10-2.5}$) are derived from suspensions of dust, soil or other crustal material from roads, mining or agricultural, and may also include pollen, moulds, spores, or other biological material. Both fine and ultrafine particles ($PM_{2.5}$ and $PM_{0.1}$) are produced by combustion processes, and are emitted directly from vehicles, smokestacks, and fires. They can also form in reactions in the atmosphere from gaseous precursors, including sulfur oxides, nitrogen oxides, and volatile organics from diesel exhaust emissions and other industrial processes. The emissions of $PM_{2.5}$ and $PM_{0.1}$ from diesel are of particular concern to the AMA, and gaps in the relevant regulations and air quality standards are further discussed below.

There is extensive body of research documenting a variety of adverse health effects resulting from exposure to fine ($PM_{2.5}$) and coarse ($PM_{10-2.5}$) particulates. $PM_{10-2.5}$ and $PM_{2.5}$ are associated with increases in mortality and morbidity associated with various cardiovascular, respiratory and other health effects. The latest review from the World Health Organisation (WHO), released in January 2013, shows that long-term exposure to fine particles ($PM_{2.5}$) can trigger atherosclerosis, adverse birth outcomes and childhood respiratory diseases.[10] The review also suggests a possible link with neurodevelopment, cognitive function and diabetes, and indicates that recent research has further strengthened the causal link between $PM_{2.5}$ and cardiovascular and respiratory deaths.

The health effects of ultrafine particulates ($PM_{0.1}$) have also been subject to growing attention by researchers, and there is suggestive evidence that these particulates pose significant risks to human health.[6,7,8] Australia's National Environment Protection Measures for ambient air quality do not currently include standards or monitoring guidelines for ultrafine particles. This is despite the fact that ultrafine particles are the main constituent of airborne particulate matter and, due to their numerous quantity and ability to penetrate deep within the lungs, are regarded as a major concern for respiratory exposure and health.[9,10]

The most recent review by the WHO stated that there is a small but increasing body of epidemiological research showing an association between short-term exposures to ultrafine particles and cardiorespiratory health, as well as adverse effects to the central nervous system.[11] The review indicates that the toxicity of these particulates is well known, and clinical and toxicological studies have shown that they can act aggressively through physiological mechanisms not shared with larger particulates. However, the WHO concluded that:

> Although there is considerable evidence that ultrafine particles can contribute to the health effects of particulate matter… the data on concentration-effect functions are too scarce to evaluate and recommend an Air Quality Guideline… Current efforts to reduce the number of ultrafine particles in engine emissions should continue, and their effectiveness assessed, given potential health effects.11

In short, there is compelling evidence that exposure to ultrafine particulates poses a significant threat to human health, however it is currently not possible to precisely quantify the exposure levels that may result in specific health effects. On this basis, a

prudent precautionary approach would establish provisional standards and measures designed to reduce exposure to ultrafine particulates, particularly given their ubiquity and presence in vehicle exhaust emissions. Uncertainties regarding the precise exposure-response relationship should not be taken as a cause for not acting, given the potential risks are high and measures to reduce these risks are readily available.

Recommendation: Develop air quality standards and monitoring guidelines to support reductions in ultrafine ($PM_{0.1}$) particulates, including strategies to reduce ultrafine particulate emissions from vehicles and stationary sources.

Climate change and the health impacts of air pollution

Climate change, and the associated increased in extreme weather events, has the potential to heighten the health impacts of air pollution. The formation and dispersion of air pollutants are influenced by a range of weather variables, including temperature and cyclonic conditions.[12] Extreme events such as heat waves and bushfires can also influence air quality, while drought conditions increase the incidence of dust storms and particulates. The formation of ground-level ozone is amplified by increases in temperature, and heatwaves and warmer seasons have been associated with increases in ozone-related health problems. The concentration of aeroallergens may also be elevated by climate change. In addition to increasing the ambient air concentrations of pollutants such as ozone and particulates, extreme heat events are known to exacerbate cardiovascular and respiratory symptoms, and may thereby heighten the sensitivity of certain groups to the health effects of air pollution.[12]

Recommendation: Current policy and planning frameworks need to take into account the likely impacts of climate change on air pollution. Temperature rises and extreme weather may not only increase the concentrations of certain air pollutants, but may also render vulnerable populations more susceptible to experiencing adverse effects from pollutants.

Recommendation: Further research should be initiated to investigate the health impacts and costs to communities from air pollution, including the dispersal patterns and health impacts of fine and ultrafine particulates; the cumulative and synergistic health impacts of air pollutants; the health impacts of air pollutants from coal-seam gas; and the impacts of air pollutants on vulnerable populations, including children, Indigenous communities, people with chronic health conditions, and people from low socio-economic backgrounds.

Vulnerable and at-risk populations

A number of groups within the population are more susceptible to the health effects air pollutants. This includes those who are more sensitive to exposure (e.g. due to pre-existing chronic conditions, age, or airways responsiveness), and those who are exposed to large amounts of air pollutants (e.g. due to occupation or geographic location). Members of the last group are vulnerable by virtue of their levels of exposure rather than as a result of individual susceptibility.

Groups who are more likely to be vulnerable to the health effects of air pollutants include:

- children
- older adults
- asthmatics and people with existing respiratory and cardiovascular disease

- diabetics
- pregnant women
- low socio-economic groups

In addition, people who work or exercise outdoors, or are employed in particular industries, may be more vulnerable to the effects of air pollution due to increased exposure. Gaps in current regulations and standards relating to occupational exposures are considered in greater detail below. Populations who live in close proximity to major sources of air pollution, including coal-fired power stations or traffic freeways, may also be at a heightened risk due to high exposure levels.

The role of socioeconomic status as a component of susceptibility to the adverse health effects of air pollution should be considered when setting ambient air quality standards and implementing programs and policies to achieve these standards. People from low socioeconomic populations may be more likely to reside in areas with higher pollution levels (e.g. next to major roads or industrial facilities, as land and house prices are usually lower). Adding to this vulnerability are individual risks such as increased sensitivity to air pollution, prevalence of chronic disease, and exposures to other environmental factors such as indoor air pollution. Low socioeconomic populations consistently have higher rates of chronic disease and predisposing health characteristics that can increase negative health impacts from poor air quality.

In developing standards and policies that take into account vulnerable populations, a further consideration is the impact of air pollution on Indigenous communities. For Indigenous communities that live outside urban areas, there can still be significant health impacts arising from air pollution, in particular due to particles from fires, dust and industrial developments, such as mining. In addition, people from Indigenous backgrounds experience higher rates of the heath conditions that render individuals more susceptible to the health effects of air pollution. Table 2 draws on health data from the Australian Institute of Health and Welfare, and summarises some of the key health outcomes of concern with respect to air pollution, and the respective prevalence rates for Indigenous and non-Indigenous populations.

Table 3.3 Prevalence of health conditions: Indigenous and non-Indigenous people, 2004–2005*

Health condition	Indigenous (%)	Non-Indigenous (%)
Respiratory diseases	30	29
Asthma	16	10
Circulatory problems and diseases	22	17
Diabetes mellitus	12	4
Low birth-weight	13	6

* adapted from AIHW 2007[1]

Although there is an extensive body of research documenting the health effects of air pollution on vulnerable and disadvantaged communities overseas, research in Australia is limited. One such study that has been undertaken involved an exposure-response analysis of the health effects of PM_{10} from ambient biomass smoke in Darwin. This study found a disproportionate risk for respiratory and cardiovascular hospital admissions in the Indigenous population.[13] Apart from this study, data is generally limited on the exposure to air pollution and the subsequent health risk for Indigenous people. In response to the dearth of research, the Environment and Protection Heritage Council Working Group recommended that research be

undertaken to investigate the impact of air pollution on Indigenous populations as a priority. The AMA supports this recommendation, and further recommends that the precautionary principle should guide the development and implementation of air quality standards and management policies relating to vulnerable or disadvantaged groups, including Indigenous communities, children, and people from low socio-economic backgrounds.

In addition, greater efforts need to be made to monitor the exposure to pollutants and consequent health risks for vulnerable groups. In contrast to air quality networks in European countries or in the United States, the air quality monitoring network in Australia is not designed to capture pollution variability within a region. Instead, air monitoring stations are located to provide a representative measurement of the level of exposure of the broad population, rather than at 'hot spots' (such as near major point sources or roads), or in locations where vulnerable groups may be clustered.

Accordingly, the current air quality network does not effectively capture data relating to the exposure of vulnerable groups. Air quality monitoring is not usually targeted toward low socio-economic or vulnerable populations and, as a result, information on the levels that specific communities are exposed to, and their subsequent risk, is often unknown.

Recommendation: Research should be undertaken to investigate the impact of air pollution on Indigenous populations as a priority. Further research should be undertaken to better understand the health impacts to vulnerable and at-risk groups, including children, people with chronic health conditions, and people from low socio-economic backgrounds.

Recommendation: The impact of air pollution on children's health should be actively considered when setting air quality standards. Safety margins employed in standard setting should account for members of the most sensitive groups, including children, older adults, people with pre-existing and cardiovascular disease, asthmatics, diabetics, and low socio-economic groups.

Recommendation: Air quality monitoring and health surveillance needs to be expanded and strengthened to more effectively measure the exposure of vulnerable groups and populations living in close proximity to major source of air pollution, such as industrial point sources or major roads.

Recommendation: The AMA supports the protection of all people from the harm from nearby sources of air pollution, especially those who suffer disproportionate exposure. The AMA supports the development, implementation and enforcement of health and environmental laws and policies to reduce such exposures. This should include regular, thorough and transparent assessments of the impacts to nearby communities from sources of dangerous pollutants, including during the planning for highways and other transportation sources; industrial and commercial point sources; and mining and agricultural activities.

Occupational exposures to air pollutants

Current occupational and health safety regulations relating to air quality are unevenly applied, placing workers in certain industries and occupations at a heightened risk of adverse health outcomes. Work-related respiratory disease is almost certainly an important cause of work-related morbidity and mortality in Australia, and Safe Work Australia has targeted respiratory diseases as one of eight identified occupation diseases for priority action.[14]

Despite the recognised health risks associated with airborne hazards in workplaces, Australia lacks a comprehensive system of surveillance for occupational diseases associated with poor air quality. Information is primarily limited to workers compensation claims, which do not provide a reliable or complete set of data to help target prevention activities. The lack of effective information and data was highlighted in 2006 by a Parliamentary Inquiry into workplace harms related to toxic dust and emerging technologies, which recommended that robust surveillance systems be established to facilitate early and accurate diagnosis of occupation-related respiratory diseases. A subsequent national survey into occupational exposure to air pollutants was undertaken by Safe Work Australia in 2008. This survey found widespread exposure to airborne hazards within the workplace, with large proportions of exposed workers being exposed to air pollutants associated with the development or exacerbation of severe respiratory diseases. The survey report concluded that regular and systematic national surveillance should be undertaken to identify airborne hazards in Australian workplaces, and to facilitate the targeting of preventative measures for respiratory disease.

Recommendation: Current occupational health and safety regulations and standards need to be strengthened and enforced to support improvements in air quality in workplaces, particularly in highly exposed occupations and workplaces. Robust and systematic health surveillance should be regularly undertaken in industries where there is an elevated risk of developing respiratory diseases, including mining and construction industries.

Diesel emissions

The need for regular monitoring and surveillance, and the strengthening of air management practices, is imperative in industries where there is an elevated exposure to particulates arising from diesel emissions, such as underground mining. Diesel engines have a wide range of industrial applications including on-road equipment (e.g. heavy- and medium-duty trucks and buses), and off-road applications in the mining, rail, construction, and farming industries, including the use of diesel-powered heavy equipment, forklift trucks, ships, tractors, and generators. Diesel emissions are a particular problem in enclosed environments such as underground mines and workshops, where exhaust particulates and gases can accumulate if ventilation is inadequate.

Diesel emissions pose significant risks to human health. In 2012, the WHO reclassified diesel engine exhaust as a Group 1 carcinogen, raising it from a 'probable' to a 'confirmed' cause of lung cancer.[15] The WHO's ruling highlighted the need to focus on heavily exposed occupations, with the most powerful evidence for the reclassification coming from a landmark retrospective study of 12,000 underground miners in the United States.

Given the significant health risks associated with diesel, it is imperative exposure standards are set and enforced, particularly in occupations and industries with an elevated potential for heavy exposure. Such standards are currently in place in the United States, Canada, and Europe. Despite the demonstrated need for such regulations, Australia lacks a national workplace exposure standard for Diesel Particulates, and monitoring and control methods for diesel emissions are inconsistent and poorly enforced. Within the mining industry, there has been a general shift away from prescriptive regulations to a more self-regulatory approach. For example, in January 2013, the Western Australian Department of Mines ceased a program that involved the compulsory long-term health monitoring of mine workers exposed to dangerous air pollutants, including diesel.

In addition to developing and enforcing exposure standards for diesel emissions, regulations and standards need to be developed to control emissions from the non-road diesel sector. Non-road diesel engines are used widely in industries associated with the most hazardous exposures to air pollutants, including construction, mining, and agriculture. Currently, emission standards apply to on-road diesel vehicles, but are not in place for the non-road diesel sector. This is despite the fact that the non-road sector emits a similar amount of particulates as the on-road diesel sector, and emits considerably more particulate matter and oxides of nitrogen than petrol engines.[16] Moreover, regulated emissions limits for these engines have been enforced in the EU and United States since the mid-1990s, and more recently in Canada, Japan, China and India. A 2010 report from the NSW Department of Environment, Climate Change and Water found that nearly a quarter of non-road diesel engines sold in 2008 were non-compliant with EU or United States standards for diesel emissions.[16]

Recommendation: Nationally consistent and comprehensive occupational health and safety standards and policies should be enforced, and should focus on industries and occupations with the greatest risks of exposure to airborne hazards, and those where workers are exposed to hazards with the most serious health consequences. This includes the mining industry, manufacturing, construction and agriculture, and transport and storage.

Recommendation: The Commonwealth, in conjunction with State and Territory governments, should consider mechanisms to improve the health surveillance of employees with a high-risk of exposure to air pollutants, or in industries where workers are exposed to hazards with the most serious health consequences.

Recommendation: National regulations should be developed and enforced regarding the measurement and monitoring of diesel particulates in the workplace, and acceptable exposure limits.

Recommendation: National emission standards should be developed for non-road diesel engines and equipment, and in alignment with US and EU emissions standards and regulations.

Air quality standards

Current air quality standards do not meet the requirement for adequate protection of human health.

The Australia standards for a number of air pollutants lag behind levels set in overseas jurisdictions, and there is compelling scientific evidence of health impacts from pollutants at levels below those set under the National Environment Protection Measure for Ambient Air Quality (NEPM). That is, exposures below the standards that are currently in place represent a statistically significant and measurable health risk to the Australia population. Consequently, compliance with the standards alone is not sufficient to ensure the desired environmental outcome of 'adequate protection' of human health. Current air quality standards therefore need to revised to bring them into alignment with current scientific evidence and international best practice. Safety margins employed in standard setting should also account for members of vulnerable groups, including children, older adults, people with pre-existing respiratory and cardiovascular disease, and low socio-economic groups.

Given the strong and consistent evidence relating to $PM_{2.5}$ (particulate matter with aerodynamic diameter less than 2.5 µm), the standard for $PM_{2.5}$ should be upgraded

from an advisory to a regulatory standard. In addition, national guidelines should be developed for monitoring ultrafine particulate matter ($PM_{0.1}$).

As discussed above, air quality standards needs to be developed and applied to non-diesel vehicle emissions and occupational settings. In addition, Australia's vehicle emission standards (e.g. for heavy vehicles) continue to lag behind European standards, and should be reviewed and updated to ensure they are consistent with international best practice.

In addition to revising standards, the AMA recommends that the National Environmental Protection Measures (NEPM) be reframed to support *exposure reduction* approach. As discussed above, there has been an accumulation of scientific evidence indicating that there is no clear threshold for health effects from the current NEPM criteria pollutants. Adverse health effects may therefore be experienced through exposure to air pollutant levels below current standards; accordingly, compliance with the standards is not sufficient to protect human health. Recognition of this has prompted overseas jurisdictions, including Europe and the United States, to move air management policy away from a strict standards-based approach, and toward a focus on reducing population exposure. This approach is recommended by the WHO and, in terms of supporting better public health outcomes, has two fundamental benefits. Firstly, given there is no known threshold for health effects, any reduction in exposure (either above or below a compliance standard) will result in health benefits. Second, this approach creates an impetus to ensure air quality monitoring is more effectively linked into air pollutant reduction targets and activities.

An effective exposure assessment framework determines the frequency, extent and duration of exposure by identifying air pollution levels, exposed populations, sensitive subgroups, and potential exposure pathways. This in turn requires the establishment of a monitoring network that measures variability in air pollution levels. Australia currently lacks a monitoring network that fulfils these requirements, as discussed below.

Recommendation: Current air quality standards for criteria pollutants and, in particular, ozone and particulates, should be revised and upgraded to align with current scientific evidence and international best practice.

Recommendation: Air quality management policy should be based reducing human exposure to air pollution, rather than simply complying with air quality standards. This requires linking air monitoring into pollutant reduction targets and national air quality management actions.

Air quality monitoring and health surveillance

Current air monitoring and reporting practices in Australia require strengthening. The AMA recommends that an independent review be undertaken to assess the adequacy of the current monitoring network, and to underpin future improvements.

The original intent of Australia's air monitoring network was to avoid monitoring near localised sources of pollution, such as industrial areas of heavy traffic flow areas, and to capture instead the average concentrations of pollutants in a specific region, or 'airshed'. Monitoring was not designed to measure the variability in pollutant levels within a specified airshed. As a consequence, the air monitoring that is currently undertaken under the National Environment Protection Measure is likely to significantly underestimate real-life *exposures* for many sections of the population. In addition, monitoring activity is limited in geographic coverage and is not, for example,

undertaken in regional areas where there may be poor air quality due to industrial or agricultural practices. As a result, the ability of communities and local governments to access information about air quality in their own areas is often limited.

The design and coverage of Australia's air monitoring network differs to monitoring networks in the United States and European Union, which were established at locations chosen to measure variability in air pollution levels. The WHO also recommends using monitoring to assess population *exposure*, and provides guidance on how this should be done. Exposure differs from concentration, which is a quantitative measure of the amount of pollutants within an airshed. High concentrations of air pollutants do not necessarily result in high exposures. For example, air pollution concentrations may be high near a source, but high exposures will occur only if people spend time near that source. Developing a monitoring system that effectively captures *exposure* levels is critical if policies are to be appropriately targeted to reduce the health effects of air pollution.

The impacts of climate changes are likely to exacerbate problems with air quality, and this further underscores the need to invest in monitoring regimes that are rigorous, timely and linked into to policy processes at the local, state and national levels. For example, in response to the increasing risk of bushfires, a number of jurisdictions have increased prescribed burning activities, and the diminished air quality that results requires careful management to minimise the health impacts on nearby populations.

In addition to deficiencies in the current air monitoring regime, Australia lacks a nationally consistent framework linking health datasets with monitoring and prospective assessments of ambient air quality. This is despite one of the stated objectives of the National Environmental Health Strategy 2007-2012 being "to develop a national environmental health surveillance capability to ensure that health risks are appropriately managed by responsible stakeholders".

Recommendation: Current air monitoring and reporting practices in Australia require strengthening, and the AMA recommends that an independent review be undertaken to assess the adequacy of the current monitoring infrastructure, and to provide recommendations for improvements.

Recommendation: Based on the outcomes of an independent review of the air monitoring network in Australia, the Commonwealth should work with State governments to identify and address gaps in the network of air quality monitoring stations throughout Australia, and to ensure the outcomes of monitoring inform ongoing policy development and the prioritisation of pollution reduction programs. This includes establishing monitoring stations in regional Australia and near localised sources or pollution, and taking into account population risk and vulnerability to exposure and adverse health effects (and not simply population size).

Recommendation: Health surveillance and monitoring needs to be expanded and strengthened, particularly in the vicinity of air pollutant sources, in occupations where there is a high risk of exposure to hazardous air pollutants, and in populations known to have a heightened susceptibility to the health effects of air pollution.

Recommendation: Independent monitoring and reporting should be established for major industrial sources of pollution, and penalties imposed when air quality standards are consistently breached.

Increasing community awareness

A sound understanding of the health implications of air pollution is vital to mobilise preventive and remedial actions by communities, services, and local governments. In relation to particulate pollutants, for example, relevant information for communities includes an understanding of the health effects of particulate pollution; actions to reduce exposure and limit health effects (e.g. during acute biomass smoke events); and where to access information about current pollution levels and the associated levels of risk. Such education is particularly important among groups who have a heightened susceptibility to air pollution (e.g. asthmatics).

Despite the importance of such awareness, community education regarding air pollution has been limited in Australia, and information regarding air quality and monitoring is not always accessible or communicated effectively. A 2007 review of air quality education suggested that Australians are largely lacking in knowledge relating to the health implications of indoor air quality. This review recommended that a more concerted and strategic approach be adopted to community education around air quality, including national leadership and coordination and improved communication and cooperation between various levels of government.[17]

To motivate appropriate responses across all sectors of society, further research is required to identify how to communicate most effectively the health risks associated with air pollutants, and to develop mitigation and adaptation measures to address these risks.

Recommendation: It is imperative greater efforts are made to communicate to the public and relevant service sectors the health impacts of air pollutants. Targeted messaging is particularly important for vulnerable subpopulations, including people working in occupations or industries where there is a high risk of exposure to air pollutants.

Improved links between poor air quality and health alerts

Air quality indices and proactive alert services are a standard feature in European jurisdictions and in the United States, and have been adopted to a limited extent in some Australian jurisdictions. The AMA believe that the development of a nationally consistent framework for air quality indices, which is in turn linked into specific health warnings and recommendations, would support efforts to reduce the adverse health effects of air pollution. Overseas evidence suggests that such index and alert systems can reduce the morbidity and mortality associated with periods of heightened air pollution, enabling individuals who are sensitive to the effects of air pollution to modify their behaviours or reduce the severity of their symptoms. [18] To be effective, early warning systems need to be communicated in a timely and relevant manner to communities and, in particular, to those who are most susceptible to the health effects of air pollution. Community and service providers also need to be equipped to take the appropriate course of action and adopt preventative measures if warnings are issued. In addition, input from health professionals is necessary to ensure early warning systems incorporate relevant information and are communicated appropriately. This may include, for example, identifying preventative health and protective actions that should be initiated when such alerts are issued.

Recommendation: Consistent air quality indices proactive alert systems should be developed and maintained, particularly in regions that experience greater levels of air pollutants, and during periods of heightened risk of poor air quality, such as extreme weather events.

Overall coordination of air management policies and regulations

Recommendation: The coordination of air quality management policies and regulations at national, state and local levels needs to be strengthened to support a whole-of-government and cross-portfolio approach. This includes improving intersectoral approaches between health, environment and planning departments; harmonising state and territory environmental protection legislation relating to air quality; and achieving greater national consistency in air quality monitoring and health surveillance infrastructure, and in environmental impact assessments. The substantial health effects of air pollution need to be costed and factored into economic and sectoral decision-making.

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