The Senate

Community Affairs References Committee

Impacts on health of air quality in Australia

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43rd Parliament

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ABBREVIATIONS

AAQG	Australian Air Quality Group
ABS	Australian Bureau of Statistics
ADR	Australian Design Rules
AHHA	Australian Home Heating Association
AMA	Australian Medical Association
AMEC	Australian Marine Engine Council
AT-NEPM	Air Toxics National Environmental Protection Measure
CAR	Centre for Air Quality and Health Research and Evaluation
CSIRO	Commonwealth Scientific and Industrial Research Organisation
EIS	Environmental Impact Statement
EPA	Environmental Protection Authority
GMR	Greater metropolitan region
IARC	International Agency for Research on Cancer
ILAQH	International Laboratory for Air Quality and Health
NEPC	National Environmental Protection Council
NEPM	National Environmental and Protection Measure for Ambient Air Quality
NQBP	North Queensland Bulk Ports
PM	Particulate matter
$PM_{2.5}$	particles less than 2.5 µm (1µm = 1 thousandth of a millimetre) in diameter
PM_{10}	particles less than 10µm (1µm = 1 thousandth of a millimetre) in diameter
QRC	Queensland Resources Council

SEWPaC	Department of Sustainability, Environment, Water, Population and Communities
TSP	total suspended particles
UFP	ultrafine particles
UHR	Upper Hunter region
WHO	World Health Organisation

LIST OF RECOMMENDATIONS

Recommendation 1

3.21 The committee recommends that the Australian Government's representative to the Standing Council on Environment and Water support the adoption of the 23 recommendations of the *Ambient Air Quality NEPM Review*.

Recommendation 2

3.34 The committee recommends that the Australian Government advocate, through the appropriate Council of Australian Governments process, the inclusion of mechanisms to collect additional data on ultrafine particles.

Recommendation 3

3.42 The committee recommends that buffer zones be used to protect populated areas from large point-source emitters.

Recommendation 4

3.67 The committee recommends that pollution monitoring should accurately capture population exposure for communities and homes proximate to pollution point sources.

Recommendation 5

3.68 The committee recommends that providing monitoring and real-time data of air quality be a condition of environmental approvals issued by the Australian Government unless an operator can demonstrate that air pollution created by the development will not impact upon human health.

Recommendation 6

4.50 The committee recommends that states and territories require industry to implement covers on all coal wagon fleets.

Recommendation 7

4.51 The committee recommends that the Commonwealth develop and implement a process for assessing cumulative impacts of coal mine developments that take into account other mines in the region and their impact on resident health.

Recommendation 8

4.52 The committee recommends that health impact assessments be required as part of the assessment process for all new developments.

Recommendation 9

5.6 The committee recommends that Safe Work Australia undertake research regarding the exposure of workers in the hospitality, transport and mining industry to diesel emissions.

Recommendation 10

5.31 The committee recommends that the Commonwealth develop a national emissions standard for diesel engines.

Recommendation 11

5.32 The committee recommends that the Commonwealth implement a national emissions standard for small non-road engines equivalent to the US EPA standards.

Recommendation 12

6.43 The committee recommends that Australian Governments immediately adopt minimum efficiency and maximum emission standards for all newly installed wood heaters in Australia.

Recommendation 13

6.44 The committee recommends that local councils continue to manage the use of wood heaters in their own jurisdictions through the use of bans, buy-backs, minimum efficiency standards, and other mechanisms as appropriate to protect the health of their local communities.

Chapter 1

The impacts on health of air quality in Australia

Terms of Reference

1.1 On 28 November 2012 the Senate referred the following matter to the Senate Community Affairs Committee for inquiry and report:

> The impacts on health of air quality in Australia, including:
>
> (a) particulate matter, its sources and effects;
>
> (b) those populations most at risk and the causes that put those populations at risk;
>
> (c) the standards, monitoring and regulation of air quality at all levels of government; and
>
> (d) any other related matters.

1.2 The reporting date for the inquiry was set by the Senate for 16 May 2013. On 18 June 2013 the Senate granted an extension of time to report until 12 August 2013.

Conduct of the inquiry

1.3 The committee invited submissions from Commonwealth and State and Territory governments and interested organisations. The committee received public submissions from 162 organisations and individuals (listed at Appendix 1).

1.4 The committee held three public hearings over the course of the inquiry. The hearings were held in:

- Newcastle – 16 April 2013;
- Canberra – 17 May 2013; and
- Brisbane – 11 June 2013.

1.5 A list of witnesses who appeared before the committee is set out in Appendix 2.

1.6 Submissions, additional information, the Hansard transcript of evidence and responses to questions on notice can be accessed through the committee's website at: http://www.aph.gov.au/Parliamentary_Business/Committees/Senate_Committees?url=clac_ctte/index.htm

1.7 References in this report are to individual submissions as received by the committee, not to a bound volume.

Structure of the report

1.8 This report is comprised of 6 Chapters:

- Chapter 2 provides a summary of the sources of air pollution and its impact on human health;
- Chapter 3 discusses current air quality standards and monitoring;

- Chapters 4 through 6 consider the issues of emissions from coal, diesel, and wood smoke respectively.

1.9 As the structure cited above makes clear, this report confines itself to the issues that were most prominent in the evidence provided to the committee. There are other air quality issues, such as indoor air quality, other pollutants, road transport and urban planning, that are not discussed in great detail in this report but may require further attention in the future.

Chapter 2

Particulate matter sources and effects

2.1 Everyone is affected by the quality of air that we breathe, and has an interest in ensuring the ongoing availability of safe, clean air. For the most part, Australians enjoy clean air which has been getting cleaner in recent decades. The NSW Environmental Protection Authority (EPA) reported that:

> In terms of overall air quality in New South Wales, it has improved significantly since the 1980s. We have seen a steady decline in the order of 20 to 40 per cent in some of the key pollutants such as ammonia, carbon monoxide, lead and sulphur dioxide as well as the oxides of nitrogen and volatile organic compounds.[1]

2.2 It was clear throughout the inquiry, however, that air pollution is still a significant problem for certain parts of the Australian population. The Commonwealth Scientific and Industrial Research Organisation (CSIRO) provided a definition of air pollution for the committee:

> Air pollution refers to the presence in the atmosphere of chemicals, particulates, or biological materials that cause discomfort, disease, or death to humans, damage other living organisms such as food crops, or damage the natural environment or built environment. Examples of air pollutants include particulates, oxides of sulphur and nitrogen, carbon monoxide, volatile organic compounds, toxic metals (such as lead), ground-level ozone, and odours.[2]

2.3 Particulate matter (PM) refers to everything in the air that is not a gas; with the PM and air mixture referred to as aerosol. It includes both solid particles and vapours (liquid particles). Particulate matter is highly heterogeneous in size and composition. PM is often chemically active in the environment and in humans, can be transported long distances in the atmosphere, and can influence weather and climate.[3] The total mass of PM in the air is referred to as TSP (total suspended particles).[4] The particles of most concern for human health are those than can enter the lungs, namely particles less than 10µm (1µm = 1 thousandth of a millimetre) in diameter (PM_{10}) and particles less than 2.5 µm in diameter ($PM_{2.5}$).[5]

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1 Mr Buffier, Chief Executive Officer, New South Wales Environmental Protection Authority, *Committee Hansard*, 16 April 2013, p. 1.

2 Commonwealth Scientific and Industrial Research Organisation, *Submission 48*, p. 3.

3 Commonwealth Scientific and Industrial Research Organisation, *Submission 48*, p. 7.

4 Commonwealth Scientific and Industrial Research Organisation, *Submission 48*, p. 8.

5 Centre for Air Quality and Health Research and Evaluation, *Submission 29*, pp. 1–2.

Sources

2.4 There are many sources of particulate matter included natural and anthropogenic sources. In Australia PM load naturally fluctuates due to airborne dust, sea salt, and smoke from bushfires. PM is categorised as primary or secondary depending on its source.

2.5 Primary particles originate from both anthropogenic and natural sources. Natural sources are derived from processes that occur naturally in the earth system, such as bubbles bursting on the sea surface which release sea salt aerosol into the atmosphere, wind-blown dust, and smoke from naturally lit bushfires. Anthropogenic sources result from human activity and include: dust associated with agriculture, mining, urban developments, and road traffic; smoke from deliberately lit bushfires, prescribed burning, and household wood heaters; emissions from vehicle exhaust, industrial processes, and commercial activities; and spray drift from aerial application of agricultural and horticultural chemicals.[6]

2.6 Secondary particles are formed by chemical reactions in the atmosphere that result in gases being converted to particles, which are also known as secondary aerosols. These conversions lead to the production of a large number of very small particles (nucleation) and the growth in size of existing particles (condensation).[7] These processes are represented graphically below:

6 Commonwealth Scientific and Industrial Research Organisation, *Submission 48*, pp. 7–8.

7 Commonwealth Scientific and Industrial Research Organisation, *Submission 48*, p. 8.

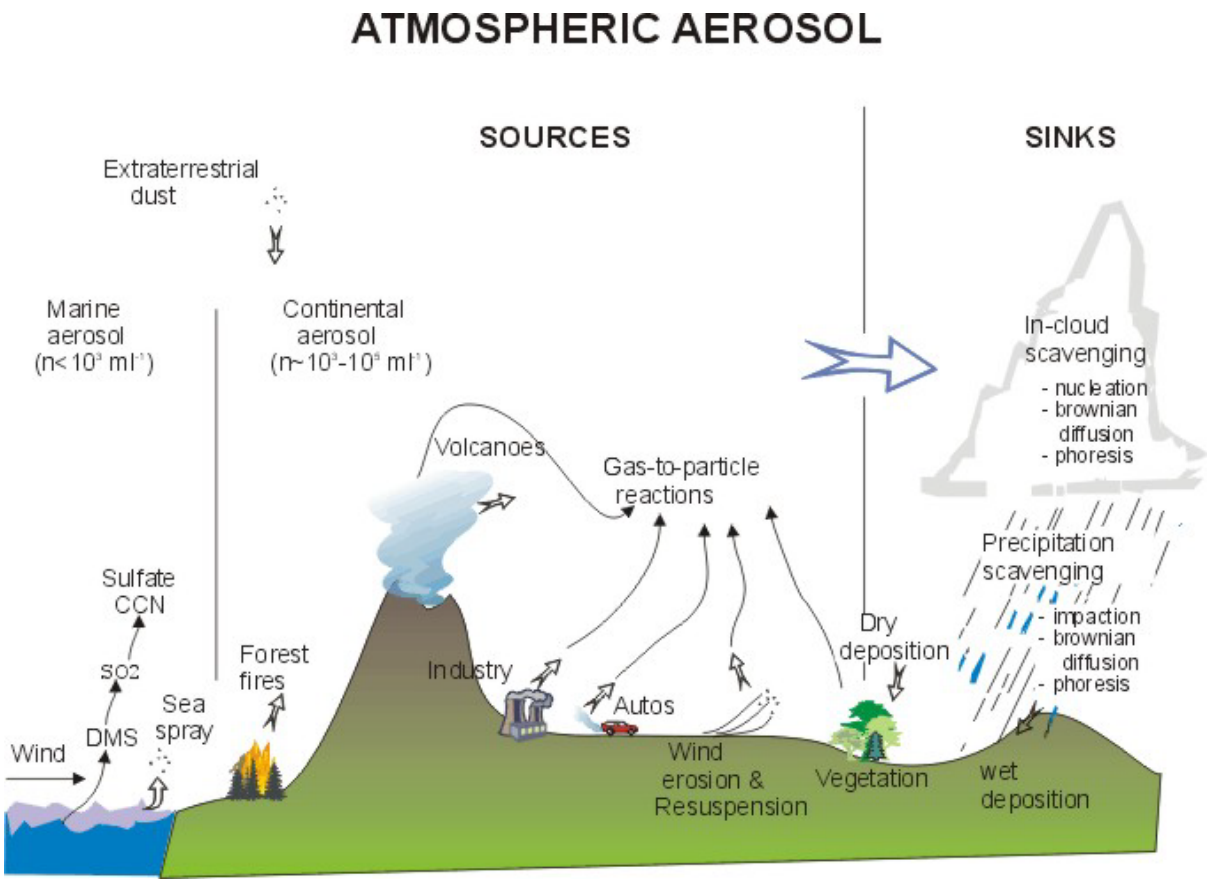

Figure 1 – Schematic of atmospheric aerosol sources[8]

2.7 It was put to the committee that the combination of natural and anthropogenic sources makes the controlling of emission of PM challenging.[9]

2.8 An example of the interplay between natural and anthropogenic sources in the production of PM is provided by the Sydney Particulate Study which demonstrated that local urban sources (motor vehicles, wood combustion, and industrial sources) may contribute less than fifty per cent of the fine particle mass in Sydney, with background sources (dust, smoke, sea salt, biogenic) comprising the remainder.[10]

2.9 The sources of different sizes of PM are as follows:

- $PM_{10-2.5}$ primarily is derived from suspension or re-suspension of dust, soil, and other material from roads, farming, mining, and dust storms but also includes sea salt, pollen, mould, and spores;
- $PM_{2.5}$ primarily is derived from direct emissions from combustion processes, such as petrol and diesel vehicles, wood burning, coal burning for power generation, and industrial activities such as smelters, cement plants, paper mills, and steel mills; and

8 Commonwealth Scientific and Industrial Research Organisation, *Submission 48*, p. 7.

9 Commonwealth Scientific and Industrial Research Organisation, *Submission 48*, p. 4.

10 Commonwealth Scientific and Industrial Research Organisation, *Submission 48*, p. 4.

- $PM_{0.1}$ results from combustion related sources and atmospheric photochemical reactions.[11]

2.10 On-road motor vehicles and off-road engines such as generators, mining, earthmoving equipment and ships were cited to the committee as the main sources of anthropogenic particulate pollution in Australia.[12]

2.11 There are a number of indoor pollutants and emission sources that may be harmful to human health but are, in many cases, not regulated. Some of these are tabulated below:

POLLUTANT	**MAJOR EMISSION SOURCES**
Allergens	House dust, domestic animals, insects
Asbestos	Fire retardant materials, insulation
Carbon dioxide	Metabolic activity, combustion activities, motor vehicles in garages
Carbon monoxide	Fuel burning, boilers, stoves, gas or kerosene heaters, tobacco smoke
Formaldehyde	Particle board, insulation, furnishings
Micro-organisms	People, animals, plants, air conditioning systems
Nitrogen dioxide	Outdoor air, fuel burning, motor vehicles in garages
Organic substances	Adhesives, solvents, building materials, volatilization, combustion, paint, tobacco smoke
Ozone	Photochemical reactions
Particles	Re-suspension, tobacco smoke, combustion products
Polycyclic aromatic hydrocarbons	Fuel combustion, tobacco smoke
Pollens	Outdoor air, trees, grass, weeds, plants
Radon	Soil, building construction materials
Fungal spores	Soil, plants, foodstuffs, internal surfaces

11 Commonwealth Scientific and Industrial Research Organisation, *Submission 48*, p. 8.

12 Centre for Air Quality and Health Research and Evaluation, *Submission 29*, p. 3.

Sulphur dioxide	Outdoor air, fuel combustion

2.12 It was argued to the committee that there is a need to explore what standards or regulations may need to be put in place as building energy efficiency increases in order to balance efficiency gains against potential health costs, as energy efficiency gains often come at the cost of reduced ventilation.[13]

Health impacts of poor air quality

2.13 There is a substantial body of evidence indicating that particulate matter has negative impacts on human health – regardless of the size of particulates.[14] A study published in the Lancet in 2012 found 'ambient particulate matter pollution' to be the ninth leading cause of global disease burden.[15] The National Health and Medical Research Council-funded Centre for Air Quality and Health Research and Evaluation (CAR), reported to the committee that:

> People exposed to the short-term bursts or long-term higher levels of particulate pollution suffer a range of adverse effects, including:
>
> - Increased risk of deaths, particularly due to heart and lung diseases;
> - Increased risk of hospitalisation for heart and lung diseases; and
> - Increased risk of asthma attacks.[16]

2.14 It was reported to the committee that the 'main properties of PM that determine its environmental and health risks are: concentration; size distribution; structure; and chemical composition.'[17] The effects on health vary substantially between geographic settings, partly as a result of variation in the chemical composition of the particulates, which is dependent on their local sources.[18]

2.15 The committee learnt that the size of the PM was the principal determinant of how deeply it is inhaled into the human respiratory system, with smaller particles able to penetrate further into the lungs.[19] As most particles with a diameter >10µm are generally filtered by the nose and throat, PM_{10} is typically used as the threshold value

13 Commonwealth Scientific and Industrial Research Organisation, *Submission 48*, p.15.

14 Commonwealth Scientific and Industrial Research Organisation, *Submission 48*, p. 3.

15 Lim SS, Vos T, Flaxman AD, Danaei G, Shibuya K, Adair-Rohani H, et al. 'A comparative risk assessment of burden of disease and injury attributable to 67 risk factors and risk factor clusters in 21 regions, 1990–2010: a systematic analysis for the Global Burden of Disease Study 2010.' *The Lancet*, 2012;380(9859):2224-60.

16 Centre for Air Quality and Health Research and Evaluation, *Submission 29*, p. 3.

17 Commonwealth Scientific and Industrial Research Organisation, *Submission 48*, p. 3.

18 Centre for Air Quality and Health Research and Evaluation, *Submission 29*, p. 3.

19 Commonwealth Scientific and Industrial Research Organisation, *Submission 48*, p. 4.

for studies on the effects of PM on human health.[20] The relative distribution of PM in the human respiratory system is represented in figure two.

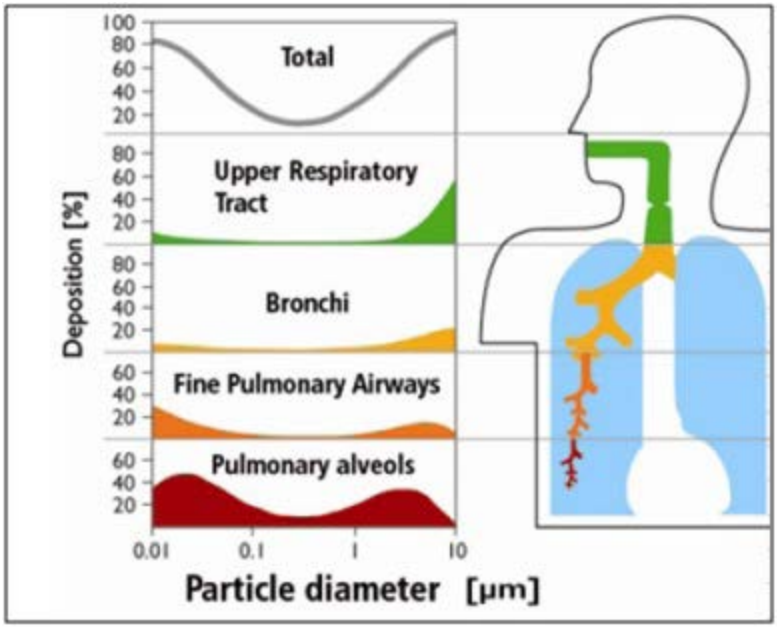

Figure 2 - Deposition of different sized particles in different segments of the respiratory system[21]

2.16 Furthermore, it was argued by the CSIRO that:

> Epidemiological studies have concluded that there is a statistically significant relationship between fine particles and human health effects, such as decreased lung function, increased respiratory symptoms, increased chronic obstructive pulmonary disease, increased cardiovascular and cardiopulmonary disease, and increased mortality. Recent research has identified a strong link between $PM_{2.5}$ and life expectancy.[22]

2.17 The committee heard that there were particularly high health risks associated with $PM_{2.5}$:

> PM2.5 is believed to be the most health-hazardous air pollutant, responsible for 10 to 20 times as many premature deaths as the next worst pollutant, ozone. Just as 'every cigarette is doing you damage', every gram of wood smoke or other particle emissions is also causing health problems. Wood smoke is more hazardous than cigarette smoke – in tumour initiation tests it was found to cause 12 to 30 times as many cancers as the same amount of cigarette smoke. The estimated health cost of a kg of PM2.5 emissions in Sydney is more than $235.[23]

20 Commonwealth Scientific and Industrial Research Organisation, *Submission 48*, p. 8.

21 Commonwealth Scientific and Industrial Research Organisation, *Submission 48*, p. 9.

22 Commonwealth Scientific and Industrial Research Organisation, *Submission 48*, p.4.

23 Asthma Foundation NSW, *Submission 50*, p. 20.

2.18 There is also some evidence to suggest that ultrafine particles (UFPs) – particles less than 0.1µm in diameter – can be harmful to human health. It was reported by CAR that:

> Epidemiological evidence about the adverse health effects attributable to exposure to UFPs, as distinct from the effects of other particles (measured as PM_{10} and $PM_{2.5}$) is limited at present. However, toxicological studies in animals and humans have shown diverse effects on cardiovascular, blood, respiratory and brain function. Further evidence is required to establish the relevance of these toxicological findings to population health and hence to gauge the importance of control measures specifically targeting UFP emissions.[24]

2.19 The committee heard that indoor air quality is also critical to human health, but has not been investigated as fully as the impacts of ambient air quality which is monitored and controlled to some extent.[25] A 2002 paper from the Journal of Exposure Analysis and Environmental Epidemiology found that people in Canada in the United States of America spent only between six and seven per cent of their time out of doors with the rest either in buildings or vehicles.[26]

Safe levels of exposure

2.20 The committee heard, that at least for some pollutants, there is no safe level of exposure:

> Of importance is that the new evidence not only supports the previous scientific conclusions but also indicates that the effect can occur at air pollution concentrations lower than those used to establish the existing WHO health guidelines, particularly into relation to PM 2.5 and PM 10. So far no limit of exposure where there is no impact has been identified.[27]

2.21 Similarly:

> Available evidence suggests that, at least for particulates and for NO_2, there is a linear dose response relationship over a large range of exposure levels. This means that, even at levels below the current targets, further health gains can be achieved by further reduction in pollutant levels.[28]

2.22 This position was supported by the Environment and Sustainable Development Directorate of the Australian Capital Territory (ACT) who noted 'there

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24 Centre for Air Quality and Health Research and Evaluation, *Submission 29*, p. 3.

25 Commonwealth Scientific and Industrial Research Organisation, *Submission 48*, p.15.

26 Leech, JA; Nelson WC; Burnett RT; Aaron S; Raizenne ME, 'It's about time: a comparison of Canadian and American time-activity patterns', *Journal of Exposure Analysis and Environmental Epidemiology*, vol. 12 no. 6, November 2002, 431.

27 Professor Morawska, International Laboratory for Air Quality and Health, *Committee Hansard*, 11 June 2013, p. 2.

28 Centre for Air Quality and Health Research and Evaluation, *Submission 29*, p. 5.

is no safe threshold for particulate pollution at which health effects do not occur.'[29] A number of submissions to the inquiry made similar points.[30]

Populations most at risk

2.23 The health impacts of air quality are not shared equally by all people. Certain groups of people, and certain geographies, are at a greater potential risk than others. The populations who are at the greatest risk are those who are exposed to the largest quantity of harmful particulates, and those who are inherently more susceptible to exposure.

2.24 As noted above, the general Australian population enjoys comparatively good air quality. According to World Health Organisation (WHO) analysis, annual average $PM_{2.5}$ totals in 2010 gave Sydney a rating of seven, the Lower Hunter a rating of 8.2, New York 13, London 14, and Paris 23.[31] The committee notes, however, that these ratings are for relatively large urban areas. Within these areas there are populations exposed to higher levels of air pollution, and associated health risks. Populations most exposed to particulate matter are those people living in close proximity to transport corridors and industrial and agricultural pollution sources. The committee heard that:

> The highly urbanised nature of Australia means that a high proportion of the population are co-located with major transport corridors and hence highly exposed to transport related emissions.[32]

2.25 While air pollution is often considered to be an urban problem, rural communities are also exposed to PM due to wind-blown dust smoke from controlled burning, bushfires, wood heaters, and PM from mining and other activities.[33] The CSIRO noted that 'regional towns co-located with heavy industry (e.g., Gladstone, Kalgoorlie, Mt Isa, Port Pirie);' are subject to higher risks from impacts of air quality.[34] It was further noted that 'Peri-urban populations (i.e. at the rural–urban interface)… may be vulnerable to spray drift from agricultural and horticultural sprays'.[35] The committee also received evidence that risk increases in areas where

29 Environment and Sustainable Development Directorate of the ACT, *Submission 30*, p. 1.

30 See, Doctors for the Environment Australia, *Submission 4*, p. 3; Centre for Air Quality and Health Research and Evaluation, *Submission 29*, p. 3; Asthma Foundation NSW, *Submission 50*, p. 20; Australian Network of Environmental Defender's Offices, *Submission 85*, p. 5; Dr Adrian Barnett, *Submission 92*, p. 1.

31 Mr Buffier, Chief Executive Officer, New South Wales Environmental Protection Authority, *Committee Hansard*, 16 April 2013, pp. 2–3; see also New South Wales Environmental Protection Authority, *Submission 80*, p. 19.

32 Centre for Air Quality and Health Research and Evaluation, *Submission 29*, p. 4.

33 Commonwealth Scientific and Industrial Research Organisation, *Submission 48*, p. 4.

34 Commonwealth Scientific and Industrial Research Organisation, *Submission 48*, p.12.

35 Commonwealth Scientific and Industrial Research Organisation, *Submission 48*, p.12.

there is poor dispersion due to a 'combination of meteorology, topography (e.g. valleys), and location factors (e.g. coastal regions with land-sea breeze circulations)'.[36]

2.26 It was reported to the committee that the segments of society who are most inherently susceptible to poor air quality are:

- Children and the elderly;
- Those with pre-existing heart and lung disease; and
- Socio-economically disadvantaged groups.[37]

2.27 The committee heard that exposure to air pollution can negatively impact unborn children:

> One neglected area I want to highlight is the effect of pollution during pregnancy. There is now strong evidence that exposure to particulate matter during pregnancy reduces birth weight and shortens gestation time. This includes a recent international study of three million births worldwide and a study that I worked on of just under 1,000 mothers in Logan. There is also evidence of association between pollution exposure during pregnancy and stillbirth, and biological evidence of harm from studies finding greater DNA damage in the placentas of mothers with higher pollution exposure. This creates a potentially huge economic cost for Australia because we know that babies born early or underweight spend more time in hospital as children and have an increased risk of chronic disease in adulthood.[38]

2.28 The Australian Medical Association (AMA) also noted that workers in certain industries and occupations have a heightened risk of experiencing adverse health impacts due to poor air quality.[39]

Committee comment

2.29 There are a wide range of air quality issues that the committee has considered in the course of its inquiry. On the broadest of levels, the committee received evidence that global phenomena such as climate change have consequences for air quality. The committee heard from the CSIRO that:

> There is an important nexus between Australia's air quality and a changing and increasingly variable climate because: a likely increase in frequency and severity of bushfires and droughts would increase the PM levels in urban and regional Australia; photochemical smog, which affects all Australian cities, is influenced by air temperature as well as urban vegetation and levels of ozone and increased air temperatures due to global warming are likely to exacerbate the incident and severity of photochemical

36 Commonwealth Scientific and Industrial Research Organisation, *Submission 48*, p.12.

37 Centre for Air Quality and Health Research and Evaluation, *Submission 29*, p. 4, Australian Medical Association, *Submission 114*, pp. 6–7.

38 Dr Adrian Barnett, Queensland University of Technology, *Committee Hansard*, 11 June 2013, p. 1.

39 Australian Medical Association, *Submission 114*, p. 8.

> smog events in Australian cities; and the effects of air pollution will be in addition to other stressors that affect human health such as heat stress, with such combined effects very likely to adversely affect the morbidity and mortality of Australia's population.[40]

2.30 While the committee recognises the significant impact of broader influences on air quality such as climate change and urbanisation, the majority of evidence received during the course of this inquiry was concerned with more local and immediate impacts. The committee received detailed evidence around sources, health impacts, and risk factors in relation to three specific types of air pollution: coal, diesel, and wood smoke. After a discussion of standards and monitoring in Chapter 3, the remainder of this report discusses the evidence and makes recommendations in relation to each of these major sources of air pollution.

40 Commonwealth Scientific and Industrial Research Organisation, *Submission 48*, p. 7.

Chapter 3

Standards and monitoring of air quality

3.1 Government involvement in establishing air quality standards to protect human health is important as individuals cannot readily control the extent to which they may be exposed to harmful air-borne pollutants.

3.2 On 26 June 1998 the Commonwealth and State and Territory governments agreed to the National Environmental and Protection Measure for Ambient Air Quality (NEPM). This measure sets air quality standards that are legally binding on each level of government. The desired environmental outcome from the NEPM is achieving 'ambient air quality that allows for the adequate protection of human health and well-being.'[1]

3.3 The NEPM regulates six air pollutants: carbon monoxide, nitrogen dioxide (NO_2), photochemical oxidants, sulphur dioxide, lead and particles.[2] An advisory reporting standard for $PM_{2.5}$ was incorporated in 2003 and an Air Toxics National Environmental Protection Measure (AT–NEPM) was added in 2004.[3]

3.4 The current approach to controlling air pollution in Australia was explained to the committee as identifying thresholds for specific hazardous air pollutants and set these as air quality targets. Sources of pollution are then monitored to attempt to achieve these targets.[4] These thresholds are articulated in the NEPM[5]:

Pollutant	Concentration and averaging period
Carbon monoxide	9.0 ppm (parts per million) measured over an eight hour period
Nitrogen dioxide	0.12 ppm averaged over a one hour period
	0.03 ppm averaged over a one year period
Ozone	0.10 ppm of ozone measured over a one hour period
	0.08 ppm of ozone measured over a four hour period

1 National Environmental Protection Council, *Ambient Air Quality NEPM Review*, Adelaide, 2011, p. 9.

2 National standards for criteria air pollutants in Australia – Air quality fact sheet, Department of the Environment and Heritage, 2005, available from: http://www.environment.gov.au/atmosphere/airquality/publications/standards.html (accessed: 03/04/13)

3 Commonwealth Scientific and Industrial Research Organisation, Submission 48, p. 13.

4 Centre for Air quality and health Research and evaluation, *Submission 25*, p. 5.

5 National standards for criteria air pollutants in Australia – Air quality fact sheet, Department of the Environment and Heritage, 2005, available from: http://www.environment.gov.au/atmosphere/airquality/publications/standards.html (accessed: 03/04/13)

Sulfur dioxide	0.20 ppm averaged over a one hour period
	0.08 ppm averaged over a 24 hour period
	0.02 ppm averaged over a one year period
Lead	0.5 µg/m³ (micrograms per cubic metre) averaged over a one year period
Particles as PM_{10}	50 µg/m³ averaged over a 24-hour period
Particles as $PM_{2.5}$	Advisory reporting standard: 25 µg/m³ over a one day period; 8 µg/m³ over a one year period

3.5 The previous chapter discussed the evidence regarding safe exposure limits to pollution, highlighting that in most cases the lower the exposure level the better, and that as a rule of thumb there is no safe level of exposure that does not cause some level of harm.

3.6 The exposure limits outlined in the NEPM were agreed based on the available academic literature, comparable international standards, and Australia conditions. As the Department of Sustainability, Environment, Water, Population and Communities' (Department) website explains:

> The standards were set on the basis of scientific studies of air quality and human health from all over the world, as well as the standards set by other organisations, such as the World Health Organisation. Australian conditions, eg climate, geography and demographics, were taken into account in estimating the likely exposure of Australians to these major air pollutants. Each air quality standard has two elements: the maximum acceptable concentration and the time period over which the concentration is averaged.[6]

3.7 As is indicated by the term 'adequate protection' of health in the NEPM, it can be seen that the allowable limits of pollutants in the atmosphere are a necessary compromise between health and necessity. So long as people drive cars, require electricity and farm the land, some level of human created pollution is unavoidable – not to mention sources such as bushfires. As was noted by the National Environmental Protection Council (NEPC): 'The extent to which health risk can be minimised will be dependent on a range of factors, including economic, social and environmental considerations.'[7]

3.8 The International Laboratory for Air Quality and Health (ILAQH) put forward the case that standards are a compromise between competing interests including the economy and human health, stating 'standards are based on all kinds of reasons,

6 National standards for criteria air pollutants in Australia – Air quality fact sheet, Department of the Environment and Heritage, 2005, available from: http://www.environment.gov.au/atmosphere/airquality/publications/standards.html (accessed: 03/04/13)

7 National Environmental Protection Council, *Ambient Air Quality NEPM Review*, Adelaide, 2011, p. 14.

including economic; therefore, objectives are like this as well. So this is not based on health.'[8]

3.9 The development process behind the NEPM targets was explained to the committee by the New South Wales Environment Protection Authority (NSW EPA):

> The development of the NEPMs goes through several steps. The first is to go to the literature on what the epidemiological risks are for a given amount of pollutant. The second step is to look at the monitoring data that you have in population centres. Then you map the population sizes, the morbidities from those populations. Then you do a cost-benefit looking at what are the levels that would reduce morbidity and mortality and total health economic cost to the community by reducing those levels to a certain amount. That is how they are arrived at, to look at what is the best cost-beneficial target that we can have in the nation. They are developed on population levels and that requires numbers of people to be exposed to get certain health savings, because if you do it out on the Nullarbor you are not going to save many lives, so the cost-benefit of doing something out there is really quite negligible but the cost-benefit of doing something in a big city or a large population area is much higher. So they are developed on the cost-benefit model and therefore they are applied on the cost-benefit model.[9]

3.10 This principle of population level risk that is used in the NEPM is articulated by the NEPC:

> For the purpose of setting air quality standards, the risk characterisation applies to population risk not individual risk. Population risk refers to an assessment of the extent of harm for the population as a whole.[10]

2011 Review

3.11 A review of the NEPM in 2011 by the National Environmental Protection Council (NEPC Review), the first since the NEPM was made in 1998, found that:

> Implementing the NEPM has led to a greater understanding of air quality in Australia which has, in turn, led to an improved understanding about the health impacts of air pollution on the community…Therefore, governments now have the opportunity to act more strategically to manage and further improve air quality in Australia, moving beyond strict compliance with the standard to a focus on reducing population risk.[11]

3.12 The NEPC Report summarised the current state of affairs under the NEPM:

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8 Professor Morawska, International Laboratory for Air Quality and Health, *Committee Hansard*, 11 June 2013, p. 10.

9 Professor Smith, New South Wales Department of Health, *Committee Hansard*, 16 April 2013, p. 6.

10 National Environmental Protection Council, *Ambient Air Quality NEPM Review*, Adelaide, 2011, p. 21.

11 National Environmental Protection Council, *Ambient Air Quality NEPM Review*, Adelaide, 2011, p. 3.

> Overall, the results of the health reviews show that there are significant health effects at current levels of air pollution in Australian cities. These findings indicate that the current standards are not meeting the requirement for adequate protection of human health. There is evidence that these standards should be revised to minimise the impact of air pollution on the health of the Australian population.[12]

3.13 In light of this conclusion, the review included 23 recommendations – many of which would – if implemented – go a long way to significantly address issues raised throughout this inquiry. The NEPC Review recommended to:

- Revise the desired environmental outcome of the NEPM to 'minimise the risk from adverse health impacts from exposure to air pollution for all people wherever they may live';
- Revise the desired environmental goal to make reference to the air quality standards and incorporation of exposure reduction targets for priority pollutants;
- Remove lead from the Ambient Air Quality NEPM and include in the Air Toxics NEPM during the scheduled Air Toxics NEPM review of 2012;
- Revise the standards for all air pollutants in Schedule 1 of the NEPM to take into account new evidence around the health effects of air pollution;
- Introduce compliance standards for PM2.5;
- Introduce an 8-hour standard for ozone;
- Introduce an annual average standard for PM10;
- Introduce an exposure reduction framework and targets for priority pollutants;
- Remove allowable exceedances from Schedule 2 and introduce a natural events rule;
- Redesign monitoring networks to represent population exposure on a pollutant-by-pollutant basis without compromising data collection for long-term trend analysis. A procedure to determine the location and number of sites similar to EU and/or US EPA is recommended;
- Remove the population threshold and formula to enable monitoring on potential population risk rather than on population size;
- Amend requirements of monitoring methods (clause 16 and Schedule 3) to allow appropriate Australian Standards methods; or methods determined by the EU and/or US EPA as Reference or Equivalence Methods;

12 National Environmental Protection Council, *Ambient Air Quality NEPM Review*, Adelaide, 2011, p. 28.

- Remove Schedule 5 of the NEPM;
- Develop nationally consistent approaches to assess population exposure, including appropriate modelling and emissions inventories;
- Revise the assessment (clause 17) and reporting (clause 18) protocol to include additional performance assessment indicators and expanded reporting requirements to enable inclusion of population exposure determinations, severity of exceedances and effectiveness and management actions undertaken;
- Revise guidance documents and templates associated with assessment and reporting to accommodate presentation of clear messages, to allow for better communication and more accessible air quality reports;
- Amend the NEPM protocol (part 4) to incorporate natural event rule including definition of these events and criteria for assessment and reporting;
- Require timely reporting of all exceedances, with jurisdictions publicly releasing the analysis of these events on their respective websites within 3 months of the event;
- Disband the existing PRC and replace with a specialist working group or groups with a broader range of expertise to assist with scientific and technical matters. This working group would report to the Air Quality Working Group;
- Evaluate the options to assess ozone and secondary particle precursors;
- Initiate research into the composition of particles in Australia and associated health impacts;
- Initiate health research on the impact of air pollution (in particular, particles) in regional areas; and
- Monitor and report coarse particle fraction.[13]

3.14 Evidence received by the committee indicated that the recommended changes from the review will be prioritised and responded to via the development of the National Plan for Clean Air (NPCA) by the Council of Australian Governments Standing Council on Environment and Water (SCEW) for delivery in 2014.[14] The Department emphasized the collaborative nature of SCEW, but assured the committee that the relevant governments continue to work together to address the recommendations of the review, stating:

> The Australian government cannot establish, vary or revoke a NEPM unilaterally…The Australian government will continue to work with states

13 National Environmental Protection Council, *Ambient Air Quality NEPM Review*, Adelaide, 2011, p. 5.

14 Commonwealth Scientific and Industrial Research Organisation, Submission 48, p. 13.

> and territories to respond to the recommendations of the review of the air NEPM in the delivery of the National Plan for Clean Air. The plan is to be delivered to COAG by the end of 2014.[15]

National Plan for Clean Air

3.15 In 2011 SCEW agreed to formulate a National Plan for Clean Air (NPCA) to be released in 2014. Representatives from SEWPaC explained to the committee the purpose of NPCA:

> It is intended, firstly, to look at the review of the air quality NEPM and the recommendations there and incorporate appropriate action. So it will undertake analysis to see what should be done to implement those recommendations. Secondly—and this links to that review—it will undertake a health risk assessment and also look at developing an exposure risk reduction framework. Both of those are incorporated in the review of the air quality NEPM. So this is looking at shifting the paradigm somewhat. The WHO in its guidelines has said that there is little evidence to suggest that there is a threshold below which adverse health impacts are unlikely to occur. The current approach is really threshold based. Most OECD countries are moving to an exposure risk reduction framework.[16]

3.16 The Victoria EPA informed the committee that:

> The NPCA, will…include an exposure reduction approach which will take into account health effects at low levels. This will shift the emphasis of policy responses from reducing pollution to reducing the risk of harm from pollution. It will also shift the emphasis from providing an absolute level of protection to also finding the economically optimum point for intervention. The exposure reduction framework will provide efficiency outcomes by maximising health benefits across a population.[17]

3.17 The CAR supported the use an incremental scale to achieve the lowest possible pollution levels,[18] a view supported by the AMA.[19] The NEPC Review argued that a move towards an exposure reduction approach would align Australia with international best practice while improving health outcomes:

> There appears to be significant merit and across-the-board stakeholder support for an exposure reduction framework…the air quality standards do not provide absolute protection and any reduction in exposure will have a net positive health benefit. The introduction of an exposure reduction

15 Dr Wright, First Assistant Secretary, Environment Quality Division, SEWPaC, Committee Hansard, 17 May 2013, p. 59.

16 Dr Wright, First Assistant Secretary, Environment Quality Division, SEWPaC, Committee Hansard, 17 May 2013, p. 64.

17 Victoria EPA, *Submission 110*, p. 9.

18 Centre for Air quality and health Research and evaluation, Submission 25, p. 5.

19 Australian Medical Association, *Submission 114*, p. 11.

> approach will align Australian air quality management policy with international best practice approaches.[20]

3.18 The NEPC Review argued that an exposure reduction framework would be to reduce exposure for communities living in close proximity to large emission sources:

> Under the current monitoring protocol in the NEPM, people who live near major sources of pollution such as roads do not have air quality monitoring data and are likely to be exposed to higher levels of air pollution than that measured at performance monitoring stations. The exposure reduction approach would drive improvements in air quality across the whole population and not focus on meeting standards at the designated monitoring stations.[21]

3.19 The committee heard that an exposure reduction framework is better able to take into account the individual communities' appetite for risk when considering specific air quality controls:

> We are currently doing interdepartmental work on this—when I say 'we' it is New South Wales Health but I am also on the national environmental health council and they will be looking at these results as well—and we are also doing interjurisdictional work on this at the moment to come up with an incremental level above which you should not pollute. That is based on the same way that you set standards for everything else, which is: what is the risk appetite of the community? We accept risks from radiation, so you get one in 10 to the minus six excess cases of disease per one millisievert above background. For most water quality indices for our drinking water, we will accept a 10 to the minus four or 10 to the minus five increase in risk above background. We are doing the same sort of work around air, looking at: if we translate those sorts of risks that the community is generally going to accept for their environmental hazards and we apply that to air, what numbers do we come up with? That work is in train at the moment.
>
> …
>
> As I said before, most standards are set this way, but there is usually a risk appetite of somewhere between 10 and minus four and 10 and minus six excess risk above and beyond what you would normally get. In other words, if you got one case in 100 normally, then you would have an extra one case in 10,000 above those one cases in 100 of increased risk for a particular health outcome and we are usually talking about death here. That is the way that the process is working for us to look at this as an approach. This hasn't been done before. People have used the NEPM as a standard, saying: 'Okay, you've got to hit this goal.' That is not necessarily correct, because that goal may be too lenient or it may be too strict in certain circumstances. As the discussion earlier noted, you cannot use NEPM on very small populations that are exposed to a particular development. It does not lend itself to that

20 National Environmental Protection Council, *Ambient Air Quality NEPM Review*, Adelaide, 2011, p. 19.

21 National Environmental Protection Council, *Ambient Air Quality NEPM Review*, Adelaide, 2011, p. 29.

> because of the way it was developed. This approach will lend itself to that and it will be much clearer to people who are exposed to these risks what their actual level of risk is and what risk society is asking them to tolerate on behalf of development for all of society. [22]

Committee view

3.20 As the previous chapter showed, there is no safe level for exposure to most pollutants, and as was explained above, some pollutants that were previously thought to have threshold effects are now deemed to have no safe limit. This evidence, along with the findings of the NEPC Review, indicates that the exposure reduction model is the best approach to protect human health from harmful air pollutants. The committee notes the efforts of governments around Australia to move towards the exposure reduction approach to ensure the health of all Australians is adequately protected.

Recommendation 1

3.21 The committee recommends that the Australian Government's representative to the Standing Council on Environment and Water support the adoption of the 23 recommendations of the *Ambient Air Quality NEPM Review*.

$PM_{2.5}$ ultrafine particles and other contaminants

3.22 Finding the correct balance between human health and other considerations is a moving target as society's expectations change, and as the evidence base grows. The NEPC Review notes some of this evolution:

> Determining potential population health risk resulting from ambient air quality exposure has been complicated by the fact that epidemiology studies are now indicating there is no clear threshold for effect for the current NEPM pollutants, with exposures below the standards still representing a statistically significant and measurable health risk to the Australia population…when the NEPM was made it was thought sulfur dioxide and carbon monoxide had an identified threshold effect, and nitrogen dioxide and lead had an apparent threshold effect.[23]

3.23 The committee heard repeated calls throughout this inquiry for more stringent air quality standards to be put in place for pollutants such as $PM_{2.5}$, ultrafine particles and some other contaminants.

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22 Professor Smith, New South Wales Department of Health, *Committee Hansard*, 16 April 2013, pp. 6–8.

23 National Environmental Protection Council, *Ambient Air Quality NEPM Review*, Adelaide, 2011, p. 14.

$PM_{2.5}$

3.24 Under the current NEPM $PM_{2.5}$ is subject to an advisory reporting standard rather than a compliance standard. A large number of submissions and witnesses recommended that the advisory standard be replaced with a compliance standard.[24]

3.25 The decision to include $PM_{2.5}$ as an advisory standard in the NEPM from 2003 was to gather data to assess the impacts of $PM_{2.5}$:

> Advisory reporting standards are considered to be the appropriate form for a standard for $PM_{2.5}$ at this time, given the lack of comprehensive data that would make it possible to establish compliance standards and to fully assess the impacts associated with breaches of such standards. The purpose of advisory reporting standards is to facilitate the collection of data and provide a framework for reporting these data.[25]

3.26 Since that time it has become clear that $PM_{2.5}$ poses a risk to human health. The NSW EPA noted that 'fine particles, $PM_{2.5}$, are the pollutants imposing the greatest health and cost burden on the people of New South Wales.'[26]

3.27 In recommending the introduction of a compliance standard for $PM_{2.5}$ the NEPM Review noted that there is now sufficient Australian evidence to justify a compliance standard:

> This support is based on the understanding of the health effects of $PM_{2.5}$. The initial introduction of an advisory reporting standards rather than compliance standards was due to a lack of monitoring data. All jurisdictions have since been monitoring $PM_{2.5}$ and there is now sufficient data to develop compliance standards. The Review Team considers that compliance standards should be introduced for $PM_{2.5}$.[27]

3.28 The introduction of a compliance standard appears to be supported by regulators[28] and community groups including by the NSW EPA which commented:

> Because of that growing awareness here and internationally that we need to focus on $PM_{2.5}$, we believe that the NEPM needs to change. Specifically, the New South Wales EPA is strongly of the view that the NEPM reporting

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24 Australian Medical Association, *Submission 114*, p. 10; Ms Roberts, Campaign Organiser, Communities Protecting Our Regions, *Committee Hansard*, 11 June 2013, p. 45; Cleanairtas, *Submission 81*, p. [7]; Australian Network of Environmental Defender's Offices Inc., *Submission 85*, p. 2; Mr Hutton, President, Lock the Gate Alliance, *Committee Hansard*, 11 June 2013, p. 52.

25 National Environmental Protection Council, *Summary of submissions received in relation to the Draft Variation to the National Environmental Protection (Ambient Air Quality) Measure for Particles as PM2.5 and National Environmental Protection Council's responses to those submissions*, Adelaide, 2003, pp. 1–2

26 Mr Buffier, Chief Executive Officer, New South Wales Environmental Protection Authority, *Committee Hansard*, 16 April 2013, p. 2.

27 National Environmental Protection Council, *Ambient Air Quality NEPM Review*, Adelaide, 2011, p. 28.

28 Environmental Protection Authority Victoria, *Committee Hansard*, 17 May 2013, p. 37.

> standard for $PM_{2.5}$ should be adopted as a compliance standard. As well as the annual standard, the health evidence also indicates that a daily standard is necessary.[29]

Ultrafine particles

3.29 Some submissions also called for UFP, particles of a diameter less than 0.1µm, to be subject to regulation.[30] UFP are generally produced through combustion processes and can penetrate deep into the lungs of humans and enter the bloodstream.[31]

3.30 Professor Morawska highlighted that research of the effects of UFP on human health is progressing, but there is still little understanding and monitoring of UFP:

> Epidemiological evidence is also mounting on the impact of ultrafine particles on health; however, progress in this field is hampered by the lack of monitoring of these particles. In general there is little monitoring and hence understanding of a complex urban pollution mix, including elemental carbon, primary organics and secondary organic aerosols.[32]

3.31 The AMA advocated for a precautionary approach to ultrafine particles:

> 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 necessitate provisional standards and measures designed to reduce exposure to ultrafine particulates, particularly given their ubiquity and presence in vehicle exhaust emissions.[33]

3.32 As a result of the lack of current evidence, the ILAQH argued that:

> There is a critical need for the routine monitoring of UFPs, to provide input for epidemiological studies and in turn, the development of regulations (it is unlikely that regulations would be developed without exposure-response relationships).[34]

3.33 The NEPC Review argued against the inclusion of UFP in the NEPM, arguing that there is currently insufficient evidence to justify the inclusion of UFP:

> The health reviews conducted as part of this review have shown that, although there is some evidence for health effects linked to ultrafine

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29 Mr Buffier, Chief Executive Officer, New South Wales Environmental Protection Authority, *Committee Hansard*, 16 April 2013, p. 2.

30 Lake Macquarie City Council, *Submission 15*, p. 3.

31 Commonwealth Scientific and Industrial Research Organisation, *Submission 48*, p. 4; Doctors for the Environment, *Submission 4*, p. 5.

32 Professor Morawska, International Laboratory for Air Quality and Health, *Committee Hansard*, 11 June 2013, p. 2.

33 Australian Medical Association, *Submission 114*, p. 5.

34 International Laboratory for Air Quality and Health, *Submission 53*, p. 4.

> particles, there is not sufficient evidence to support the setting of standards at this time. This finding is supported by the recent reviews conducted by the WHO and by US EPA. In additional, as ultrafine particles are not routinely monitored, there is no monitoring data available in Australia that would enable the setting of standards.[35]

Committee view

3.34 While the committee appreciates that there may not be sufficient data at this time to warrant a compliance standard, it does appear that there is enough evidence to indicate that further and urgent research is required to assess the levels population exposure to UFP and the impact that this has on human health. In the same way that $PM_{2.5}$ was initially included in the NEPM as an advisory standard to gather data, UFP particles should be included in the NPCA.

Recommendation 2

3.35 The committee recommends that the Australian Government advocate, through the appropriate Council of Australian Governments process, the inclusion of mechanisms to collect additional data on ultrafine particles.

Other contaminants

3.36 A number of other contaminants were nominated for regulation to protect human health. For example, the committee heard that there is currently no standards around arsenic or cadmium for air quality; contaminants important for mining communities where those metals are being extracted. Some communities are also exposed to higher than average levels of lead and dust.[36] Although this report is unable to discuss these concerns in detail as little evidence was received on these issues, the committee notes these concerns.

Reducing community exposure: buffer zones

3.37 The committee heard that one of the most effective ways of reducing exposure to harmful pollutants is by separating populations from those pollutants.[37] The Minerals Council of Australia explained that buffer zones can be used to control dust and other emissions, improve visual amenity and for occupational health and safety reasons.[38] The committee heard concerns from some communities such as Anglesea in

35 National Environmental Protection Council, *Ambient Air Quality NEPM Review*, Adelaide, 2011, p. 22.

36 Professor Taylor, Professor of Environmental Science, Macquarie University, *Committee Hansard*, 11 June 2013, pp. 21,25.

37 Dr Jeremijenko, Occupational and Environmental Physician – Australasian Faculty of Occupational and Environmental Medicine, *Committee Hansard*, 11 June 2013, p. 62.

38 Mr McCombe, Assistant Director – Environmental Policy, Minerals Council of Australia, *Committee Hansard*, 16 April 2013, p. 28.

Victoria and Newcastle in New South Wales that mines, port, transport corridors power stations are too close to vulnerable communities.[39]

3.38 Buffer zones are already used in some jurisdictions for various industrial developments. Queensland has a mandated buffer zone on coal mines of two kilometres from towns with greater than one thousand inhabitants.[40] Wind farm developments are also subject to a two kilometre buffer zone in Victoria and South Australia.[41]

3.39 The verifiability of buffer zones was cited as one of their key benefits as 'you do not have the uncertainty as to whether the standards are being met through complicated monitoring. You can see there is a gap.'[42]

3.40 Several groups called for a more extensive use of buffer zones to control air quality.[43] The Asthma Foundation of New South Wales called for the '[establishment of] a minimum buffer zone between human habitation and all new open-cut coalmines, mine expansion and port infrastructure.'[44] ANEDO and the Lock the Gate Alliance both suggested that, considering the potential scale of mining developments, two kilometres was an insufficient barrier.[45] A large number of submissions, while expressing concern regarding the health impacts of air pollution on proximate communities, did not suggest the use of buffer zones[46] and instead proposed stronger enforcement of current standards or more stringent standards.[47]

3.41 The use of buffer zones does need to take into account the local meteorological and planning circumstances. The town of Moranbah, for example, has mines on three sides of it and their existing buffer zones were reported to the

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39 Surf Coast Air Action, *Submission 52*, p. 1; Islington Village Community Group, *Submission 54*, p. 4.

40 Mr Hutton, President, Lock the Gate Alliance, *Committee Hansard*, 11 June 2013, p. 55.

41 Associate Professor Carey, Member – Management Committee, Doctors for the Environment, *Committee Hansard*, 17 May 2013, p. 3.

42 Ms Bragg, representative, Australian Network of Environmental Defenders Offices, *Committee Hansard*, 11 June 2013, p. 64.

43 Australian Network of Environmental Defenders Offices, *Submission 85*, p. 2; Wilderness Society of Newcastle, *Submission 99*, p. [9].

44 Mrs Goldman, Chief Executive Officer, Asthma Foundation New South Wales, *Committee Hansard*, 17 May 2013, p. 41.

45 Ms Bragg, representative, Australian Network of Environmental Defenders Offices, *Committee Hansard*, 11 June 2013, p. 64; Mr Hutton, President, Lock the Gate Alliance, *Committee Hansard*, 11 June 2013, p. 55.

46 Hunter Valley Protection Alliance, *Submission 19*; Environment Victoria, *Submission 27*.

47 Port Adelaide Resident's Environmental Protection Group, *Submission 108*, pp. 4–5; Hunter Community Environment Centre, *Submission 5*, p. 3; Greenpeace Australia Pacific, *Submission 43*; Nature Conservation Council of New South Wales, *Submission 58*, p. [3].

committee to be limiting development in the town.[48] On the other hand, the Port Augusta City Council reported that although a two kilometre distance exists between local power stations and the city, prevailing winds mean that populations are exposed to air pollution.[49]

Committee view

3.42 The use of buffer zones to protect communities from large point-sources of pollution such as coal mines, power plants, ports and transport corridors is not a new idea. Having considered the evidence before it, the committee is of the view that buffer zones – taking into account local conditions and requirements – are an important tool in protecting communities from poor air pollution. Importantly, buffer zones are physical control measures that the community can see and authorities can accurately verify.

Recommendation 3

3.43 The committee recommends that buffer zones be used to protect populated areas from large point-source emitters.

Air pollution monitoring and data

3.44 Currently in Australia there are two primary sectors responsible for collecting data and monitoring air quality: governments collecting data to meet their requirements under the NEPM; and private sector entities that are required to undertake air quality monitoring as part of their various operating licences.

Government monitoring

3.45 The committee received evidence from a number of State government environmental protection authorities outlining the way in which they monitored air quality in their state. Western Australia and Victoria both reported the use of a fixed network of monitoring stations – necessary to meet their obligations under the NEPM – supplemented by mobile monitoring stations that can be deployed to assess local air quality issues and undertake research into specific point sources.[50] The NSW EPA operates 40 monitoring stations (15 in Sydney), and works with industry to monitor emissions from local sources.[51]

3.46 The NEPM provides explicit guidance on the location and operation of performance monitoring stations, in accordance with the Australian Standard AS2922–1987: *Ambient Air – guide for siting of sampling units*. The stations must be located in a manner that contributes to obtaining a representative measure of the air

48 Ms Dix, Member Representative, Moranbah Cumulative Impacts Group, *Committee Hansard*, 11 June 2013, p. 46.

49 Port Augusta City Council, *Submission 12*, p. 1.

50 Western Australian Government, *Submission 155*, pp. 4–5; Victoria EPA, *Submission 110*, p. 11;

51 New South Wales EPA, *Submission 80*, p. 17.

quality likely to be experienced by the general population in a region.[52] The NEPC Review provides an explanation of the intent behind this approach:

> The intent was to provide some sense of population exposure by focusing on the higher levels to which a regional population was likely to be exposed, without direct influence of local sources such as major traffic areas; that is, where large proportions of the population experience similar average air quality.[53]

3.47 Data from monitoring conducted by State and Territory governments is widely available. The committee heard that the NSW EPA provides hourly air quality updates and that residents can subscribe to SMS and email alerts informing them of high pollution days.[54] Western Australian and Victorian residents can similarly view hourly updates on their respective agency's websites.[55] Findings from the data from periodic point source monitoring, at least in Victoria, is presented 'regularly' via the internet and community meetings.[56]

3.48 Because the NEPM is focused at the population level, the data does not measure air pollution likely to be experienced by any one individual. The NEPC Review explains that:

> The NEPM standards were established as ambient standards; that is, pertaining to broad air quality within air sheds. They were not generally aimed at assessing air quality at localised point sources, such as those from industrial plants.[57]

3.49 This measurement of airshed exposures was criticised during the inquiry as hiding the true air quality in places that people live and work. For communities and residents in close proximity to large emitters, they cannot be sure of their actual exposure as data is reported for the airshed as a whole. The AMA argued that this consequence of this system is that individual communities often cannot accurately gauge their specific exposures:

> The original intent of Australia's air quality monitoring network was to avoid monitoring near localised sources of pollution, such as industrial areas or 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 specific airshed. As a consequence, the air monitoring that is undertaken

52 National Environmental Protection Council, *Ambient Air Quality NEPM Review*, Adelaide, 2011, p. 32.

53 National Environmental Protection Council, *Ambient Air Quality NEPM Review*, Adelaide, 2011, p. 32.

54 New South Wales EPA, *Submission 80*, p. 17.

55 Western Australian Government, *Submission 155*, p. 3; Victoria EPA, *Submission 110*, p. 11

56 Victoria EPA, Submission 110, p. 11.

57 National Environmental Protection Council, *Ambient Air Quality NEPM Review*, Adelaide, 2011, p. 15.

> under the current [NEPM] 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.[58]

3.50 As a result of the use of ambient standards, the committee heard that many communities that are collocated with industrial sites, mines, or major transport routes and infrastructure are being exposed to air quality that does not meet the NEPM standard's object of protecting health,[59] and that currently 'monitoring of pollution and health impacts locally is unsatisfactory and a cause for concern among the local community.'[60] Representatives from Moranbah in Queensland argued that the lack of information about population exposure is as much a concern for residents as the exposure itself.[61]

3.51 One reason for monitoring air pollution levels is to use that data to improve our understanding of the impact poor air quality has on human health. The committee heard concerns that the current design of the NEPM air monitoring regime may be inadequate to collect the necessary data to properly assess the health impacts of poor air quality.[62] An impact of this system, reported by the AMA, is that the necessary data to draw causal links between health impacts and poor air quality is not being collected.[63] The Moranbah Cumulative Impacts Group also called for monitoring to be better integrated with health information to 'provide an accurate picture of any risks to human health or otherwise.'[64] The Australian Network of Environmental Defender's Offices (ANEDO) also called for 'monitoring stations in areas where the community is being affected – schools, the nearest home, and so forth.'[65] Doctors for the Environment expressed frustration that the current system limited the ability to draw causal links between air quality and human health:

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58 Australian Medical Association, *Submission 114*, p. 11.

59 Associate Professor Carey, Member – Management Committee, Doctors for the Environment, *Committee Hansard*, 17 May 2013, p. 1.

60 Environment Victoria, *Submission 27*, p. 1.

61 Ms Dix, Member Representative, Moranbah Cumulative Impacts Group, *Committee Hansard*, 11 June 2013, p. 46.

62 Professor Morawska, International Laboratory for Air Quality and Health, *Committee Hansard*, 11 June 2013, p. 2.

63 Ms Dobson, Senior Policy Officer, Australian Medical Association, *Committee Hansard*, 16 April 2013, p. 42.

64 Ms Dix, Member Representative, Moranbah Cumulative Impacts Group, *Committee Hansard*, 11 June 2013, p. 46.

65 Ms Bragg, representative, Australian Network of Environmental Defenders Offices, Committee Hansard, 11 June 2013, p. 59.

> At the moment it seems crazy to the community that the sources that are most polluting, which could be major roads or coal fired power stations, are actively excluded because the EPA is looking for an airshed average and that affects the airshed average. It is very mechanistic. It is not actually giving us the information about risk, which is really what we are after in order to reduce that for the population.[66]

3.52 The committee was informed that in the United States and European Union air quality monitoring considers population exposures rather than airshed concentrations of pollutants.[67]

3.53 The NEPM Review noted the concerns that current monitoring does not adequately capture human exposure to pollutants and recommended a redesign of the monitoring networks to represent population exposure.[68]

3.54 Some pollutants currently monitored under the NEPM are measured as averages over a period of time. This has impacts on the presentation of data, with short intervals of elevated pollution levels being hidden within the averages. It was argued that:

> A 24-hour average just hides those spikes and does not really give you a true picture of useful information you can use for health impact, that you can correlate spikes directly with health impact and see what is going on. You cannot get that from averaged information.[69]

3.55 Similarly:

> You bodgie up air quality all the time by doing averages. You do an average over a period of time and you get something that comes inside the set parameters and that neglects the fact that on a number of occasions you had serious exceedences, which caused major health issues. You have to go for the large spikes as well as the averages if you are going to get any sort of idea about what impact these are having on health.[70]

3.56 In the case of lead, the NEPM measures use an average of TSP. It was argued that this obscures actual contaminant concentrations:

> So, the standard is based on an annual average. What this does not do is, first, take into account the short-term fluctuations, which are very significant—and that information is in the documentation that I sent to the parliament. It also does not take into account the effect of very small particulates, because you have a dilution by consequence of including all

66 Associate Professor Carey, Member – Management Committee, Doctors for the Environment, *Committee Hansard*, 17 May 2013, p. 5.

67 Australian Medical Association, *Submission 114*, p. 12.

68 National Environmental Protection Council, *Ambient Air Quality NEPM Review*, Adelaide, 2011, pp. 5–6.

69 Ms Dix, Member Representative, Moranbah Cumulative Impacts Group, *Committee Hansard*, 11 June 2013, p. 47.

70 Mr Hutton, President, Lock the Gate Alliance, *Committee Hansard*, 11 June 2013, p. 52.

> particulates, including coarse particulates, in the measurement. As particles become smaller their surface area to volume increases, and it is well known and well understood that most of the contaminants reside in the very fine particulates.[71]

Committee view

3.57 While the committee recognises that certain NEPM standards are evaluated as averages, the committee did not hear any reason why raw data could not be made available to the public. The availability of this data might assuage concerns about exposure and also allow for additional research into correlations between high pollution levels and other markers of health impacts such as hospital admissions.

Industry monitoring

3.58 Some large-scale emitters undertake their own air quality monitoring either on their own initiative or as required as part of their operating licences. These monitoring sites can provide a more detailed picture of air quality being experienced by a proximate community. EPA Victoria reported to the committee that the use of industry monitoring – subject to agreed standards – is standard practice around the world:

> [EPAs] require businesses that pollute to monitor and report on their pollution, but there are often concerns from the community that that is not independent, even though it is subject to rigour in the way in which it is done.[72]

3.59 It was reported to the committee, for example, that North Queensland Bulk Ports (NQBP) that for over 20 years they have conducted coal dust monitoring around the coal terminals and nearby communities,[73] and that power stations in the La Trobe valley and Anglesea in Victoria conduct monitoring.[74]

3.60 The committee heard concerns that the data from these monitoring stations was inaccurate and difficult to obtain,[75] and does not necessarily measure for things such as PM2.5.[76] The committee heard evidence from ANEDO that the monitoring requirements in operating licences are often insufficiently specific to ensure that point-source monitoring is conducted in places that will accurately represent

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71 Professor Taylor, Professor of Environmental Science, Macquarie University, *Committee Hansard*, 11 June 2013, p. 21.

72 Mr Merritt, Chief Executive Officer, Environment Protection Authority Victoria, *Committee Hansard*, 17 May 2013, p. 39.

73 North Queensland Bulk Ports Corporation, *Submission 148*, p. 4.

74 Mr Merritt, Chief Executive Officer, Environment Protection Authority Victoria, *Committee Hansard*, 17 May 2013, p. 39.

75 Professor Shearman, Honorary Secretary, Doctors for the Environment, *Committee Hansard*, 17 May 2013, p. 3.

76 Mackay Conservation Group, *Submission 8*, p. 3.

community exposure.[77] It was the view of Doctors for the Environment that, overall, 'there is an overreliance on industry to provide information, and that is frequently far from adequate and far from transparent.'[78]

3.61 Industry bodies, such as NQBP, disputed the negative characterisation of their monitoring practices. They informed the committee that their monitoring was conducted by 'independent consultants' and was thus a reliable indicator of air quality.[79] The Victorian EPA informed the committee that they monitor industry established monitoring equipment to ensure that the data is accurate and appropriate monitoring standards and practice are being observed.[80]

3.62 The committee is not in a position to verify claims regarding the validity of data, but is of the belief that effective industry monitoring of air quality – especially when one industry is creating a large amount of air pollution such as coal mining in the Upper Hunter Valley area – should be encouraged to supplement government data collection.

3.63 The committee regularly heard that it was difficult for the community to access air quality data, especially data collected from a point source emitter as part of an operating licence. The ANEDO informed the committee that 'it is a torturous and difficult process for the locals to try and get hold of the relevant monitoring data.'[81] Doctors for the Environment elaborated on the difficulties of accessing industry gathered data:

> …the trouble with industry monitoring is that it goes to the EPA but it is not transparent and so it is not readily accessible for citizens or people in the community. To be able to extract information from the EPA, as David has mentioned, you have to be extremely committed with your time and energy, generally. People really need something they can quickly look up and get some indication of what sort of problem there is.[82]

3.64 The committee heard the example of the difficulty the residents of Anglesea in Victoria faced in trying to access data collected by Alcoa:

> …at the moment that data is difficult to access. It can be accessed at times through—for example, the reporting that companies do to the EPA. However, that reporting may or may not be made public. So, for example,

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77 Ms Bragg, representative, Australian Network of Environmental Defenders Offices, *Committee Hansard*, 11 June 2013, p. 59.

78 Associate Professor Carey, Member – Management Committee, Doctors for the Environment, *Committee Hansard*, 17 May 2013, p. 3.

79 North Queensland Bulk Ports Corporation, *Submission 148*, p. 4.

80 Mr Torre, Principle Expert – Air Quality, Environment Protection Authority Victoria, *Committee Hansard*, 17 May 2013, p. 34.

81 Ms Bragg, representative, Australian Network of Environmental Defenders Offices, *Committee Hansard*, 11 June 2013, pp. 58–59.

82 Associate Professor Carey, Member – Management Committee, Doctors for the Environment, *Committee Hansard*, 17 May 2013, p. 4.

> the community was not able to access the particulate matter data recorded at Anglesea power station without having gone through a process of freedom of information and eventually a decision being made by the Victorian parliament that Alcoa Anglesea was required to provide its health impact assessments to that community. It was a period of years that that community was seeking information that contained monitoring levels before they were able to be provided with that information.[83]

3.65 It was recommended by ANEDO that 'real-time online monitoring data' be available to the public.[84] Quit Coal made the same recommendation so that residents near heavy pollution sources would have the necessary information 'that would allow them to take action to protect themselves.'[85]

3.66 NQBP disputed that data on air quality was difficult to obtain, pointing out that their independent monitoring was available on their website.[86] The committee notes however that there appears to be a gap of around one month between the data being collected and published.

Committee view

3.67 Industry monitoring of emissions is an important tool in ensuring compliance with licensing conditions and protecting human health. As the creators of potentially harmful pollutants, industry has a responsibility to ensure that human health is preserved and the reliable and regular data is collected. The committee is of the view that this information should be made available to the public in as close to real-time as possible.

Recommendation 4

3.68 The committee recommends that pollution monitoring should accurately capture population exposure for communities and homes proximate to pollution point sources.

Recommendation 5

3.69 The committee recommends that providing monitoring and real-time data of air quality be a condition of environmental approvals issued by the Australian Government unless an operator can demonstrate that air pollution created by the development will not impact upon human health.

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83 Dr Redenbach, Representative, Quit Coal, *Committee Hansard*, 17 May 2013, p. 55.

84 Ms Bragg, representative, Australian Network of Environmental Defenders Offices, *Committee Hansard*, 11 June 2013, p. 59.

85 Dr Redenbach, Representative, Quit Coal, *Committee Hansard*, 17 May 2013, p. 53.

86 North Queensland Bulk Ports Corporation, answer to question on notice, 11 June 2013 (received 20 June 2013).

Chapter 4
Coal

Sources of coal emissions

4.1 Coal is a potential source of dust and particulates throughout its lifecycle as a fuel. Coal is likely to be a source of significant air pollution if not properly managed during extraction, storage, and transport. It is also a source of significant CO_2 emissions during burning. Evidence provided from the NSW EPA indicated the contribution of coal mining to emission levels in that State broadly, with mining for coal accounting to 27.6 per cent of $PM_{2.5}$ in the greater metropolitan region of Wollongong, Sydney and Newcastle (GMR), 58.4 per cent of PM_{10} in the GMR. In the Upper Hunter region (UHR), those levels are higher, at 66 per cent of $PM_{2.5}$ and 87.6 per cent of PM_{10} emissions.[1]

4.2 The Minerals Council of Australia (MCA) recognised that coal mining is a source of air pollution, but emphasised the importance of the different size of particles and their respective impacts:

> Without a doubt, the industry by its very nature makes a contribution to particulate emissions. It digs, it has haul roads, it transports material. But as part of that, and this is where the context comes in, you need to look at the composition, the size and the very nature of those particles. For example, if it is a rock it is not going to go very far. If it is dust, depending on prevailing weather conditions, it will go a certain distance but then it will drop out—especially if it is coarser particles. If it is ultrafine particles, they are not sourced from mechanical digging. They are not sourced from haul roads. They are sourced primarily from combustion sources….Without a doubt, we recognise that the industry, by its very nature, contributes to particle emissions.[2]

4.3 Coal dust and other particulates are produced during the extraction process of coal, when diesel is burned operating mining machinery, 'blasting' sends dust and other substances into the air, and draglines and trucks create or re-mobilise dust.[3]

4.4 While coal is waiting to be loaded onto trains or boats, it is stored in large mounds referred to as stockpiles. The committee heard that these stockpiles are a potential source of coal dust. Community groups in particular expressed concerns about the size of the stockpiles. It was reported to the committee that the proposed

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1 NSW Environmental Protection Agency, *Submission 80*, pp. 10–11.

2 Mr McCombe, Assistant Director – Environmental Policy, Minerals Council of Australia, *Committee Hansard*, 16 April 2013, p. 23.

3 Mr Krey, Member, Hunter Valley Protection Alliance, *Committee Hansard*, 16 April 2013, p. 12.

stockpile at the Dudgeon Point coal terminal in Mackay would cover 400 hectares; and be located two kilometres from residential areas.[4]

4.5 The potential for coal trains to cause dust emissions was a key issue throughout the committee's inquiry. While the amount and nature of pollution emanating from coal trains was a contested point,[5] it did appear that coal trains are a source of air pollution. Dust emissions from coal can also be released during the loading and unloading of coal during transport, whether by truck, train or conveyor.

4.6 Finally, coal is used extensively for power generation in Australia. This process involves the burning of coal which results in the emission of various compounds such as sulphur dioxide, oxides of nitrogen, and particulate matter. The committee heard that combustion of coal in power plants was a leading source of $PM_{2.5}$:

> In relation to PM2.5s electricity generation, coal fired and coalmining are just two sources of particulate matter of PM-size 2.5 or less in Australia. In relation to Victoria, four of Australia's six largest-emitting single-emitting facilities of PM2.5 are in Victoria's Latrobe Valley, including Loy Yang, Yallourn, Loy Yang B and Hazelwood power stations. Eight of the nation's top ten emitters of PM2.5s around the country are power stations.[6]

Impact of coal dust on health

4.7 Dr Jeremijenko informed the committee that:

> Coal dust is obviously a risk; it is all the impurities that go along with it in the transport, as well. Coal may have arsenic, lead, heavy metals, mercury.
>
> …
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> The science is clear that coaldust is a killer if you are exposed to it too much, so the simple thing is to remove that risk as much as possible.[7]

4.8 It was asserted to the committee that emissions from coal extraction and transport tended to be coarse particles rather than the fine particles that are more harmful to health.[8] As the Deputy Chief Executive Officer of NQBP argued:

> The CSIRO work that I cited a moment ago clearly makes that distinction. The point is this: there is a body of literature that clearly links some health risks to the smaller finer particulate matter. Such a body of literature does not seem to be evident for the larger material. I think the point is that if we

4 Ms Roberts, Campaign Organiser, Communities Protecting Our Regions, *Committee Hansard*, 11 June 2013, pp. 44–45.

5 Mr Roche, Chief Executive, Queensland Resources Council, *Committee Hansard*, 11 June 2013, p. 12.

6 Dr Redenbach, Representative, Quit Coal, *Committee Hansard*, 17 May 2013, p. 51.

7 Dr Jeremijenko, Occupational and Environmental Physician – Australasian Faculty of Occupational and Environmental Medicine, *Committee Hansard*, 11 June 2013, pp. 61, 63.

8 Mr Stewart–Harris, Deputy Chief Executive Officer, North Queensland Bulk Ports Corporation, *Committee Hansard*, 11 June 2013, p. 35.

> are trying to lump this all together and say 'all coal dust is bad', frankly, the literature does not support that.[9]

4.9 As was noted earlier in this report, epidemiological research has shown that there is no safe level of exposure to particulate matter. Although it is unclear whether coal in and of itself is better or worse than other particulates, there are locations where populations are exposed to large volumes of air pollution because of the activities surrounding coal mining and its transport or combustion. The committee heard from one Jondaryan resident who related her health concerns:

> We get burning eyes, a burning tongue, a sore throat and burning throat. I am a bit croaky, that is from coal. We also suffer from itchy skin, ringing in the ears, ringing in your brain. Sometimes at night, you go to sleep and your brain is swishing like it is running around in your head. It will wake you at 3.30 in the morning and you will not get to sleep again because you will just sit there and hold your head. We suffer from lack of concentration. We have jaw problems. Because of the noise from the plant we are not sleeping properly. The dentist told me we are just clenching our teeth in our sleep and that is causing us to have jaw problems. Of course, then we have the fits of anger, hopelessness and depression that just go along with frustration of nobody listening and nobody caring.[10]

4.10 The committee received similar anecdotal evidence from the Moranbah Cumulative Impacts Group who indicated that there is a heightened rate of asthma in the town, but that this is difficult to directly attribute to coal dust rather than other sources of pollution such as smoking and airborne pollens.[11] The Asthma Foundation New South Wales argued that proximity to coalmines has been linked to higher rates of asthma,[12] and cited research from 2010:

> In May 2010 the New South Wales government released a report on child health which showed that nearly 40 per cent of nine-to-15-year-olds in the Hunter Valley and the New England region had suffered at some stage from asthma. That is significantly above the national average of 10 per cent. Other areas that have expressed concerns are the Hunter Valley and Lithgow in the Blue Mountains, which has a coalmine, a newly extended coal fired power station and an asthma rate 80 per cent higher than the New South Wales average.[13]

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9 Mr Stewart–Harris, Deputy Chief Executive Officer, North Queensland Bulk Ports Corporation, *Committee Hansard,* 11 June 2013, p. 36.

10 Ms Hammond, private capacity, *Committee Hansard,* 11 June 2013, p. 28.

11 Ms Dix, Member Representative, Moranbah Cumulative Impacts Group, *Committee Hansard,* 11 June 2013, p. 46.

12 Mrs Goldman, Chief Executive Officer, Asthma Foundation New South Wales, *Committee Hansard,* 17 May 2013, p. 41.

13 Mrs Goldman, Chief Executive Officer, Asthma Foundation New South Wales, *Committee Hansard,* 17 May 2013, p. 43.

4.11 The committee heard that some companies paid for annual health checks of their workforce to protect against exposure and provided extensive written guidance on protecting health, but that similar services were not provided to nearby communities,[14] which had to pay for their own healthcare.[15]

4.12 Greenpeace Australia Pacific argued that there has been insufficient research undertaken to understand the impact on health of coal affected communities, despite many communities reporting health concerns.[16] The committee heard concerns that residents in Anglesea in Victoria who are living half a kilometre from an open cut coal mine were unable to assess whether their community was at risk because no independent monitoring is being undertaken.[17]

4.13 A number of communities expressed their concerns to the committee about the possible impact of coaldust on human health. Evidence from the Mackay group Communities Protecting Our Regions explained:

> We found very clearly that people were concerned about coal dust. It was one of their main concerns about the Dudgeon Point coal port proposal, and in fact we found that this was their primary concern. We found this as we continued to campaign on the coal port—that is, that is one of the main things that people are concerned about.[18]

4.14 The Moranbah Cumulative Impacts Group similarly informed the committee that 'quite a lot of residents have become concerned for their health.'[19]

Protecting vulnerable communities

4.15 Occupational and environmental physician Dr Jeremijenko argued that it is possible to significantly reduce the risk from coal mining and its associated activities:

> We know what works; we have applied it at the coalface and there are other ways—like dust suppression, covering coal trains and others—that we can reduce the risk.[20]

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14 Ms Hammond, private capacity, *Committee Hansard*, 11 June 2013, p. 28.

15 Dr Jeremijenko, Occupational and Environmental Physician – Australasian Faculty of Occupational and Environmental Medicine, *Committee Hansard*, 11 June 2013, p. 61.

16 Ms Woods, Senior Climate Campaigner, Greenpeace Australia Pacific, *Committee Hansard*, 11 June 2013, p. 29.

17 Associate Professor Carey, Member – Management Committee, Doctors for the Environment, *Committee Hansard*, 17 May 2013, p. 3.

18 Ms Roberts, Campaign Organiser, Communities Protecting Our Regions, *Committee Hansard*, 11 June 2013, p. 44.

19 Ms Dix, Member Representative, Moranbah Cumulative Impacts Group, *Committee Hansard*, 11 June 2013, p. 46.

20 Dr Jeremijenko, Occupational and Environmental Physician – Australasian Faculty of Occupational and Environmental Medicine, *Committee Hansard*, 11 June 2013, p. 58.

4.16 Furthermore, it was argued that protecting vulnerable communities through pit to port dust management receives less emphasis than minimising emissions at the coal-face:

> There are a lot of areas where we could do a lot more work and address this a lot more proactively. It is a high risk, in my view, and it is a high risk that goes right past the homes and the schools of many people, and it is not being treated and addressed with the same level of risk management as we treat it with at the coalface.[21]

4.17 Broadly speaking, the committee has identified two categories of protective measures that must be considered for these vulnerable communities: minimising the creation of dust, and limiting human exposure to dust that is unable to be managed. Some solutions put to the committee addressed both of these measures, such as best practice loading techniques described below. Most solutions identified, however, were directed towards limiting exposure to dust. These may keep people away from the dust, minimise the time people are exposed to a hazard, or involve the use of personal protective equipment such as face masks.[22] The use of personal protective equipment is not a realistic approach for residents living near coal industry facilities, meaning that engineering, planning and administrative solutions are critical.

4.18 It was recommended by several stakeholders, including the Lock the Gate Alliance, that there should be 'an absolute minimum' mine set-back of two kilometres from residential areas.[23] The committee heard that in Queensland a two-kilometre minimum buffer exists for towns above 1000 inhabitants.[24] The committee heard that buffers are a useful solution because they are easily verified by regulatory bodies:

> I think the concept of buffer areas between the stockpile or the mine, and the community is incredibly important, because in terms of enforcement—and we talked about enforcement a little earlier—it is something you can see. There is the mine and there is a two-kilometre buffer and you do not have uncertainty as to whether the standards are being met through complicated monitoring. You can see there is a gap.[25]

4.19 Although the two-kilometre minimum was put to the committee, it was emphasized that the buffer necessary to protect residential populations would depend

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21 Dr Jeremijenko, Occupational and Environmental Physician – Australasian Faculty of Occupational and Environmental Medicine, *Committee Hansard*, 11 June 2013, p. 61.

22 Dr Jeremijenko, Occupational and Environmental Physician – Australasian Faculty of Occupational and Environmental Medicine, *Committee Hansard*, 11 June 2013, pp. 62–3.

23 Mrs Goldman, Chief Executive Officer, Asthma Foundation New South Wales, *Committee Hansard*, 17 May 2013, p. 44; Mr Hutton, President, Lock the Gate Alliance, *Committee Hansard*, 11 June 2013, p. 52.

24 Mr Hutton, President, Lock the Gate Alliance, *Committee Hansard*, 11 June 2013, p. 55.

25 Ms Bragg, representative, Australian Network of Environmental Defenders Offices, *Committee Hansard*, 11 June 2013, p. 64.

on the size and characteristics of each individual mine.[26] The MCA recognised that buffer zones are a means to reduce direct exposure to particulate matter from coal mining.[27]

4.20 In an apparent recognition of the utility of keeping industrial and residential areas separate, the committee was informed that in the case of Jondaryan, the company's mine continuation plan involves moving the loading facility 'well away from Jondaryan into the heart of the mining leases and well away from any sort of urban or residential areas.'[28]

4.21 In addition to buffer zones, containing stockpiles by either covering or the use of veneers was also identified as a possible engineering solution to manage coal emissions. In response to questions regarding the use of covers of stockpiles at storage facilities, the committee was informed that:

> Over a certain size it just becomes impractical to cover coal stockpiles. As we said, with veneers, these surface veneers are very effective in high-wind conditions. The moisture controls and the veneering together manage to control stockyard dust emissions, which is the major source of dust in the coal terminal.[29]

4.22 It was clarified however that veneer is only useful when a stockpile is not being reclaimed as once the veneer's surface is broken the stack once again becomes a source of dust emissions, and therefore is only used when the stockpile is not being actively reclaimed or stacked.[30]

4.23 In relation to coal dust emissions during transportation, the committee heard that there are a number of ways that coal can be moved from mine, to train, to ship using a number of different technologies. As Dr Smith explained, best-practice loading techniques minimise dust emissions:

> There are best-practice loading techniques for loading coal, and that is typically having an overhead hopper and dropping the coal into the wagons. That is not what is done at Jondaryan. They use dozers and front-end loaders to load the coal. You can imagine that that causes a lot of dust. So those sorts of suggestions seem to be things that would help to alleviate the problem.[31]

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26 Ms Bragg, representative, Australian Network of Environmental Defenders Offices, *Committee Hansard*, 11 June 2013, p. 64.

27 Mr Wagner, Executive Director, Northern Territory Division, Minerals Council of Australia, *Committee Hansard*, 16 April 2013, p. 21.

28 Mr Roche, Chief Executive, Queensland Resources Council, *Committee Hansard*, 11 June 2013, p. 19.

29 Mr Brunner, General Manager – Planning, Hay Point, North Queensland Bulk Ports Corporation, *Committee Hansard*, 11 June 2013, p. 39.

30 Mr Brunner, General Manager – Planning, Hay Point, North Queensland Bulk Ports Corporation, *Committee Hansard*, 11 June 2013, p. 43.

31 Dr Smith, Friends of the Earth, *Committee Hansard*, 11 June 2013, p. 32.

4.24 The committee heard that in other towns such as Wynnum unloading takes place in a shed to limit renegade particles; a practice that reportedly produces better air quality for nearby residents.[32] The committee was also informed of the dust minimisation systems used in the port of Hay Point:

> On rail receival, in the port of Hay Point we use best practice techniques. Rail wagons are unloaded in a building with a roof and two sides. We have dust extinguishment systems in which we collect any dust from the rail dump hoppers and we extract that and contain it. With the in-loading and stockyard conveyors, we have designed the conveyors to minimise dust generation. Transfer sheets are sealed between entry at the head-sheet and exit onto the downstream conveyor. We use belt scrappers and belt washing. Floors under conveyors are sealed for elevating conveyors, draining to the coal collection pit. I could go on, but I suspect there is not much value in me giving you a full range of techniques.
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> …
>
> The wagons in the port of Hay Point are all bottom-dump. The coal is released into hoppers, and that is in a partially enclosed building with dust-extraction systems. The coal is washed or brushed from the wheels of the wagons, but the wagons themselves are not washed before they go back.
>
> …
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> The other thing is that, in recent times—partly for dust and partly for noise attenuation—these particular receival dump station sheds have had those heavy clear PVC-type curtains put around them so that the fit of the train through the aperture into the shed is a lot tighter now than it used to be, to prevent dust emissions and to help with the noise attenuation.[33]

4.25 Some stakeholders suggested that the best way to manage dust from coal trains was through the use of covered wagons.[34] The committee heard that:

> Closing the cabins and enclosing the coaldust seems like a very sensible solution. I do not know why it has not been done…It is just putting a top on the wagons. As they said, when you bring coaldust in it vibrates and, even though you veneer some or all of them, some will still be released. But as you go back again you have empty coal trains with coaldust at the bottom; they do not empty totally. So it just seems to make good sense for them to be covered. I think this is a risk that can be managed.[35]

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32 Dr Smith, Friends of the Earth, *Committee Hansard*, 11 June 2013, p. 32.

33 Mr Brunner, General Manager – Planning, Hay Point, North Queensland Bulk Ports Corporation, *Committee Hansard*, 11 June 2013, pp. 38, 42, .

34 Mr Gordon, Spokesperson, Stop Brisbane Coal Trains, *Committee Hansard*, 11 June 2013, p. 50; Mrs Goldman, Chief Executive Officer, Asthma Foundation New South Wales, *Committee Hansard*, 17 May 2013, p. 44.

35 Dr Jeremijenko, Occupational and Environmental Physician – Australasian Faculty of Occupational and Environmental Medicine, *Committee Hansard*, 11 June 2013, p. 63.

4.26 The Asthma Foundation of NSW posited that as well as being a simple and effective measure, covering coal wagons would reduce the exposure of large populations in the towns and suburbs transited by rail infrastructure; groups whose exposure is not directly offset with employment or other benefits.[36]

4.27 The New South Wales Minerals Council (NSWMC) queried the value of covering wagons, however, stating: 'Research to date suggests that this would be an extremely expensive action that would have little or no effect on dust and air quality near rail lines.'[37] This however appeared to be contradicted by evidence from the Queensland Resources Council (QRC) that said that veneering in central Queensland had significantly reduced dust emissions.[38]

4.28 The QRC provided the committee with an evaluation of the cost-effectiveness of introducing wagon lids commissioned by Queensland Rail Limited. Queensland Rail Limited estimated that the costs to provide and operate lids on all coal wagons in Australia would be approximately $10 per wagon, per day.[39] While the evaluation concludes that it would not be cost effective for Queensland Rail Limited to introduce lids at the current time, the analysis notes that the introduction of covers on coal wagons 'would almost eliminate coal dust emissions from the primary dust source'. Given this, the analysis notes that its assessment of cost effectiveness 'cannot be taken at face value'. The analysis further notes that the scores used to determine cost effectiveness 'are highly dependent upon the operational impact and reliability of the lids, [neither] of which can be accurately estimated without a thorough investigation'.[40]

4.29 The QRC informed the committee that covered wagons used in some international jurisdictions are utilised to protect the cargo from issues such as ice and snow, not to reduce dust emissions.[41] The QRC further claimed that covering wagons was unnecessary, as industry in Queensland had commenced veneering coal wagons to reduce dust:

> Veneering has proved itself worldwide to be the most effective means of suppressing dust from coal wagons. As our submission notes, there is no significant health or amenity benefit from putting lids on wagons, just

36 Mrs Goldman, Chief Executive Officer, Asthma Foundation New South Wales, *Committee Hansard*, 17 May 2013, p. 46.

37 NSW Minerals Council, *Submission 71*, p. 10.

38 Mr Roche, Chief Executive, Queensland Resources Council, *Committee Hansard*, 11 June 2013, p. 12.

39 Queensland Resources Council, answer to question on notice 1 June 2013 (received 26 June 2013), p. 26.

40 Queensland Resources Council, answer to question on notice 1 June 2013 (received 26 June 2013), p. 28.

41 Mr Roche, Chief Executive, Queensland Resources Council, *Committee Hansard*, 11 June 2013, p. 17.

> significant cost implications for everyone on the supply chain from pit to port.[42]
>
> …
>
> Veneering is world-leading dust suppression technology. All Queensland coalmines in Central Queensland and in the Surat Basin have committed to introducing veneering by the end of 2013. In Central Queensland, where the majority of mines are already veneering their coal, the practice has led to dust reductions of up to 90 per cent.[43]

4.30 Similarly NQBP argued strongly in support of the use of veneering to minimise dust from coal trains:

> One of the things that we can take some comfort from is that veneering of coal wagons with polymer veneers to suppress dust from blowing off wagons has been demonstrated to be particularly effective. By the end of this calendar year, all receiving coals to the port of Hay Point will be veneered. That is just one simple measure that has been a continuous improvement that has been applied and that is at the, I guess, sourced, port part of the supply.[44]

4.31 Representatives from NQBP provided evidence to the committee regarding the mechanisms and strategies used to minimise dust emissions while in the stockpile and during transit phases through the use of moisture management and veneers:

> There is a relationship between moisture content and dust generation. We test each one to determine the optimum moisture content and we aim to control the moisture content of that coal right from the mine all the way through to the ship.
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> …
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> Probably the one major control at the port is the fact that in the stockyards at Hay Point we have a dust control system to keep that coal at its optimum moisture content. We have automatic water spray systems. We estimate the evaporation from the coal stockpiles and those spray systems automatically apply water to keep the coal at that optimum moisture content. If the winds get too high and dry it out too fast for the stockyard sprays, the veneer can be applied. Those veneers are very effective. We have had testing done on dust suppression for the coals that indicates that, at certain wind conditions, the veneer gets dust emissions down to zero.[45]

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42 Mr Roche, Chief Executive, Queensland Resources Council, *Committee Hansard*, 11 June 2013, p. 13.

43 Mr Roche, Chief Executive, Queensland Resources Council, *Committee Hansard*, 11 June 2013, p. 12.

44 Mr Stewart-Harris, Deputy Chief Executive Officer, North Queensland Bulk Ports Corporation, *Committee Hansard*, 11 June 2013, p. 38.

45 Mr Brunner, General Manager – Planning, Hay Point, North Queensland Bulk Ports Corporation, *Committee Hansard*, 11 June 2013, pp. 38–39.

4.32 In relation to power generation, the committee heard that there is technology available to reduce the emissions from coal fired power plants that is used in other jurisdictions with tighter emissions standards:

> Here, frequently the sulphur dioxide levels do exceed the 75 parts per million that would be allowed in the US. So yes, that is correct: it frequently exceeds what would be allowed in the United States. And exceedences are not uncommon, or occur on a semi-regular basis, certainly much more so in the past at Anglesea than they do now, and that is because the company has put in place a procedure of actually switching down the power station when the sulphur dioxide levels exceed the accepted level. In fact, sulphur dioxide pollution control measures that can be fitted to power stations exist. Those could be fitted to the Anglesea power station, but the company has chosen instead to implement a protocol whereby the output of the power station is decreased when sulphur dioxide levels exceed the acceptable level.[46]

4.33 The committee also heard that reductions in coal combustion and fossil fuel combustion generally, 'can improve human health directly by reducing chronic disease risks from air pollution as well as indirectly from mitigation of climate change'.[47]

Regulation

4.34 The regulation of coal mines, especially regarding their possible environmental and health impacts, was a significant point of contention in the evidence received by the committee. For the most part, the approval and monitoring of coal mines is a function of State and Territory governments and as such subject to variations between jurisdictions. As a result of this, the committee heard that 'there is also considerable difference in transparency and consistency in the application of air quality controls on different mines within the same state jurisdiction and also between state jurisdictions.'[48]

Approval processes

4.35 Some stakeholders argued that the approval process for new mines did not consider cumulative impacts of additional developments in a single area during the approvals process:

> There are plenty of EISs done on mining projects, and I include especially the coal seam gas projects here in Queensland, where cumulative impacts are not even looked at. When you put this particular project in with a whole lot of other projects, there are no attempts to quantify what that might mean, or, if they do it, they do it in the most offhand manner, as has

46 Dr Redenbach, Representative, Quit Coal, *Committee Hansard*, 17 May 2013, p. 56.

47 Associate Professor Carey, Member – Management Committee, Doctors for the Environment, *Committee Hansard*, 17 May 2013, p. 2.

48 Ms Woods, Senior Climate Campaigner, Greenpeace Australia Pacific, *Committee Hansard*, 11 June 2013, p. 30.

> happened in Gladstone, just simply by saying, 'Gladstone is already over allocated so it does not matter if we do one more.'[49]

4.36 The NSW EPA informed the committee that they had adopted air quality targets in certain air sheds. The emissions from new developments would need to be assessed against that target:

> That was one of the points I was making about the fact that we have now adopted this target level that we are trying to achieve for the Upper Hunter. That is all around new mines that are being proposed, new activities, and what is it that we have to do to achieve that target. So if you think about that target of eight, for PM2.5, for that air shed that is a cumulative impact target that we are talking about.[50]

4.37 The NSW EPA informed the committee that all coalmines have an environmental protection licence that is issued by the EPA which includes conditions covering environmental performance such as dust.[51]

Regulatory approaches

4.38 The committee received evidence that in Queensland companies are responsible for monitoring and managing their dust emissions. Some submitters argued that the system was not effective in controlling air quality:

> [I]n this state we do not have a regulatory model, we have a self-regulatory model. We do not have an EPA or a department of environment and heritage protection, or whatever it is called these days, that actually does audits of mine sites or audits of extractive industry. The companies do all of that. All that the regulator does is gather audits on paper. They do paper audits. They do not do on-site audits. They do not do on-site monitoring. All the regulator does is respond to complaints. So it is a complaint driven regulatory model with self-regulation as the main basis for the whole thing. Basically a company has to put up its hand for a breach, if there is a breach. It is never found out by the regulator itself.[52]

4.39 It was reported that a similar practice is adopted in Victoria where in many places the EPA does not have the resources to monitor industry sources and therefore relies on self-regulation.[53]

4.40 In addition to its general monitoring, the committee was told that, the NSW EPA responds to community complaints regarding the activities from a mine and will

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49 Mr Hutton, President, Lock the Gate Alliance, *Committee Hansard*, 11 June 2013, p. 52.

50 Mr Buffier, Chief Executive Officer, New South Wales Environmental Protection Authority, *Committee Hansard*, 16 April 2013, p. 10.

51 Mr Davey, Director – North Branch, New South Wales Environmental Protection Authority, *Committee Hansard*, 16 April 2013, p. 9.

52 Mr Hutton, President, Lock the Gate Alliance, *Committee Hansard*, 11 June 2013, p. 52.

53 Associate Professor Carey, Member – Management Committee, Doctors for the Environment, *Committee Hansard*, 17 May 2013, p. 4.

investigate further, either via the telephone or in person.[54] Evidence provided by the NSW EPA appears to indicate a more proactive approach to reducing emissions from coalmining in NSW:

> In terms of where our priorities are, the Hunter Valley is clearly one of those…We recognise, along with the community, that impacts of particle pollution on the Hunter region are increasing and likely to increase further in the absence of any action, because of the expansion of the coal mining industry. Last year we established an interagency task force…to work together on managing air quality by improving our planning and enforcement activities.[55]

4.41 Mr Buffier reported to the committee that one of the reasons for the establishment of this taskforce was 2012 data showing an increasing number of exceedences of the $PM_{2.5}$ advisory standards and PM_{10} levels.[56]

4.42 It was reported further that open cut coal mines across New South Wales are subject to particular pollution reduction programs to minimise dust from haul roads, stockpiles, and the operation of machinery which aims to reduce particulate emissions from mines by 20 per cent.[57]

Enforceability

4.43 In order to be enforceable, regulations and permits must be sufficiently explicit and prescriptive in what they require an operator to do, and the standards to which they will be held to account. ANEDO, using the permit for the Jondaryan mine as an example, highlighted that there is no reference to the control of damaging fine particles,[58] and the monitoring of PM_{10} is to be monitored 'at a sensitive place downwind of the operational land', without specifying other factors such as distance from the mine or proximity to residences.[59]

4.44 State government authorities also need to be appropriately resourced in order to properly discharge their duties. The committee heard concerns that recent or

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54 Mr Davey, Director – North Branch, New South Wales Environmental Protection Authority, *Committee Hansard*, 16 April 2013, p. 9.

55 Mr Buffier, Chief Executive Officer, New South Wales Environmental Protection Authority, *Committee Hansard*, 16 April 2013, p. 2.

56 Mr Buffier, Chief Executive Officer, New South Wales Environmental Protection Authority, *Committee Hansard*, 16 April 2013, p. 2.

57 Mr Davey, Director – North Branch, New South Wales Environmental Protection Authority, *Committee Hansard*, 16 April 2013, p. 8; Mr Buffier, Chief Executive Officer, New South Wales Environmental Protection Authority, *Committee Hansard*, 16 April 2013, p. 10.

58 Ms Bragg, representative, Australian Network of Environmental Defenders Offices, *Committee Hansard*, 11 June 2013, p. 52.

59 Permit Number: MIN100550507, tabled by the Queensland Environmental Defenders' Office, 11 June 2013, p. 3.

prospective cuts to regulatory authorities limit the capacity of the public sector to appropriately monitor the private sector.[60]

Appropriate regulations for vulnerable groups

4.45 The committee heard evidence, noted previously in this report, that children are particularly vulnerable to health impacts of poor air quality. An important point was raised by Dr Jeremijenko in relation to this fact:

> The different effect of coal dust on children is quite significant. Their lungs are developing. Coal dust has been shown to have a much greater effect on children's developing lungs, so the standards written for coal workers, even for the PM10s that are measured, are not the same as what would be written for children. We need to consider that because these coal trains are going through the suburbs. It is really important that the children's health is protected as well as the health of adults in the community. I think that has been totally ignored in this situation.[61]

4.46 In order to be effective guardians of community health, regulations must take into account that a standard that is acceptable for one group or locations may need to be more stringent for another, such as children. The committee received evidence that coal trains and stockpiles are often proximate to playgrounds, childcare centres and schools.[62] Measurements undertaken by the Hunter Community Environment Centre, for example, showed elevated levels of pollution in people's homes and gardens compared to official monitoring.[63]

Balancing economic, environmental and health concerns

4.47 Although the committee received a large body of evidence largely critical of some of the current practices of the coal industry broadly, many also believe that coal is an important source of employment and economic activity – especially in smaller communities, but one that needed to be monitored. The Asthma Foundation New South Wales noted for instance:

> I do not think [communities] will want to see extreme measures that are going to reduce economic benefits like employment, but I am sure that responsible measures that would allow the coal industry to continue to do

60 Ms Bragg, representative, Australian Network of Environmental Defenders Offices, *Committee Hansard*, 11 June 2013, p. 59; Associate Professor Carey, Member – Management Committee, Doctors for the Environment, *Committee Hansard*, 17 May 2013, p. 5.

61 Dr Jeremijenko, Occupational and Environmental Physician – Australasian Faculty of Occupational and Environmental Medicine, *Committee Hansard*, 11 June 2013, p. 58.

62 Associate Professor Higginbotham, Committee Member – Dust and Health Committee, Hunter Community Environment Centre, *Committee Hansard*, 16 April 2013, p. 14.

63 Associate Professor Higginbotham, Committee Member – Dust and Health Committee, Hunter Community Environment Centre, *Committee Hansard*, 16 April 2013, pp. 14–15.

> its bit for Australia without causing a great degree of impact on the health of Australian citizens would be very welcome.[64]

4.48 Similarly, Professor Jalaludin commented:

> If you have a large number of small communities, the science would suggest that, yes, in terms of equity they should not be exposed to high levels of air pollution also. Ultimately it might come down to a political decision about the costs of trying to reduce air pollution to such low levels and what might be the benefits of it. If, for example, we are thinking of the Hunter Valley and the coalmines, what are the benefits in terms of employment and so on? That is a difficult decision to make, but I think we should not forget the issue around equity. Is it fair to let one community be exposed to high levels of air pollutants so that the larger population can benefit from that? That is a difficult issue. I do not think there is a right or wrong answer.[65]

Committee view

4.49 The committee accepts that coal, throughout its lifecycle, is a source of air pollution that is harmful to human health. Those harms manifest themselves in individual discomfort and at a cost to private and public purses. Coal is also a part of the Australian economy both as an export earner and a source of cheap electricity. Governments and communities together need to decide what level of pollution they are willing to tolerate. It appears clear, however, that there are some concrete steps that can be taken that would minimise coal pollution and manage the risks associated with it. The committee considers that measures such as the covering of coal wagons are appropriate regulatory steps to take towards minimising the impact of coal emissions on vulnerable communities.

Recommendation 6

4.50 The committee recommends that states and territories require industry to implement covers on all coal wagon fleets.

Recommendation 7

4.51 The committee recommends that the Commonwealth develop and implement a process for assessing cumulative impacts of coal mine developments that take into account other mines in the region and their impact on resident health.

Recommendation 8

4.52 The committee recommends that health impact assessments be required as part of the assessment process for all new developments.

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64 Mrs Goldman, Chief Executive Officer, Asthma Foundation New South Wales, *Committee Hansard*, 17 May 2013, p. 44.

65 Professor Jalaludin, Centre for Air Quality and Health Research and Evaluation, *Committee Hansard*, 16 April 2013, p. 32.

Chapter 5
Diesel and non-road engines

5.1 The impacts of diesel and two-stroke engine emissions on health were a key concern raised throughout this inquiry. Petroleum diesel (diesel) is a fractional distillate of crude oil widely used as fuel in industrial, transport and domestic machinery.

Health impacts of diesel emissions

5.2 The potential negative health impacts of diesel emissions are now well known. The WHO has listed diesel emissions as a Group 1 carcinogen.[1] The International Agency for Research on Cancer (IARC), a WHO body that coordinates and conducts research on the causes of human cancer, reclassified diesel engine exhaust as a Group 1 carcinogen based on extensive evidence that exposure is associated with increased risk of lung cancer.[2] The committee heard from the ILAQH that '[diesel] is not a likely cause – it is a cause of cancer.'[3]

5.3 Diesel exhausts release benzene, sulphur dioxide, carbon monoxide, nitrogen dioxide, polycyclic aromatic hydrocarbons and particulate matter, all of which have known adverse health effects.[4]

Occupational Health and Safety

5.4 Evidence received by the committee pointed towards a potential shortfall in regulating exposure to diesel emissions in an occupational health and safety context. The AMA noted for instance:

> Occupational and workplace standards for hazardous air pollution are inconsistent and poorly enforced and major sources of hazardous air pollutants are not currently regulated, as indicated by the lack of standards for off-road diesel engines.[5]

5.5 Dr Adrian Barnett provided evidence to the committee that certain groups such as miners and workers at drive-through businesses may be exposed to unsafe levels of diesel emissions.[6] Unfortunately there have not been sufficient studies

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1 Dr Hambleton, President, Australian Medical Association, *Committee Hansard*, 16 April 2013, p. 41.

2 International Agency for Research on Cancer, *IARC: Diesel Engine Exhaust Carcinogen*, press release no. 213, 12 June 2012.

3 Professor Ristovski, International Laboratory for Air Quality and Health, *Committee Hansard*, 11 June 2013, p. 5.

4 Dr Adrian Barnett, *Submission 92*, p. 2.

5 Dr Hambleton, President, Australian Medical Association, *Committee Hansard*, 16 April 2013, p. 41.

6 Dr Adrian Barnett, *Submission 92*, p. 2.

undertaken to adequately assess the impacts of emissions on these workers who are often more vulnerable due to being adolescents with developing respiratory systems, and to date industry has not been willing to work with researchers to better assess whether a problem exists.[7]

Recommendation 9

5.6 The committee recommends that Safe Work Australia undertake research regarding the exposure of workers in the hospitality, transport and mining industry to diesel emissions.

On-road diesel vehicles

5.7 On-road diesel vehicles have become increasingly popular in recent years as the price of petrol has risen and consumers have sought products with potentially lower recurrent running costs. Since 2006 the proportion of diesel vehicles in the national fleet has increased from 10.6 per cent to 14.7 per cent. Passenger vehicles and light commercial vehicles were the major contributors to this increase.[8]

5.8 The efficiency of these diesel vehicles is regulated by the Australian Design Rules (ADR). ADR 30 stipulates that new vehicles produced on or after 1 January 2002 adhere to the United Nations Economic Commission for Europe Regulation No. 24.[9] It was reported to the committee that despite emission controls on vehicles, they remain a source of dangerous particulate matter:

> A major source of particle in Australia are vehicle exhausts. Particles are created by both diesel and petrol engines, and the constituents of vehicle exhaust particles are particularly damaging to health as they often contain metals and sulfates. Filters on modern vehicles stop some particles escaping, but the filters mainly stop larger particles and the smaller particles – which are potentially more damaging to health – still escape in large numbers.[10]

5.9 It was reported to the committee that motor vehicles – particularly diesel powered – are the largest single contributor to UFP in the urban areas.[11] Studies assessing UFP emissions in Los Angeles and Barcelona found that on-road vehicles are responsible for 43 per cent and between 54 and 86 per cent of UFP emissions respectively.[12] Modelling from urban southeast Queensland showed that although

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7 Dr Adrian Barnett, Queensland University of Technology, *Committee Hansard,* 11 June 2013, pp. 5–6.

8 Western Australian Government, *Submission 155,* p. 2.

9 Vehicle Standard (Australian Design Rule 30/01 – Smoke Emission Control for Diesel Vehicles) 2006.

10 Dr Adrian Barnett, *Submission 92*, p. 2.

11 Centre for Air quality and health Research and evaluation, *Submission 29*, p. 3.

12 Frampton M, Brauer M, Kleeman M, Kreyling W, Ntziarchristos L, Sarnat S. *Understanding the health effects of ambient ultrafine particles*. Boston, MA: Health Effects Institute, 2013, pp. 14 – 21.

diesel engines comprise around 6 per cent of vehicle kilometres travelled, they accounted for more than 50 per cent of daily particle emissions.[13] The committee heard that although significant progress had been made in regulating emissions from vehicles, there are still significant public health gains to be realised through further emission reductions.[14]

5.10 The NSW EPA reported to the committee that 'retrofitting existing diesel vehicles with exhaust treatment devices is a cost-effective strategy to reduce air pollution emissions', and reported that they are currently working to with private enterprise and other stakeholders to retrofit fleet vehicles.[15]

5.11 The committee understands that soon-to-be-released modelling undertaken by the Victorian EPA and the CSIRO indicate that in Victoria particle emissions from on-road diesel engines will be 'significantly reduced' by 2030.[16]

5.12 The committee heard a suggestion, based on international experience, to introduce anti-idling laws:

> In the US and Massachusetts, they have laws such as you are not allowed to keep your engine running for more than five minutes and then there are some restrictions, if you are a courier and things like that going in and out of buildings. Again, it is a very simple thing. I pass a school everyday and you see the school buses with the engines on and all the kids next to it. Those are some of our most vulnerable people standing right next to a source that we could just simply turn off. Anti-idling laws are worth investigating. You might not have to do it for long. If you look at utes these days, every single one of them now has a netting over the back. This time last year none of them did. They said, 'You have to put netting now on your ute and we are going to give out fines if you do not,' and now all the utes have them. So, potentially, if there was an anti-idling law, you would hand out a couple of fines and then it would become the norm for people to switch off their engine.[17]

Off-road and industrial diesel engines

5.13 Diesel fuel is widely used for fuel for large machinery such as mining equipment. There are currently no emissions standards for the off-road diesel sector.[18]

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13 Frampton M, Brauer M, Kleeman M, Kreyling W, Ntziarchristos L, Sarnat S. *Understanding the health effects of ambient ultrafine particles*. Boston, MA: Health Effects Institute, 2013, pp. 17 – 18.

14 NSW EPA, *Submission 80*, p. 34.

15 NSW EPA, *Submission 80*, p. 35.

16 Victoria EPA, *Submission 110*, p. 7.

17 Dr Adrian Barnett, Queensland University of Technology, *Committee Hansard*, 11 June 2013, p. 6.

18 Ms Crotty, Manager – Air Policy, New South Wales Environmental Protection Authority, *Committee Hansard*, 16 April 2013, p. 10.

5.14 In 2010 the Cleaner Non-road Diesel Engine Project – Identification and Recommendation of Measures to Support the Uptake of Cleaner Non-road Diesel Engines in Australia – Final Report (ENVIRON Report) was released. Prepared by international environmental consulting firm ENVIRON Australia on behalf of the NSW Department of Environment, Climate Change and Water and the Commonwealth Department of the Environment, Water, Heritage and the Arts, the ENVIRON Report included a number of key findings including:

- Diesel engines are not manufactured locally but are imported into Australia either as standalone units or as a component of equipment. In 2008 about 74 000 non-road diesel engines/equipment were imported into Australia;
- The non-road diesel sector (excluding rail and marine transport) consumes a similar volume of automotive diesel oil as the on-road diesel vehicle sector;
- Nationally, non-road diesel engines are estimated to emit around 13 500 tonnes of PM_{10} per annum; a similar magnitude to emissions from the on-road vehicle sector;
- In Australia there are no regulations or standards in place that limit emissions from non-road diesel engines. Regulated emission limits for non-road engines have been in force in the US and EU since the mid-1990s. China, India, Japan and Canada also have regulated emissions limits for non-road engines;
- When emission profiles of new non-road diesel engines sold in Australia was assessed against US and EU standards, it was found that Australian machinery was behind emission limits apply to comparable non-road engines sold in those jurisdictions;
- Only five per cent of engines were reported by industry as meeting the 2008 US standards;
- PM_{10} emission reductions achievable through compliance with latest US standards are estimated to be between 5600 and 10 200 tonnes per annum to 2020, increasing to 7300 to 14 100 tonnes per annum but 2030; and
- Annual environmental health benefits associated with PM_{10} and NO_X emission reductions are estimated to be in the range $2.5 to $4.7 billion (2008 AUD) by 2030.[19]

5.15 Diesel emissions are created through a number of various sources such as mining, transport and recreation; these and others are discussed below.

19 ENVIRON Australia Pty Ltd., Cleaner Non-road Diesel Engine Project – Identification and Recommendation of Measures to Support the Uptake of Cleaner Non-road Diesel Engines in Australia – Final Report, April 2010, pp. 8–9.

Mining

5.16 The committee heard that the emissions from diesel engines, particularly in mines, can contribute significantly to poor air quality with approximately one litre of diesel fuel used per tonne of coal produced.[20] The NSW EPA reported to the committee that in the Upper Hunter region non-road diesel equipment is responsible for 13.2 per cent of $PM_{2.5}$ and 3.1 per cent of PM_{10}.[21]

5.17 The committee was assured by the NSWMC that they are working with regulatory bodies to better understand and minimise mining related diesel emissions:

> The New South Wales Minerals Council and the mining industry are fully cooperating with the EPA to better understand PM2.5 emissions from diesel. The industry, through the Australian Coal Association Research Program—which is a well-established research program—is also commissioning pieces of work to invest in technologies that reduce emissions from diesel equipment on site.[22]

5.18 Professor Ristovski from the ILAQH explained some of the technical difficulties in limiting emissions from subterranean diesel powered coalmining equipment:

> There is a standard but the biggest problem with coalmines is that all the machines used there have to be explosion proof. And to make a machine explosion proof you cannot use the latest technology and the newest diesel engines. There are certain technical issues with them. So, essentially, the standards that the engines have to comply with are much behind – several generations behind – the standards that the above-ground engines comply with. In simple words, they are much dirtier than engines that would be allowed on the streets.[23]

5.19 The NSW EPA is currently assessing ways to reduce emissions from non-road vehicles and equipment at coal mines, and that:

> If warranted, it is proposed that coal mines will be required, via [Pollution Reduction Programs] attached to their environment protection licences, to take feasible measures to reduce diesel emissions.[24]

Trains

5.20 Diesel trains are extensively used in the transportation of goods from the site of their production to ports which tend to be in heavily populated areas such as

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20 Mr Krey, Member, Hunter Valley Protection Alliance, *Committee Hansard*, 16 April 2013, p. 12.

21 NSW EPA, *Submission 80*, p. 15.

22 Ms Brown, Policy Manager – Environment and Health, New South Wales Minerals Council, *Committee Hansard*, 16 April 2013, p. 12.

23 Professor Ristovski, International Laboratory for Air Quality and Health, *Committee Hansard*, 11 June 2013, p. 4.

24 NSW EPA, *Submission 80*, p. 30.

Brisbane and Newcastle. For historical reasons, train lines also tend to pass through smaller regional communities.

5.21 The committee heard concerns from resident groups about the health impacts of particulate emissions from diesel trains moving through communities. Newcastle's Professor Higginbotham reported:

> When we learned that the coal industry was aspiring to transport up to 330,000,000 tonnes into the Port of Newcastle, we became gravely concerned that this would bring industrial workplace emissions into the homes and schools along the rail corridor. As James mentioned, there are 32,000 residents who live within half a kilometre of the rail line from the port up to Rutherford. In fact, there are 23,000 schoolchildren who also attend school within this zone...What would be the fine particulate and diesel emissions from the 108,000 yearly train movements needed to get this amount of coal into ships?[25]

5.22 Dr Jeremijenko of the Australasian Faculty of Occupational and Environmental Medicine suggested to the committee that diesel trains could be replaced by electric locomotives in heavily built up areas to prevent diesel emissions.[26]

Marine engines, recreational diesel engines and appliances

5.23 Diesel engines are widely used in recreational engines, small power generators, and domestic appliances such as lawn mowers. These engines are not subject to any standards and emit a disproportionately large quantity of emissions compared to their size. For example, despite their small size, a lack of emissions standards means that an Australian lawnmower may emit up to 40 times the pollution of a small car per hour.[27] Although the contribution of any one source may seem minor, when scaled nationally the emissions from unregulated outboard engines are significant as highlighted by the Australian Marine Engine Council (AMEC):

> Outboard engines currently push out unnecessary pollutants directly into the waters of the Great Barrier Reef, our creeks, our rivers and our drinking water supplies—and then it bubbles into the atmosphere. The department's own cost-benefit analysis shows that regulations on outboards would save the environment more than 30,000 tonnes of hydrocarbons alone. The senators from Queensland will remember the Pacific Adventurer oil spill in Moreton Bay, which was 250 tonnes. In other words, what comes out of outboards is equivalent to a Pacific Adventurer oil spill every three days. Atmospheric pollutants will also be cut. Emissions standards will mean

25 Associate Professor Higginbotham, Member – Dust and Health Committee, Hunter Community Environment Centre, *Committee Hansard*, 16 April 2013, p. 14.

26 Dr Jeremijenko, Occupational and Environmental Physician – Australasian Faculty of Occupational and Environmental Medicine, *Committee Hansard*, 11 June 2013, p. 61.

27 Mr Fooks, Committee Member, Australian Marine Engine Council, *Committee Hansard*, 17 May 2013, p. 27.

> 40,000 tonnes less carbon dioxide, less carbon smog, from the hydrocarbons bubbling up from the exhaust.[28]

5.24 It was reported to the committee that there are no technological impediments to introducing tighter emissions as:

> The clean products are on the shelf, they are being sold now. They are 50 per cent of the market. The products are on the shelves, they are in the brochures, the mechanics are trained, the spare parts are here–[29]

5.25 The committee heard that regulating small engine emissions is a 'low-hanging fruit' when it comes to improving air quality as there is support from industry and the public for better, more stringent regulation.[30] It was argued by AMEC that there has not been regulation of small diesel engines because 'there has been no political will to push it'.[31] As a result of this lack of political impetus, the committee heard that:

> Bureaucrats have taken it from an easy-to-finish project to a national plan for clean air, which will take until 2020 at least to make a difference.[32]

5.26 It was suggested by AMEC that Australia should move immediately to the current United States' standard for small diesel engines as those engines already exist, are readily available, and represent the world's toughest standard.[33]

Regulating off-road diesel emissions

5.27 The AMA argued that in response to this finding by the WHO it is necessary to focus on introducing standards for off-road diesel emissions.[34]

5.28 It was recognised by the NEPC that Australia lags behind international competitors when it comes to regulating harmful emissions from off-road diesel sources. As noted by the NEPC:

> Regulated emissions limits for [non-road diesel engines] have been enforced in the US and EU since the mid-1990s, and more recently in Canada, Japan, China and India.[35]

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28 Mr Fooks, Committee Member, Australian Marine Engine Council, *Committee Hansard*, 17 May 2013, p. 27.

29 Mr Fooks, Committee Member, Australian Marine Engine Council, *Committee Hansard*, 17 May 2013, p. 29.

30 Mr Fooks, Committee Member, Australian Marine Engine Council, *Committee Hansard*, 17 May 2013, p. 27.

31 Mr Fooks, Committee Member, Australian Marine Engine Council, *Committee Hansard*, 17 May 2013, p. 28.

32 Mr Fooks, Committee Member, Australian Marine Engine Council, *Committee Hansard*, 17 May 2013, p. 28.

33 Mr Fooks, Committee Member, Australian Marine Engine Council, *Committee Hansard*, 17 May 2013, p. 31.

34 Dr Hambleton, President, Australian Medical Association, *Committee Hansard*, 16 April 2013, p. 42.

5.29 The NSW EPA highlighted non-road diesel engines and small spark ignition engines (outboard motors and gardening equipment) as significant emitters that should be addressed under the NPCA.[36] The committee heard that the NSW EPA supports the develop of standards for new diesel equipment:

> As part of the national process that is going on for the National Plan for Clean Air, we are very keen to see the development of standards for new diesel equipment.[37]

Committee View

5.30 The evidence appears to be incontrovertible that diesel emissions are harmful to human health and should be minimised as far as possible through regulation. In a number of sectors the technology already exists to radically improve emission profiles from diesel engines. While the committee accepts that in specific cases such as underground coal mining there are genuine impediments to using more efficient diesel technology, on the whole the committee is of the view that off-road and small engine diesel emissions should be regulated.

Recommendation 10

5.31 The committee recommends that the Commonwealth develop a national emissions standard for diesel engines.

Recommendation 11

5.32 The committee recommends that the Commonwealth implement a national emissions standard for small non-road engines equivalent to the US EPA standards.

35 National Environmental Protection Council, *Diesel*, available from: http://www.nepc.gov.au/taxonomy/term/95 (accessed: 17 April 2013).

36 NSW EPA, *Submission 80*, p. 37.

37 Ms Crotty, Manager – Air Policy, New South Wales Environmental Protection Authority, *Committee Hansard*, 16 April 2013, p. 10.

Chapter 6
Wood smoke

6.1 Emissions from domestic solid-fuel heating, commonly known as wood-fire heaters, were a key issue raised during the course of this inquiry. The committee was informed that planned burning and bushfires are also responsible for large releases of particulates which may be harmful to health.[1] Some submissions called for the emissions from hazard reduction, forestry and agricultural practices to be regulated within the same regulatory regime as other particulate sources.[2] Evidence around air pollution resulting from wood smoke, however, primarily concerned the use of wood-fire heaters in urban areas.

6.2 The Australian Bureau of Statistics (ABS) reports that one in ten households nationally use wood as the main source of energy for heating. Wood is more commonly used by households outside capital cities (19 per cent) compared with capital cities (5 per cent).[3] It was furthermore reported to the committee that emissions from wood heaters have continued to rise at the same time that more stringent regulations on motor vehicles and industry have continued to improve air quality.[4]

6.3 Several Australian governments highlighted wood smoke emissions as a key source of poor air quality. The ACT Environment and Sustainable Department also noted that '[wood smoke] is the largest source of particulate pollution in Canberra.'[5] Similarly, it was reported to the committee by the NSW EPA that:

> Wood smoke is a major source of winter particle pollution in Sydney and some regional NSW towns. On a winter weekend day in Sydney, the contribution of wood heaters to PM10 and PM2.5 particle pollution can be as high as 48% and 60%, respectively. Figures for colder climates, such as Armidale, are higher.[6]

6.4 The Asthma Foundation NSW provided a comparative health example of the impact of wood smoke pollution:

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1 Centre for Air Quality and Health Research and Evaluation, *Submission 29*, p. 6.

2 Centre for Air Quality and Health Research and Evaluation, *Submission 29*, p. 6.

3 Australian bureau of Statistics, *Environmental Issues: Energy Use and Environment*, March 2011, available from: http://www.abs.gov.au/ausstats/abs@.nsf/Latestproducts/4602.0.55.001Main%20Features5Mar%202011?opendocument&tabname=Summary&prodno=4602.0.55.001&issue=Mar%202011&num=&view= (4 June 2013).

4 Australian Air Quality Group, *Submission 94*, p. 2.

5 ACT Environment and Sustainable Department, *Submission 30*, p. 2.

6 NSW EPA, *Submission 80*, p. 33.

> The CSIRO estimates that the average new 4g wood heater actually emits about 10 grams of particles per kg of wood, therefore, an evening's heating (10kg fire wood) emits 100 grams of particles – more than smoke from 5 000 cigarettes. Per year, the average new wood heater in colder regions such as Armidale or Canberra emits more particle pollution than in the smoke of *1.85 million* cigarettes.[7]

6.5 The Asthma Foundation NSW also compared the emission standards of vehicles compared to those applicable to wood heaters:

> The Euro 5/6 regulations are so strict, and those for wood heaters so lax, that the average new wood heater in colder areas of NSW emit as much PM2.5 pollution as 370 new diesel SUV each travelling 20,000km per year.[8]

6.6 An area's topography and other natural features appear to strongly influence the nuisance of wood smoke. For example, Sydney's Camden Council reported that:

> During winter, the key factors contributing to the concentration of emissions in the south-west are exacerbated by temperature inversions and calm wind conditions. Temperature inversions which trap pollutants close to the ground surface and the calm wind conditions inhibit the dispersal of pollutants.[9]

6.7 Despite the relatively low numbers of wood heaters in use, it was argued to the committee that they are responsible for a large amount of air pollution in some metropolitan areas. For example, the Tuggeranong Community Council stated that:

> In Canberra, and in many other towns and cities across Australia, we have a very small number of households responsible for the majority of our air pollution. In winter particle pollution increases threefold in Canberra.[10]

6.8 It was suggested by the Asthma Foundation of NSW that during winter wood heaters account for up to 85 per cent of particulate matter in Armidale.[11] The NSW EPA similarly reported:

> The use of solid-fuel heaters during winter can be a significant source of fine particle emissions throughout NSW. PM10 data shows that exceedences in the Sydney region, especially during autumn and winter, tend to be strongly local events confined to a few sites, rather than widespread.[12]

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7 Asthma Foundation NSW, *Submission 50,* p. 22.

8 Asthma Foundation NSW, *Submission 50,* p.21.

9 Camden Council, *Submission 143,* p. 1.

10 Tuggeranong Community Council, *Submission 3,* p. 1.

11 Asthma Foundation NSW, *Submission 50,* p.20.

12 NSW EPA, *Submission 80,* p. 15.

6.9 The Department of Sustainability, Environment, Water, Population and Communities also recognised that 'In winter, wood smoke from domestic heating contributes a significant amount of particulate pollution in some regions.'[13]

6.10 The industry peak body – the Australian Home Heating Association (AHHA) – stated that:

> As an industry we recognise the poor operation of wood heating appliances can contribute to air quality concerns within certain areas of Australia, particularly those that sit within valleys and often experience inversion layers which traps and holds fine particles close to the ground.[14]

6.11 For most homes with wood heaters in cities and towns there are viable, less polluting alternatives. For the majority of homes with wood heaters however, the reasons given for their use are the high cost of electricity, a lack of alternatives, and because of the ambiance of wood heaters.[15] The Armidale Dumaresq Council provided evidence that alternatives need to be available that address the appeal of wood heating for many – namely cost:

> [The] Council believes that at the heart of this problem and its resolution is the ability for communities in cold climate areas such as Armidale to have access to more environmentally sustainable heating media. Not only should the appliances and their fuel be affordable for all households, the systems offered should be capable of operating in a less polluting fashion in relation to both indoor and outdoor air quality, while being based on a sustainable energy source.[16]

Costs of action and inaction

6.12 The NSW EPA reported that the additional health costs attributable to the impact of wood smoke by 2030 could be up to $8 billion in NSW alone.[17] In addition to the economic costs associated with wood smoke there are the impacts on individuals to consider. The Armidale Dumaresq Council explained:

> Short-term exposure (over hours or days) to high levels of wood smoke may cause eye and respiratory tract irritation, aggravate asthma or worsen heart disease, while long term exposure to particulate matter can decrease lung function like angina and chronic bronchitis. All these can lead to increase dependency on medication and potential hospitalisation and shorten life expectancy.[18]

6.13 Research conducted by Sinclair Knight Merz on behalf of the NSW Department of Environment, Climate Change and Water using cost curves to rate cost

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13 SEWPaC, *Submission 82*, p. 6.

14 Australian Home Heating Association, *Submission 20*, p. 1.

15 Cleanairtas, *Submission 81*, p. [12].

16 Armidale Dumaresq Council, *Submission 158*, p. 5.

17 NSW EPA, *Submission 80*, p. 34.

18 Armidale Dumaresq Council, *Submission 158*, p. 3.

effective emission reduction actions found that the regulating new wood heaters is the most cost effective (per tonne of emissions reduced) means to reduce air pollution in that State.[19] In relation to Sydney, the report found that improving wood heater pollution standards to 1g/kg would represent 1 per cent of the cost of meeting the air quality targets of the NEPM, while representing 66 per cent of the necessary abatement in PM10 levels.[20] To summarise in the words of the NSW EPA: 'national standards for wood heaters would bring about the largest emission reductions for PM10 in Sydney at the least cost.'[21]

6.14 Evidence from Tasmania shows that reducing the pollution from wood heaters results in tangible health benefits. Following Launceston's $2 million wood smoke reduction program it was reported that between 2001 and 2004 the number of households that used wood-burning stoves fell from 66 to 30 per cent, and wintertime particulate pollution reduced by 40 per cent. This appears to have correlated with a reduction in all-cause mortality and associated costs.[22]

Regulation

6.15 Emissions caused by wood heaters are currently the subject of various Australian Standards, in particular AS/NZS 4013 – *Domestic Sold Fuel Appliances – Method of determination of flue gas emissions* which was introduced in 1999. Standards Australia is the peak non-government standards organisation. Standards developed are called Australian Standards and are not binding documents. Governments may however choose to apply a relevant standard through their own legislation.[23]

6.16 Each Standard is developed through the work of a technical committee, which 'is a balanced and representative group of specific users, industry, government, community and other interested parties'.[24] The process followed includes the establishment of a committee, the release of a draft for public comment, consideration of revisions, and ultimately a ballot of the committee.[25] The balloting aims at consensus, and thus the rules governing adopt of a new standard are:

a) A minimum of 67% of those eligible to vote have voted affirmatively; and

b) A minimum of 80% of votes received are affirmative; and

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19 NSW EPA, *Submission 80*, p. 38.

20 Sinclair Knight Merz, *Cost Abatement Curves for Air Emission Reduction Actions*, 28 May 2010, p. 63, available from: http://www.environment.nsw.gov.au/resources/air/CostCurveAirEmissionRedn.pdf (4 June 2013).

21 NSW EPA, *Submission 80*, p. 40.

22 Australian Air Quality Group, *Submission 94*, p. 4.

23 SEWPaC, *Supplementary Submission*, p 3.

24 Standards Australia, *Submission 162*, p. 2.

25 Standards Australia, *Submission 162*, p. 2.

c) No major interest involved with the subject of the Standard has collectively maintained a negative vote.[26]

6.17 The key standard for wood heaters is a maximum flue gas emission in a controlled test of 4 grams of particulate matter per kilogram burned (4g/kg). Appliances sold on the Australian market must in turn display a compliance plate indicating that the device has met the 4g/kg emissions standard in testing.[27] There is currently no efficiency requirement in the AS/NZS 4013.[28] However, to comply with AS/NZS 4012 the efficiency result must be reported on a label permanently attached to the appliance.[29]

6.18 The stipulated standards are only relevant however, if they are enforced. The AHHA queried whether this was currently the case:

> Any certification scheme is effective only to the extent that it is legally enforced. This is clearly a major opportunity for improvement. The AHHA has been concerned for some time at the lack of regulatory enforcement of the current woodheating certification scheme. There are several documented cases where we have notified the state EPA of woodheaters for sale that have either not been certified or which substantially differ from their certified design. In each case we either do not receive a reply, or are told there simply isn't the resource to investigate and follow up.[30]

6.19 As well as regulating wood heaters at the point of sale, there is a significant difference between laboratory testing and real-world application. The standards applied to wood heaters are tested in a laboratory, but these are rarely reproduced once a unit it installed. As explained by the Asthma Foundation NSW:

> A significant reduction in particle emission level is required to produce a sizeable reduction in air pollution because with the operation of domestic fires you have to consider 'real life emissions' not laboratory emissions, which are often much higher as many wood stoves are not being operated correctly, not using the correct wood and have not been cleaned for some time.[31]

6.20 The AECOM report Economic Appraisal of Wood Smoke Control Measures reported that:

> Tests conducted for the Australian Department of Environment and Heritage concluded that the increase in the emission factor when in-service was approximately 2.5 times the certified level of grams per kilogram of fuel. This figure accounts for the operation of wood heaters outside testing

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26 Standards Australia, *Submission 162*, p. 3.

27 Armidale Dumaresq Council, *Submission 158*, p. 4.

28 Australian Home Heating Association, *Submission 20*, p. 7.

29 SEWPaC, *Supplementary Submission*, p 3.

30 Australian Home Heating Association, *Submission 20*, pp. 6–7.

31 Asthma Foundation NSW, *Submission 50*, p. 22.

> parameters and the fact that wood heater owners do not generally operate the wood heater in an optimal manner.[32]

Regulating emissions

6.21 Individual States and Territories have the responsibility of monitoring and regulating emissions from wood heaters, a power often delegated to local councils. In NSW for example, the committee was informed that:

> Under the [*Protection of the Environment Operations Act 1997*] councils have the power where they are the appropriate regulatory authority to issue prevention notices to prevent pollution and specific powers to issue prevention notices and smoke abatement notices against people creating excessive smoke from wood heaters.[33]

6.22 Across Australia a number of States and Territories and local governments have taken measures to minimise and manage wood smoke from domestic heaters. In NSW the government has announced in excess of $1 million dollars' worth of grants available to NSW councils for wood smoke reduction programs in the winters of 2013 and 2014. Programs include education initiatives, local enforcement programs and targeted rebates to remove old heaters.[34] The ACT government reported a number of measures to address to issue of wood smoke:

> This involves public education and enforcement activities, the licensing of firewood merchants, implementation of the 'Don't Burn Tonight Campaign' and the on-going implementation of the Wood Heater Replacement Program.[35]

6.23 The committee also heard that the ACT government 'supports the prohibition on wood heaters in new development areas where planning studies show that they would have an adverse impact on air quality.'[36] Prohibitions have already been introduced in a number of new developments around Canberra.[37]

6.24 The committee heard that the Armidale Dumaresq Council has implemented more stringent standards for wood heaters within the Council's jurisdiction:

> Since 2010 we have introduced a Local Approvals Policy under the NSW Local Government Act 1993 which requires wood heaters installed in new homes in our urban area to have an AS 4013 tested emission rating of 2.5g/kg and 3g/kg for all other homes…We are currently exhibiting an

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32 AECOM, *Economic Appraisal of Wood Smoke Control Measures – Final Report*, June 2011, p. 19.

33 NSW EPA, *Submission 80*, p. 33.

34 NSW EPA, *Submission 80*, p. 34.

35 ACT Environment and Sustainable Department, *Submission 30*, p. 2.

36 ACT Environment and Sustainable Department, *Submission 30*, p. 2.

37 ACT Environment and Sustainable Department, *Submission 30*, p. 2.

> amendment to this Policy which would extend the 2.5g maximum test emissions requirement to all urban wood heater installations.[38]

6.25 The committee received evidence that the Camden Council:

> [R]esolved on 21 July 2012 to only allow the installation of wood heaters that have a maximum emissions rate of 1g/kg of fuel burnt and a minimum efficiency rate of 65%. These criteria are a significantly higher standard than the 4g/kg and no minimum efficiency that is currently in place in NSW.[39]

6.26 The AHHA reported that of the 300 wood heater models currently available to the public, only four imported models would comply with the standards imposed by the Camden Council.[40]

6.27 The AHHA called for a nationally consistent approach to regulating wood heaters:

> The AHHA would like to see a nationally consistent level of emission requirements, rather than break-away councils requiring individual emission levels in specific areas.[41]

Attempts at strengthening national standards

6.28 There was a lot of discussion during the inquiry regarding the process for tightening wood smoke regulation, particularly through a stricter Australian Standard. The committee sought information from Standards Australia as well as from witnesses regarding the process and current proposals.

6.29 Australian Standards in relation to wood heaters began with a standard from the early 1990s, which was then revised and issued as a joint Australia-New Zealand standard on the measurement of flue emissions, promulgated in 1999 and designated *AS/NZS 4013:1999 Domestic solid fuel burning appliances – Method for determination of flue gas emission*.[42]

6.30 A process of revision of the standard by a technical committee (referred to as CS–062) began in 2003. This resulted in the release of a succession of drafts for comment, in November 2003, December 2004 and again in October 2006.[43] Despite these extensive discussions, the results of a ballot of committee members indicated there was not consensus on the proposal. Following further discussion, consensus was still not reached and the project was 'placed in abeyance' as a result.[44]

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38 Armidale Dumaresq Council, *Submission 158*, p. 4.

39 Camden Council, *Submission 143*, p. 2.

40 Australian Home Heating Association, Submission 20, p. 8.

41 Australian Home Heating Association, Submission 20, p. 8.

42 Standards Australia, *Submission 162*, p. 4.

43 Standards Australia, *Submission 162*, p. 4.

44 Standards Australia, *Submission 162*, p. 5.

6.31 Based on the minutes of the Standards Australia committee tabled by the AHHA, it appears that the committee agreed to a reduction in the proposed emission standard to 3g/kg but did not minute any action items. Industry representatives on the committee were given two weeks to consult with their membership about a further reduction of the emission limit to 2g/kg, and report back to the committee within two weeks.[45]

6.32 What transpired following this meeting was subject to conflicting evidence provided to the committee. The Department reported that 'the process stalled in 2007 and no action was taken on revising these Australian Standards at that time'.[46] The Australian Air Quality Group (AAQG) argued that:

> The Australian wood heating industry vetoed recommendations that were approved 15 votes to four by the Standards Australia committee to halve the emissions limit and put health warnings on wood heaters.[47]

6.33 This claim was strongly disputed by the AHHA who argued that no decision had actually been taken by the Standards committee, and that during its two week consultation window the Standards committee and its associated projects were suspended in a Standards Australia reshuffle:

> I am on the standards committee...During that committee, the discussion was had by all committee members that there would be a reduction in the emission level for solid fuel heating appliances. I represent the industry as a whole, and during that discussion I requested that I go back to manufacturers and discuss this with them, and then respond to the committee within a two-week period. That is in the minutes that are recorded there that I have handed up to [the secretariat]. During that two-week period, I had gone back to the industry and there was discussion, but in the meantime Standards Australia had a major reshuffle, and all our projects on the committee were shelved. The committee was basically made defunct. There was nothing I could do about that.[48]

6.34 The committee received evidence from the Australian Air Quality Group in the form of an email dated 24 April 2007 that appears to indicate that Standards Australia tabulated the position of committee members regarding reducing the emissions standard to 2g/kg. Two of the four manufacturing representatives were recorded as being opposed to the measure and it did not proceed further, as this violated the requirement that consensus include no 'major interest' maintaining its opposition.[49]

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45 Minutes of Standards Australia Solid Fuel Burning Appliances Committee – 15/16 March 2007, tabled by the Australian Home Heating Association, 17 May 2013, p. 3.

46 SEWPaC, *Supplementary Submission*, p 3.

47 Dr Robinson, Australian Air Quality Group, *Committee Hansard*, 17 May 2013, p. 10.

48 Mrs Brown, Australian Home Heating Association, *Committee Hansard*, 17 May 2013, p. 21.

49 Additional information provided by the Australian Air Quality Group, received p. 1.

6.35 Having reviewed the evidence from Standards Australia it appears clear that the process did not halt as a result of changes within Standards Australia: it was the result of a failure of the technical committee to reach consensus within the meaning of Standards Australia's rules, which according to the minutes supplied to the committee was a result of opposition from industry representatives.

Suggested standards

6.36 The Asthma Foundation recommended that the particle emission level per kilogram of dry wood burnt be reduced from the current 4g/kg to 1g/kg in order to bring Australia into alignment with international standards.[50] Cleanairtas argued that in urban areas a 2g/kg limit, at a minimum, was required.[51]

6.37 The appropriateness of the international standard cited by the Asthma Foundation of 1g/kg was questioned by the AHHA noting the differences in fuel used in Australia (hardwood), and also arguing that emission standards need to be read in conjunction with efficiency standards.[52]

6.38 The AHHA informed the committee that industry was currently advocating for tighter emissions standards for their products:

> As the peak body which represents the Solid Fuel Heating industry, we have put forward a proposal to Standards Australia to have the National Standard for wood heating appliances changed from 4g/kg of particulate matter per kilo of wood burnt to reduce this down to 2.5g/kg…Should the government departments represented on the [Standards Committee][53] agree to these recommended changes, the emission level will reduce from the current National Standard of 4g/kg to 2.5g/kg with an efficiency requirement of 55% enforced by May 2015 and then further reduced to 1.5g/kg and 60% by 2019.[54]

6.39 Standards Australia advised that a new proposal to revise the standard was received in September 2011; the project formally commenced in May 2012, and that a draft standard is expected to be released for comment around October 2013.[55]

Committee view

6.40 Based on the evidence heard the committee considers that it is necessary to implement emission and efficiency standards for all newly installed wood heaters. Those standards need to be significantly stricter than those currently in place. The

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50 Asthma Foundation NSW, *Submission 50*, p. 22.

51 Cleanairtas, *Submission 81*, p. [12].

52 Australian Home Heating Association, *Answers to questions on notice*, 5 June 2013, p. 2.

53 CS-062 is a Standards Australia committee revising AS/NZS 4013. Further information regarding the committee can be found here: http://www.sdpp.standards.org.au/ActiveProjects.aspx?CommitteeNumber=CS-062&CommitteeName=Solid%20Fuel%20Burning%20Appliances#simple1

54 Australian Home Heating Association, *Submission 20*, pp. 5–6.

55 Standards Australia, *Submission 162*, p. 6.

committee was disturbed by the disproportionate contribution made by wood smoke to urban air pollution, given the relatively small number of households using it as a heating source.

6.41 The committee noted that industry and regulatory bodies appear to have already come to an understanding that better regulation should be in place. Wood heaters are used elsewhere in the world in a safer manner which provides a more appropriate balance between the needs and desires of individuals and the community at large. Appropriate regulation including both efficiency and emissions standards will be a step towards finding that balance in Australia.

6.42 The committee notes that local environmental conditions can have a significant effect on the polluting consequences of wood smoke and that it can therefore be appropriate that local planning regulations impose specific conditions to reflect those environmental conditions.

Recommendation 12

6.43 The committee recommends that Australian Governments immediately adopt minimum efficiency and maximum emission standards for all newly installed wood heaters in Australia.

Recommendation 13

6.44 The committee recommends that local councils continue to manage the use of wood heaters in their own jurisdictions through the use of bans, buy-backs, minimum efficiency standards, and other mechanisms as appropriate to protect the health of their local communities.

Senator Rachel Siewert

Chair

APPENDIX 1

Submissions and additional information received by the Committee

Submissions

1 Mr Agner Sorensen

2 Ms Wendy Wales

3 Mr Darryl Johnston

4 Doctors for the Environment Australia Inc.

5 Hunter Community Environment Centre

6 Ms Deidre Olofsson

7 Ms Diane O'Mara

8 Mackay Conservation Group

9 Canberra Lung Life Support Group

10 On the Nose Community Group Inc.

11 Ms Wendy White

12 Port Augusta City Council

13 Hunter Environment Lobby Inc.

14 Faculty of Law, University of Sydney

15 Lake Macquarie City Council

16 Rathmines Progress Association

17 Cr Tony Briffa

18 Brooklyn Residents Action Group Inc

19 Hunter Valley Protection Alliance

20 Australian Home Heating Association Inc

21 Total Environment Centre

22 Rio Tinto

23 Repower Port Augusta Group

24 Confidential

25 Latrobe Valley Sustainability Group

26 Hunter Valley Wine Industry Association

27 Environment Victoria

28 Singleton Shire Healthy Environment Group

29 Centre for Air quality and health Research and evaluation (CAR)

30 Environment and Sustainable Development Directorate, ACT Government

31 Mr Rick Banyard

32 No submission

33 No submission

34 Confidential

35 Residents Against Polluting Stacks Inc

36 Anglo American Metallurgical Coal

37 Mr John Kaye

38 Mr Paul Connor

39 Name Withheld

40 Ms Alyson Shepherd

41 Mr Douglas Blackwell

42 Ms Sophie L'Estrange

43 Greenpeace Australia Pacific

44 Dr Jennifer Kent

45 Mr Scott Bilby

46 Mr Josh Armistead

47 Dr Steve Robinson

48 CSIRO

49 Mr Ian McCallan

50 Asthma Foundation NSW

51 Port Waratah Coal Services

52 Surf Coast Air Action

53 International Laboratory for Air Quality and Health (ILAQH), Queensland University of Technology

54 Islington Village Community Group

55 Oakey Coal Action Alliance

56 Correct Planning and Consultation for Mayfield Group

57 Queensland Resources Council

58 Nature Conservation Council of NSW

59 Australian Marine Engine Council

60 Ms Kathy Cave

61 Stockton Community Action Group

62 New England Greens

63 Maribyrnong City Council

64 Ms Rosemary Gatfield

65 Ms Larisa Cooper

66 Dr Murray May

67 Dr Dorothy Robinson

68 Mr and Mrs Peter and Rhonda Selmanovic

69 No submission

70 Ms Narelle Gallop

71 NSW Minerals Council

72 Ms Denise Gilbert

73 Ms Anna Kasper

74 Confidential

75 ACT Government

76 Mr Paul McGannon

77 Confidential

78 Lock the Gate Alliance Ltd

79 Gunnedah Basin HIA Steering Committee

80 NSW Environment Protection Authority

81 Cleanairtas

82 Department of Sustainability, Environment, Water, Population and Communities

83 Mr Chris Brown

84 Mr Paul Murphy

85 Australian Network of Environmental Defender's Offices Inc

86 Dr. Raymond Kearney

87 Dr John Todd

88 Tuggeranong Community Council Inc

89 Mr John Krey

90 Name Withheld

91 Dr James Markos

92 Dr Adrian Barnett

93 Mr Tuan Au

94 Australian Air Quality Group

95 Ms Colleen Hartland MP

96 Dr Nick Higginbotham

97 Friends of the Earth Australia

98 Maribyrnong Truck Action Group (MTAG)

99 The Wilderness Society Newcastle

100 Hobsons Bay City Council

101 General Electric

102 National Toxics Network Inc.

103 Muswellbrook Shire Council

104 Climate and Health Alliance

105 Dr Craig Dalton

106 Communities Protecting Our Region

107 Quit Coal

108 Port Adelaide Resident's Environment Protection Group

109 Minerals Council of Australia

110 EPA Victoria

111 Mr Garry Reed

112 Stop Brisbane Coal Trains

113 Clean Air Society Australia New Zealand

114 Australian Medical Association

115 Brimbank City Council

116 Environmental Medicine Working Group

117 Bureau of Meteorology

118 Ms Glennis Hammond

119 Mr William Thomson

120 No submission

121 Ms Gabrielle Mogck

122 Ms Lyn Kilby

123 Name Withheld

124 Confidential

125 Confidential

126 Ms Jennifer Thompson

127 Mr Phillip Edwards

128 Ms Aina Ranke

129 Dr Tanya Plant

130 No submission

131 No submission

132 Mr David Dettrick

133 Name Withheld

134 Name Withheld

135 Ms Margaret Airoldi

136 Ms Kylie Goldthorpe

137 Mr John Sutton

138 Mr Glenn Beutel

139 Hunter Communities Network

140 Ms Janet Graham

141 Moranbah Cumulative Impacts Group

142 Dr Joanna McCubbin

143 Camden Council

144 Name Withheld

145 Mr Paul Bambrick

146 Ms Cathy Burgess

147 Name Withheld

148 North Queensland Bulk Ports Corporation

149 Confidential

150 Mr Jonathon Dykyj

151 Ms Debbi Orr

152 Ms Julie Turner

153 Mr Alan Joynt

154 Mr Mark Selmes

155 Western Australian Government

156 Ms Carol Cosentino

157 Ms Lyn MacBain

158 Armidale Dumaresq Council

159 Mr Peter Thornton

160 Confidential

161 Save the Reef

162 Standards Australia

Form Letters

1 Form Letter Type 1, received from approximately 34 individuals

2 Form Letter Type 2, received from approximately 17 individuals

3 Form Letter Type 3, received from approximately 7 individuals

4 Form Letter Type 4, received from approximately 5 individuals

5 Form Letter Type 5, received from approximately 3 individuals

Additional Information

1 Health effects of air pollution information, from Dr Ben Ewald, received 7 March 2013

2 Coal Dust and Health in the Mackay Region report (February 2013), from Communities Protecting Our Region, received 8 March 2013

3 Emission charts, tabled by Hunter Community Environment Centre, at Newcastle public hearing 16 April 2013

4 Picture of covered rail wagons, tabled by Mr John Sutton, at Newcastle public hearing 16 April 2013

5 Identification of environmental lead sources and pathways in a mining and smelting town: Mt Isa, Australia (proof journal article), from Mackay, Taylor and others, received 10 May 2013

6 Selected Air Quality Data from around Australia, from Professor Mark Taylor, received 10 May 2013

7 The health impacts of coalmining operations and coal combustion on geographically proximate communities report, from author Mallory Barnes, received 15 May 2013

8 Minutes of Standards Australia meeting, tabled by Australian Home Heating Association, at Canberra public hearing 17 May 2013

9 Presentation, tabled by Quit Coal, at Canberra public hearing 17 May 2013

10 Opening statement, tabled by Department of Sustainability, Environment, Water, Population and Communities, at Canberra public hearing 17 May 2013

11 Email correspondence dated 24 April 2007, from Standards Australia, received 22 May 2013

12 Health Factor report, from Doctors for the Environment Australia, received 29 May 2013

13 Picture of coal on railway station platform, tabled by Friends of the Earth, at Brisbane public hearing 11 June 2013

14 Map of Australian coal and gas titles and applications, tabled by Lock the Gate Alliance, at Brisbane public hearing 11 June 2013

15 Permit under Environmental Protection Act 1994, tabled by Environmental Defenders Office Queensland, at Brisbane public hearing 11 June 2013

16 Extract from Queensland permit MIN100550507, tabled by Environmental Defenders Office Queensland, at Brisbane public hearing 11 June 2013

17 Submission to the Environment Protection and Heritage Council (May 2010), from Outdoor Power Equipment Association, received 25 June 2013

Correspondence

1 Correspondence responding to comments in submissions 55, 112, 118, 129 and 138, from New Hope Group, received 1 May 2013

2 Correspondence correcting error in submission 159, from Mr Peter Thornton, received 12 June 2013

3 Correspondence responding to evidence in submissions and in the Hansard of the public hearing held on 11 June in Brisbane, from New Hope Group, received 2 July 2013

Answers to Questions on Notice

1 Answers to Questions on Notice received from Australian Medical Association, 1 May 2013

2 Answers to Questions on Notice received from NSW Minerals Council, 3 May 2013

3 Answers to Questions on Notice received from Australian Home Heating Association, 5 June 2013

4 Answers to Questions on Notice received from Department of Sustainability, Environment, Water, Population and Communities, 5 June 2013

5 Answers to Questions on Notice received from North Queensland Bulk Ports Corporation, 20 June 2013

6 Answers to Questions on Notice received from Queensland Resources Council, 26 June 2013

7 Answers to Questions on Notice received from Australian Home Heating Association, 5 July 2013

APPENDIX 2

Public hearings

Tuesday 16 April 2013

City Hall, Newcastle

Witnesses

The Wilderness Society Newcastle
BODSWORTH, Ms Prue, Campaigner
BOWSKILL, Ms Nicola, Community Campaigner

New South Wales Minerals Council
BROWN, Ms Arti, Policy Manager, Environment and Health

New South Wales Environment Protection Authority
BUFFIER, Mr Barry, Chair and Chief Executive Officer
CROTTY, Ms Ann-Louise, Manager, Air Policy
DAVEY, Mr Gary, Director, North Branch
RILEY, Mr Matthew Lance, Director, Climate and Atmospheric Science, New South Wales Office of Environment and Heritage
SMITH, Professor Wayne, Director, Environmental Health Branch, Department of Health, New South Wales

Stockton Community Action Group
BURGESS, Ms Cathy, Spokesperson

Nature Conservation Council of New South Wales
CLARKE, Mr Pepe, Chief Executive Officer

Commonwealth Scientific and Industrial Research Organisation
CLEUGH, Dr Helen, Deputy Chief
COPE, Dr Martin, Principal Research Scientist
GALBALLY, Dr Ian, Chief Research Scientist
HIBBERD, Dr Mark, Principal Research Scientist

Australian Medical Association
DOBSON, Ms Corinne, Senior Policy Officer
HAMBLETON, Dr Steve, President

Correct Planning and Consultation for Mayfield Group

HAYES, Mr John, Co-convenor and Spokesman

Hunter Community Environment Centre
WHELAN, Dr James, Committee Member
HIGGINBOTHAM, Associate Professor Nick, Committee Member, Dust and Health Committee

Lake Macquarie City Council
HOWE, Dr Alice, Sustainability Manager

Centre for Air Quality and Health Research and Evaluation
JALALUDIN, Professor Bin
MARKS, Professor Guy

Minerals Council of Australia
KELLAGHAN, Mr Ronan, Principal Consultant, Air Quality
McCOMBE, Mr Christopher, Assistant Director, Environmental Policy
WAGNER, Mr Drew, Executive Director, Northern Territory Division

Hunter Valley Protection Alliance
KREY, Mr John, Member

SUTTON, Mr John, Private capacity

Friday 17 May 2013

Parliament House, Canberra

Witnesses

Australian Home Heating Association
BROWN, Mrs Demi, General Manager

Doctors for the Environment Australia
SHEARMAN, Emeritus Professor David JC, Honorary Secretary
CAREY, Associate Professor Marion, Member, Management Committee

Australian Marine Engine Council
FOOKS, Mr Gary Ian, Committee Member
HAINES, Mr Gregory, Secretary/Treasurer

Asthma Foundation New South Wales
GOLDMAN, Mrs Michele, Chief Executive Officer

Tuggeranong Community Council
JOHNSTON, Mr Darryl, Secretary
WOODWARD, Ms Rusty, Member

Environment Protection Authority Victoria
MERRITT, Mr John, Chief Executive Officer
TORRE, Mr Paul, Principal Expert, Air Quality

Department of Sustainability, Environment, Water, Population and Communities
WRIGHT, Dr Diana, First Assistant Secretary, Environment Quality Division
O'SULLIVAN, Ms Jane, Director, Air Quality Section, Environment Protection Branch, Environment Quality Division

Quit Coal
REDENBACH, Dr Merryn Lillian, Representative

Australian Air Quality Group
ROBINSON, Dr Dorothy L, Convenor

Climate and Health Alliance
TAIT, Dr Peter William, Member, Scientific Advisory Committee

Tuesday 11 June 2013

Queensland Parliament House, Brisbane

Witnesses

Queensland University of Technology
BARNETT, Dr Adrian, Associate Professor

Australian Network of Environmental Defenders Offices, Queensland
BRAGG, Ms Jo-Anne, Representative

North Queensland Bulk Ports Corporation
STEWART-HARRIS, Mr Jeffrey, Deputy Chief Executive Officer
BRUNNER, Mr Robert, General Manager, Planning, Hay Point

Moranbah Cumulative Impacts Group
DIX, Ms Jessica, Member Representative

Stop Brisbane Coal Trains
GORDON, Mr John, Spokesperson

Communities Protecting Our Region
ROBERTS, Ms Ellen, Campaign Organiser
HOBBS, Ms Elizabeth, Member

Lock the Gate Alliance
HUTTON, Mr Peter, President

Australasian Faculty of Occupational and Environmental Medicine
JEREMIJENKO, Dr Andrew, Occupational and Environmental Physician

Mackay Conservation Group
JULIEN, Mrs Patricia, Coordinator

International Laboratory for Air Quality and Health, Queensland University of Technology
MORAWSKA, Professor Lidia, Director
RISTOVSKI, Professor Zoran, Associate Professor

Queensland Resources Council
ROCHE, Mr Michael, Chief Executive

Friends of the Earth Australia
SMITH, Dr Bradley, Representative
HAMMOND, Ms Glennis, Representative

Macquarie University
TAYLOR, Prof. Mark, Professor of Environmental Science

Katestone
WELCHMAN, Mr Simon, Director

Greenpeace Australia Pacific
WOODS, Ms Georgina, Senior Climate Campaigner