LEGISLATIVE COUNCIL

PORTFOLIO COMMITTEE NO. 2

Health impacts of exposure to poor levels of air quality resulting from bushfires and drought

Report 54

2

September 2020

www.parliament.nsw.gov.au

Portfolio Committee No. 2 - Health

Health impacts of exposure to poor levels of air quality resulting from bushfires and drought

Ordered to be printed 16 September 2020

New South Wales Parliamentary Library cataloguing-in-publication data:

New South Wales. Parliament. Legislative Council. Portfolio Committee No. 2 – Health.

Health impacts of exposure to poor levels of air quality resulting from bushfires and drought / Portfolio Committee No. 2 – Health [Sydney, N.S.W.] : the Committee, 2020. [xii, 103] pages ; 30 cm. (Report no. 54 / Portfolio Committee No. 2 – Health)

"September 2020"

Chair: Hon. Greg Donnelly, MLC.

ISBN 9781920788810

1. Air—Pollution—New South Wales.
2. Air quality management——New South Wales.
3. Health risk assessment—New South Wales.
4. Forest fires—Health aspects—New South Wales.
5. Drought—Health aspects—New South Wales.

I. Donnelly, Greg.
II. Title.
III. Series: New South Wales. Parliament. Legislative Council. Portfolio Committee No. 2 – Health. Report ; no. 54

363.7392 (DDC22)

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Terms of reference

That Portfolio Committee No. 2 - Health inquire into and report on:

1. The health impacts of exposure to poor levels of air quality resulting from bushfires and drought including:
    (a) the impact of at-risk groups including children, pregnant women, people with asthma and other respiratory-related illnesses, the elderly and other high-risk groups as well as vulnerable companion animals;
    (b) the impact on people who are exposed to poor outdoor air quality in the workplace;
    (c) the long-term impacts of exposure; and
    (d) the effectiveness of various protective materials and strategies to mitigate the health impacts of exposure.
2. The effectiveness of the New South Wales Government to plan for and improve air quality including:
    (a) the measurement, reporting and public awareness;
    (b) the provision of various protective materials including face masks and air purifiers;
    (c) the ability to ensure the health of at-risk groups;
    (d) the suitability of work health and safety regulations, industrial provisions and related guidelines; and
    (e) the capacity to respond within existing resources and ongoing efficiency dividends.
3. Any related matters.

The terms of reference were self-referred by the committee on 5 February 2020.[1]

[1] *Minutes*, NSW Legislative Council, 25 February 2020, pp 793-794.

Committee details

Committee members

The Hon Greg Donnelly MLC	Australian Labor Party	*Chair*
The Hon Emma Hurst MLC	Animal Justice Party	*Deputy Chair*
Ms Cate Faehrmann MLC	The Greens	
The Hon Wes Fang MLC	The Nationals	
The Hon Natasha Maclaren-Jones MLC	Liberal Party	
The Hon Taylor Martin MLC[2]	Liberal Party	
The Hon Walt Secord MLC	Australian Labor Party	

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[2] The Hon Taylor Martin MLC substituted for the Hon Lou Amato MLC from 9 June 2020 for the duration of the inquiry.

Chair's foreword

Between late October 2019 and January 2020 bushfires of an unprecedented scale and duration burned across many regions of Australia. Smoke from these fires directly impacted on many people in New South Wales, along with other Australian states and territories. Many will recall waking up to a blanket of thick smoke outside their windows. Equally, most people will remember those vivid images taken from drones of enormous dust storms rolling in from drought affected farms and the western deserts completely enveloping regional New South Wales cities and towns over the last few years.

While communities, businesses and people's homes were directly ravaged by these fires, the health of a significant number of other people was also affected through exposure to poor or hazardous air quality. In fact, reports have shown that the air pollution during this period was up to 11 times the base 'hazardous' air pollution level. While the long term health impacts of this exposure are not yet known, the health effects of inhaling PM2.5 are well documented. Not only can exposure to PM2.5 cause mild symptoms, like sore eyes and coughing, evidence clearly shows that breathing in tiny particulate matter can penetrate deep into the lungs and blood stream and increase the risks associated with a number of serious health conditions, including heart attacks, strokes, cancers and respiratory disease. These risks are heightened for some groups in our community, including older people, pregnant women, children, people with respiratory conditions, people with heart disease, Indigenous Australians, people living in poverty and outdoor workers.

With these health risks well understood and accepted, this inquiry was focused on looking at what should be done to improve both the policy and the regulatory responses to managing the health impacts associated with poor air quality. Overall, the committee found that there is a need for the NSW Government to continue to expand its Air Quality Monitoring Network, with the placement of additional air quality monitoring stations, in order to ensure the effective measurement and reporting of air quality levels in as many locations as possible.

Connected to this was the need for effective, timely, consistent and more nuanced messaging on air quality levels and health risks to the public. Ultimately, people cannot take steps to protect themselves from the risks of exposure if they are not provided with timely, clear and relevant information on what the air quality is like around them. With the need for improvement in this area, the committee also recommended a review on how air quality information and advice is communicated to and comprehended by the public, along with the development of an 'air smart' public education campaign.

As air pollution, dust storms and bushfire smoke know no borders, it is also clear that the NSW Government needs to work with other jurisdictions to achieve nationally consistent air quality measurement and reporting standards. It is important for this to be prioritised, and for all jurisdictions to work towards having consistent intervals in which air quality is reported, along with consistent standards and terminology.

While it is understood that the response to the COVID-19 pandemic has become the priority this year, we cannot forget the impact of these bushfires, dust events and the significant negative health effects that they have caused. Nor can the community overlook the troubling health burden arising from exposure to ongoing air pollution. The NSW Government, including all departments and agencies with a role in this area, must continue to prioritise policy and regulatory work on these matters. As noted in the report, the committee was reassured that the Environment, Energy and Science Group in the Department of Planning, Industry and Environment confirmed that the Clean Air for NSW Strategy will

be finalised in early 2021. With the next bushfire season on our doorstep, we must take immediate stock of what we have learnt from these recent devastating bushfires and be prepared, so as to minimise as far as practicable negative health impacts.

I thank all my committee colleagues for their collaborative and thoughtful approach to this inquiry, and to all those who provided valuable evidence, either by making a submission or appearing at one of the public hearings. I also thank the secretariat for their professionalism and support.

I commend this report to the House.

Hon Greg Donnelly MLC
Committee Chair

Recommendations

Recommendation 1 **44**

That the NSW Government continue to expand its Air Quality Monitoring Network, and consider:

- the placement of additional permanent monitoring sensors in locations known to have emission producing industries and those likely to experience air pollution events, including Lake Macquarie and Lithgow
- the enhanced use of mobile sensors, including unmanned aerial vehicles, that can be rapidly deployed and relocated as required
- the use of low cost sensors if necessary, in order to ensure the measurement of air quality in as many localities as possible.

Recommendation 2 **44**

That the NSW Government work with the Australian Nuclear Science and Technology Organisation (ANSTO) to expand the sampling of particulate matter in the air statewide.

Recommendation 3 **45**

That the NSW Government prioritise working with other jurisdictions to achieve nationally consistent air quality measurement and reporting, including ensuring that PM2.5 is reported separately and hourly.

Recommendation 4 **45**

That the NSW Government commission a review on how effective air quality information and health advice is communicated to and comprehended by the public, with the review and any findings to be published.

Recommendation 5 **45**

That the NSW Government develop an air-smart public education campaign, and identify and implement other strategies that will enhance public awareness and education in relation to managing and interpreting the health risks associated with exposure to poor air quality.

Recommendation 6 **46**

That the NSW Government provide additional resources to ensure that the air-smart public education campaign is widely advertised, particularly to vulnerable and at-risk groups.

Recommendation 7 **62**

That SafeWork NSW engage with Unions NSW, unions, employers and other stakeholders to identify and develop policy and regulatory reforms that will improve the protection of workers from the harmful health effects of being exposed to poor air quality. In completing such work consultation will take place with medical and health experts, including thoracic specialists.

Recommendation 8 **78**

That all NSW Government departments and agencies with a role in responding to bushfire events continue to develop and implement strategies to coordinate, collaborate and communicate more effectively on the management of air quality, to ensure optimal planning for and responses during future bushfire events.

Conduct of inquiry

The terms of reference were self-referred by the committee on 5 February 2020.

The committee received 49 submissions and one supplementary submission.

The committee also received 76 responses to two pro formas.

The committee held two public hearings by video conference on 10 June 2020 and 12 June 2020, and one socially distanced hearing in the Macquarie Room at Parliament House in Sydney on 15 July 2020 which was closed to the public, but webcast live on the Parliament's website.

Inquiry related documents are available on the committee's website, including submissions, pro formas, hearing transcripts and answers to questions on notice.

Chapter 1 Background

The 2019-20 Australian summer saw over 11,400 bush and grass fires burn more than 5.5 million hectares and destroy 2,448 homes in New South Wales.[3] Unprecedented in their scale and duration, as was the drought that created the conditions for them, the bushfires produced patterns of poor air quality that had not been witnessed before. For large sections of the population, the bushfire smoke posed significant health challenges, especially for those with underlying medical conditions.

Furthermore, in recent years the state has experienced what in some cases have been significant dust storms. These storms have been caused by dust and dirt being blown by strong winds from desert areas located in central Australia and other locations that have experienced drought. The effect of these events has been to carry and deposit large amounts of particulate matter on communities and population centres that are located in the path of the dust storms. As is the case with bushfire smoke for large sections of the population, dust events pose significant health challenges, especially for those with underlying medical conditions.

This chapter provides background information to the policy and systems examined in detail in the chapters that follow. It starts with an overview of how air quality is measured and an explanation of the impact of bushfire smoke and drought on air quality. Next it documents the features of the 2019-20 Australian bushfires, their effects on air quality and what is known about the resultant health effects. The chapter then provides a detailed overview of the health effects of poor air quality in general, and bushfire smoke in particular, then documents in detail the vulnerability of different population groups to the health effects of poor air quality.

Air quality and PM2.5

1.1 In this section the committee explains airborne particulate matter present in air pollution, along with the air quality ratings system.

Particulate matter – PM2.5

1.2 A key concern in both air pollution generally and bushfire smoke specifically is the presence of airborne particulate matter smaller than 2.5 micrometres in diameter (PM2.5). Owing to their size these tiny particles can penetrate deep into the lungs and cross into the bloodstream. They originate mainly from combustion products such as coal fired power, road vehicles, biomass burning, industry and bushfires.[4]

1.3 According to NSW Health, the health effects of inhaling PM2.5 are both well understood and informed by a substantial body of evidence.[5] NSW Health gave a snapshot of the effects of exposure and noted the higher risk groups, which are documented in detail later in this chapter:

3 Dominica Sanda, 'NSW's devastating bushfire season ends', *Canberra Times*, 31 March 2020, https://www.canberratimes.com.au/story/6704323/nsws-devastating-bushfire-season-ends/?cs=14231

4 Submission 33, Australian Nuclear Science and Technology Organisation, p 4; Submission 46, Asthma Australia, p 4.

5 Submission 47, NSW Government, p 3.

> For most people, the effects of exposure to PM2.5 in bushfire smoke are mild symptoms like sore eyes and coughing. More serious effects are rare, but include worsening of asthma, hospital admission with respiratory and cardiovascular conditions and premature death. People with existing lung and heart conditions are at higher risk of serious effects because exposure to fine particles may worsen their illness. Young children, elderly people and pregnant women may also be more vulnerable.[6]

1.4 Doctors for the Environment further explained the significance of different sized particles:

> The particles are generally measured and reported by size class as the different size particles impact different parts of the human respiratory system. All particles together are measured as TSP total suspended particles. The subset less than 10 microns in size are reported as PM10 and are of interest because this size enters the airways and deposit primarily in the nose, throat and large airways. The subset less than 2.5 microns have the most important health effects as they penetrate furthest into the lungs and can cross to the blood stream leading to systemic effects. The range of smoke components is important because while particles can be filtered the gases are not filterable. Gases may be trapped in activated charcoal masks.[7]

1.5 On the impact of drought on air quality, the Australian Medical Association (NSW) advised:

> Drought is characterised by a prolonged period of precipitation shortage and soil moisture deficit, combined with high temperatures.
>
> Severe drought conditions can negatively affect air quality. During drought, there is an increased risk of dust storms and bushfires. The combined effects of drought on deposition, natural emissions (bushfires, biogenic volatile organic compounds and dust), and chemistry, contribute to elevated ozone and PM2.5.[8]

1.6 According to the Australian Nuclear Science and Technology Organisation (ANSTO), the average PM2.5 mass levels across Greater Sydney are typically 6-8 micrograms per cubic metre ($\mu g/m^3$). Consistent with the World Health Organisation's guideline of 25 $\mu g/m^3$ average over a 24 hour period,[9] the poor air quality threshold in Australia is 25 $\mu g/m^3$, but dust storms and bushfires can push these levels to several hundred $\mu g/m^3$ on any given day.[10]

New South Wales air quality ratings system

1.7 In New South Wales air quality information is provided in a colour-coded Air Quality Index (AQI) that displays levels of observed air pollution against national standards. An AQI of 100 or more (POOR) indicates that air pollution has exceeded national standards and triggers air quality alerts. When values exceed 200, air quality is reported as HAZARDOUS. The other main categories are VERY GOOD (0-33), GOOD (34-66) and FAIR (67-99).[11] These are reflected in the chart below, which also includes an activity guide.

6 Submission 47, NSW Government, p 3; see also Submission 46, Asthma Australia, p 4.

7 Submission 24, Doctors for the Environment Australia, pp 2-3.

8 Submission 31, Australian Medical Association (NSW), p 7.

9 Submission 44, Environmental Justice Australia, p 5.

10 Submission 33, Australian Nuclear Science and Technology Organisation, p 4.

11 Submission 47, NSW Government, p 7.

1.8 According to the Department of Planning, Industry and Environment, the AQI provides a scale of air pollution that helps people to understand air quality and modify their activities if pollution levels are high. It is calculated from air quality data for five pollutants and visibility readings. For each pollutant, the AQI is the data value expressed as a percentage of the level specified by the National Environment Protection Measure for Ambient Air (NEPM) standard (or, in case of visibility, of the relevant NSW standard). An AQI of 100 corresponds to the NEPM national standard. A lower value indicates better air quality and a higher value, worse.[12]

Table 1 Air quality index and activity guide[13]

Air Quality Index (AQI)	Colour indicator	What does it mean?
0-33	Very good	Enjoy normal activities.
34-66	Good	Enjoy normal activities.
67-99	Fair	People unusually senstive to air pollution should reduce or reschedule strenuous outdoor activities. Others are are not likely to be affected when the AQI is in this range.
100-149	Poor	Sensitive groups should reduce or reschedule strenuous outdoor activities. Other adults are not likely to be affected when the AQI is in this range.
150-199	Very poor	Sensitive groups should avoid strenuous outdoor activities. Other adults should reduce or reschedule strenous outdoor activities.
200+	Hazardous	Sensitive groups should avoid **all** outdoor activities. **Other adults should avoid strenous outdoor activities.**

12 Department of Planning, Industry and Environment, *About the air quality index* (3 February 2020), https://www.environment.nsw.gov.au/topics/air/understanding-air-quality-data/air-quality-index.

13 NSW Health, *Air Quality Index (AQI) and activity guide* (9 January 2020), https://www.health.nsw.gov.au/environment/ air/Pages/aqi.aspx

The bushfires of summer 2019-20

1.9 In this section the committee documents the unprecedented scale of the bushfires of summer 2019-20, the air quality that was documented in respect of them, and the health effects that were observed.

Unprecedented fires and pollution

1.10 Between late October 2019 and January 2020 bushfires of unprecedented scale and duration burned across many regions of Australia. The resulting smoke impacted upon many people across New South Wales, as well as the Australian Capital Territory, Queensland and Victoria. It is widely accepted that the several years of drought leading up to the 2019-20 summer created the conditions for these extraordinary fires. Just as the drought and fires were unprecedented, so too was the hazardous air quality they generated, as noted by NSW Health:

> The NSW drought that began in mid-2017 and the 2019-20 bushfire season were exceptional events that created an unprecedented period of poor air quality across NSW.[14]

1.11 The Grattan Institute explained the factors combining over time to create a situation of extreme fire risk leading up to the 2019-20 bushfires:

> Heatwaves throughout Australia the year before caused bushfires in most states around the country, including NSW. Many continued to burn towards the end of the 2018-19 summer. With little rainfall and the warmest March on record, the fires in NSW continued to grow into Autumn.
>
> 2019 went on to be Australia's hottest year on record. Temperatures across the country were, on average, 1.5 degrees warmer than the long-term trend. It was also its driest year. Areas of south-eastern Australia – areas that would go on to be most affected by the bushfires – had their lowest rainfall on record.
>
> Hazard reduction burns reduce the fuel required for a bushfire, and these controlled burns had been conducted extensively in the decade leading up to the 2019-20 bushfire season. But extended drought in the south-east, combined with a shorter safe burning period, meant hazard reduction burns were lower than average in 2019.[15]

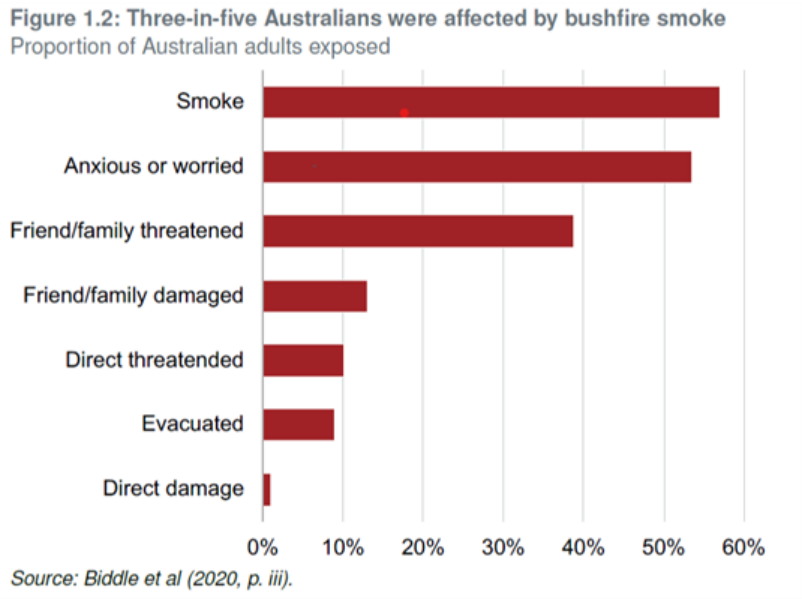
1.12 By the end of January 2020, 21 per cent of all Australian forests were burned.[16] The Grattan Institute graph below highlights the extraordinary scale of the human impact that the bushfires had on Australians, not only in terms of exposure to the health risks of bushfire smoke (discussed in detail below), but also in terms of perceived and actual threat to health and safety. According to the Grattan Institute, 10 per cent of Australians, or 2 million people, reported being directly threatened by the fires, with 1.8 million forced to evacuate. Three out of every five people living in Australia reported being exposed to bushfire smoke.[17]

14 Submission 47, NSW Government, p 3.

15 Submission 38, Grattan Institute, pp 3-4.

16 Submission 38, Grattan Institute, p 4.

17 Submission 38, Grattan Institute, p 4.



What air quality was documented?

1.13 Numerous inquiry participants referred to the impact that the 2019-20 bushfires was documented to have had on air quality.

1.14 The NSW Council of Social Service (NCOSS) and Unions NSW referred to a joint statement on air pollution released on 19 December 2019 by 28 health and medical organisations, which drew attention to communities across New South Wales being subject to consecutive days of smoke haze up to 11 times the base 'hazardous' air pollution level. The signatories, including Doctors for the Environment Australia, Royal Australasian College of Physicians, Australasian College for Emergency Medicine, Consumers Health Forum of Australia, College of Emergency Nursing Australasia, the Thoracic Society of Australia and New Zealand, and the Public Health Association of Australia, called the situation a 'public health emergency' and called on the Prime Minister and Premier to take leadership in addressing the poor air quality.[18]

1.15 Asthma Australia noted that Sydney alone experienced 81 days of poor, very poor and hazardous air quality during 2019, a figure higher than the combined total of the ten years prior.[19] According to ANSTO, in 2019 hazardous levels of PM2.5 were reached on 118 days in New South Wales, more than double the number of days reached in 2018, at 52 days.[20] With regard to PM2.5, the Grattan Institute advised:

18 Climate and Health Alliance, *Joint Statement: Air Pollution in NSW is a Public Health Emergency* (16 December 2019), https://www.caha.org.au/air-pollution, cited in Submission 29, NSW Council of Social Service, p 4. and Unions NSW, 'Hazardous air quality: The new normal?', https://www.unionsnsw.org.au/wp-content/uploads/2020/01/Hazardous-AIR-Quality-FINAL.pdf

19 Submission 46, Asthma Australia, p 2; see also Submission 44, Environmental Justice Australia, p 7.

20 Submission 33, Australian Nuclear Science and Technology Organisation, p 4.

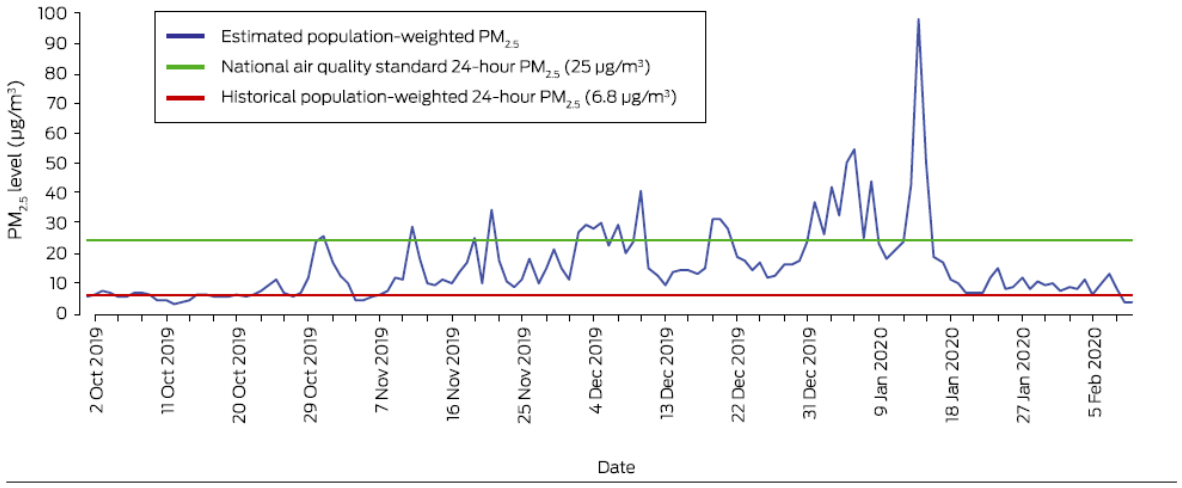
> Over the summer, there were 24 days on which the rolling 24-hour average PM2.5 level reached higher than 50 in Western Sydney. There were 23 days with PM2.5 over 50 (the 'hazardous' level) in Campbelltown in Sydney's southwest, and 19 days in Darlinghurst.
>
> There were 18 days with average PM2.5 above 100 (twice the 'hazardous' level) in south-west Sydney, and 10 in Camden. In regional NSW, there were 24 days with PM2.5 above 100 in Goulburn, and 15 in Albury and Bathurst. There were many more days in which hourly spikes reached hazardous levels.[21]

1.16 In a similar vein, Environmental Justice Australia highlighted:

> From November to January, Sydney and other cities in NSW experienced some of the worst air in the world. According to air pollution monitoring stations in Sydney, the average concentration of 24-hour PM2.5 for November and December was 27 µg/m^3, more than four times the usual everyday level.[22]

1.17 Research by Arriagada et al published in the *Medical Journal of Australia* in March 2020 examined the population-weighted PM2.5 levels for the eastern states and territories between October 2019 and February 2020.[23] The levels are set out in the box below:

1 Population-weighted $PM_{2.5}$ levels, New South Wales, Queensland, the Australian Capital Territory and Victoria, 1 October 2019 – 10 February 2020*



* Data by state are included in the online Supporting Information.

21 Submission 38, Grattan Institute, pp 7-8.

22 Submission 44, Environmental Justice Australia, p 7.

23 Nicolas Borchers Arriagada, Andrew J Palmer, David MJS Bowman, Geoffrey G Morgan, Bin B Jalaludin and Fay H Johnston, 'Unprecedented smoke-related health burden associated with the 2019–20 bushfires in eastern Australia', research letter, *Medical Journal of Australia*, 2020, 26 March 2020, attachment to correspondence from Dr Bruce Graham, Adjunct Academic in the School of Biomedical Sciences, Charles Sturt University, received 26 March 2020.

1.18 The analysis found that on 125 days out of the 133 day study period, concentrations of PM2.5 greater than the 95th percentile of historical daily average values were recorded by at least one air quality monitoring station in the study area.[24]

1.19 In addition, the highest population-weighted PM2.5 exposure level (98.5 $\mu g/m^3$ on 14 January 2020), exceeded the national air quality 24 hour standard (25 $\mu g/m^3$) and was more than fourteen times the historical population-weighted mean 24 hour PM2.5 value of 6.8 $\mu g/m^3$.[25]

What health effects were observed?

1.20 According to the Grattan Institute, around 11 million Australians reported some exposure to smoke caused by the 2019-20 bushfires, and the majority of people in New South Wales reported at least one minor symptom caused by bushfire smoke over the December to January period, with the common symptoms being eye and throat irritation, coughing, headaches, and anxiety.[26]

1.21 The Arriagada et al study published in the *Medical Journal of Australia* estimated the health burden for each of the eastern states and territories attributable to bushfire smoke during the period from October 2019 to February 2020, as set out in the box below. The researchers found that New South Wales experienced an estimated 219 excess deaths, 577 cardiovascular-related hospital admissions, 1050 respiratory related hospital admissions, and 702 asthma-related emergency department attendances.[27]

2 Estimated health burden attributable to bushfire smoke, Queensland, New South Wales, the Australian Capital Territory and Victoria, 1 October 2019 – 10 February 2020

	Estimated number of cases (95% confidence intervals)				
Outcome	Queensland	New South Wales	Australian Capital Territory	Victoria	Total
Excess deaths (any cause)	47 (17–77)	219 (81–357)	31 (12–51)	120 (44–195)	417 (153–680)
Hospital admissions, cardiovascular	135 (25–246)	577 (108–1050)	82 (15–149)	331 (62–602)	1124 (211–2047)
Hospital admissions, respiratory	245 (0–513)	1050 (0–2204)	147 (0–308)	585 (0–1227)	2027 (0–4252)
Emergency department attendances, asthma	113 (61–165)	702 (379–1026)	89 (48–131)	401 (217–586)	1305 (705–1908)

1.22 In terms of the actual, rather than estimated, health burden arising from the fires, the NSW Government submission reported on data from the NSW Public Health Rapid, Emergency, Disease and Syndromic Surveillance (PHREDSS) (which captures most unplanned presentations to NSW public hospital emergency departments and all emergency Triple Zero (000) calls to NSW Ambulance). In broad terms the data indicated that there were 'sustained increases' in emergency assistance sought in respect of asthma and breathing problems, however, there was no marked increase in presentations for cardiovascular or chest problems:

24 Arriagada et al, p 1.

25 Arriagada et al, p 2.

26 Submission 38, Grattan Institute, p 7.

27 Arriagada et al, p 2. See also Submission 34, Centre for Air pollution, energy and health Research (CAR), p 2.

> Over the 2019-20 summer period, there were sustained increases across NSW for presentations to emergency departments (ED) for asthma and breathing problems and ambulance calls for breathing problems, above expected year-on-year increases in activity. Presentations to ED for cardiovascular and chest problems were similar to the historical average.[28]

1.23 In terms of specific data, the NSW Government advised that during the period of most intense bushfire activity and the statewide emergency response from 11 November 2019 to 9 February 2020:

- 11.4 per cent (29,685) of total ambulance emergency calls (260,942) were for breathing problems, nine per cent higher than the five year average for the same period of 10.4 per cent
- 2.1 per cent (14,140) of total unplanned presentations (675,228) to 67 NSW emergency departments, were for asthma and breathing problems, 10 per cent higher than the five year average for the same period of 1.9 per cent
- 8.3 per cent (55,769) of total unplanned presentations (675,228) to 67 NSW emergency departments were for cardiovascular problems or chest pain, similar to the five year average for the same period of 8.3 per cent. [29]

1.24 Environmental Justice Australia referred to other NSW Health figures, highlighting 'immediate and significant' increases in demand for state health services, with a focus on emergency department presentations for asthma or breathing problems:

> NSW Heath reported that on December 10, there was almost twice the average number of presentations to emergency departments for asthma or breathing problems. Admissions to hospital from the emergency department for asthma and breathing problems were 556, greater than the 5 year average of 435. From 5 to 11 December 2019, emergency department presentations for asthma or breathing problems were higher than usual across NSW with 1,357 presentations, a 25% increase compared to the 5 year average of 916. Ambulance calls for breathing problems were also higher than usual with 2,448 ambulance calls received, a 30% increase compared to the 5 year average of 1742.[30]

[28] Submission 47, NSW Government p 3. The submission noted that NSW Public Health Rapid, Emergency, Disease and Syndromic Surveillance (PHREDSS) data is more useful for detecting changes in trends over time rather than the community burden of bushfire related smoke exposure. Not all emergency department presentations or ambulance calls relating to exposure to bushfire smoke will be captured by the PHREDSS system.

[29] Submission 47, NSW Government p 3.

[30] Submission 44, Environmental Justice Australia, p 7, citing NSW Health, *Take care: bushfire smoke still about* (13 December 2019), https://www.health.nsw.gov.au/news/Pages/201920131213_01.aspx.

1.25 It also reported the findings of a survey by The Australia Institute on individuals' reported health effects, noting the productivity estimated to have been lost from people's absences from work:

> In January 2020, a national survey conducted by The Australia Institute found a quarter of Australians (26%) reported illness or health effects as a result of the bushfire smoke haze. With 9% of survey respondents saying they had missed work because of the fires or smoke, The Australia Institute estimated that at least 1.8 million work days were lost as a result. This disruption to the workforce is conservatively estimated to have cost more than $1.3bn in lost economic production.[31]

What are the health effects of air pollution?

1.26 The literature differentiates between the health effects of air pollution generally and bushfire smoke specifically. Both are summarised in turn below, drawing on the research evidence cited by inquiry participants.

Air pollution

1.27 As noted above, the health effects of inhaling PM2.5 are well substantiated and understood.[32] According to the Clean Air Society of Australia and New Zealand (CASANZ), tiny airborne particles (particulate matter) produced from combustion processes such as bushfires, wood-heaters, vehicle emissions and coal-fired power stations can enter the lungs where the smallest sized particles can then transfer into the blood stream, causing systemic inflammation and damage to other organs. The list of causal associations is continuing to expand in response to the growing body of evidence.[33]

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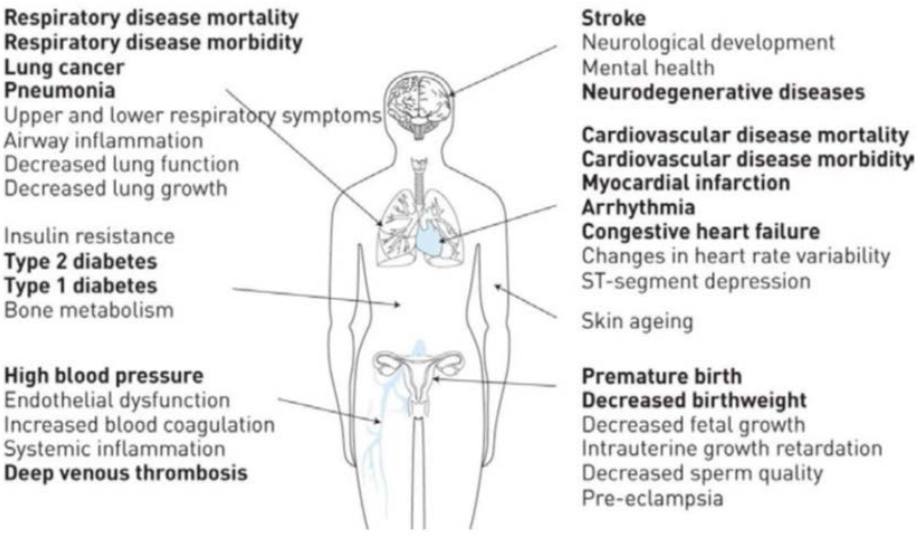
31 Submission 44, Environmental Justice Australia, p 8, citing the Australia Institute, *Survey Reveals: Bushfires Cost 1.8 million Work Days, Leave 5 Million Sick from Smoke* (23 January 2020), https://www.tai.org.au/content/survey-reveals-bushfires-cost-18-million-work-days-leave-5-million-sick-smoke and Sarah Martin, 'Bushfire crisis: more than half of all Australians found to have been directly affected', *The Guardian Australia*, 23 January 2020, https://www.theguardian.com/australia-news/2020/jan/23/bushfire-crisis-more-than-half-of-all-australians-found-to-have-been-directly-affected.

32 Submission 47, NSW Government, p 3.

33 Submission 43, Clean Air Society of Australia and New Zealand, p 1.

1.28 CASANZ provided the diagram below that depicts the diseases, conditions and biomarkers affected by outdoor air pollution.[34]



1.29 In New South Wales, around 520 people are estimated to die prematurely each year due to fine particle air pollution.[35] Nationally, ambient air pollution is estimated to contribute to 4,880 deaths per year in Australia,[36] the equivalent of three times the national road toll.[37] Looking globally, the World Health Organisation recently estimated that about 7 million deaths per year from cancer, heart disease and pulmonary illnesses are caused by the combined effect of outdoor and household air pollution.[38]

1.30 Doctors for the Environment Australia noted that the increased risk of death associated with exposure to fine particle air pollution is mostly attributed to heart attacks and strokes, although cancers also contribute. It documented evidence in respect of the following health impacts:

- respiratory disease such as asthma, chronic obstructive pulmonary disease (COPD), and other conditions such as reduced lung growth in children, dementia, and lung cancer
- cardiac arrest
- lower birthweight
- type II diabetes (noting that systemic inflammation has long been thought to be linked to the causation of this disease).[39]

34 Submission 43, Clean Air Society of Australia and New Zealand, p 2, citing GD Thurston, H Kipen, I Annesi-Maesano, J Balmes, RD Brook, K Cromar, S De Matteis, F Forastiere, B Forsberg and MW Frampton, 'A joint ERS/ATS policy statement: what constitutes an adverse health effect of air pollution? An analytical framework' European Respiratory Journal, 2017, 49. The bold type indicates conditions currently included in the Global Burden of Disease categories.

35 Submission 33, Australian Nuclear Science and Technology Organisation, p 2.

36 Submission 43, Clean Air Society of Australia and New Zealand, p 1.

37 Submission 44, Environmental Justice Australia, p 3.

38 Submission 33, Australian Nuclear Science and Technology Organisation, p 2.

39 Submission 24, Doctors for the Environment Australia, pp 3-4.

1.31 Several inquiry participants underscored that there is no safe level of exposure to fine particle air pollution,[40] with even a small amount carrying risk and larger amounts carrying greater risks. Doctors for the Environment Australia noted that, correspondingly, scientific opinion is that 'the health risk extends right down to any level above zero exposure and there is a clear health benefit to reducing fine particle pollution as much as possible'.[41]

1.32 The Australian Medical Association (NSW) also underscored that any exposure carries risk to health, stating:

> There is currently no evidence, despite extensive epidemiological research, of a threshold below which exposure to particulate matter does not cause any health effects. Health effects can occur after both short and long-term exposure to particulate matter.[42]

1.33 Noting that there is limited research on the impacts of medium term exposure to smoke pollution, that is, exposure lasting weeks and months (as occurred in the 2019-20 fires), the Australian Medical Association (NSW) cited the following evidence:

- A study of Victoria's 2014 Hazelwood coal mine fires, in which the population was exposed to six weeks of smoke, found that more than a year after the event adults had increased rates of respiratory symptoms. Parents also reported that children exposed in utero or under aged two had more respiratory tract infections. A link between exposure and lung stiffness was also found in children up to age two at the time of the fire.
- A 2013 review conducted by the World Health Organisation found that long term PM2.5 exposure can result in atherosclerosis, adverse birth outcome and childhood respiratory diseases. It suggested a link with neurodevelopment, cognitive function and diabetes, and noted that recent research has strengthened the causal link between PM2.5 and cardiovascular and respiratory deaths.[43]

1.34 The Australian Medical Association (NSW) further noted that when combined with high temperatures, the health risks associated with poor air quality are heightened, with greater effect on mortality.[44]

1.35 According to Asthma Australia, the longer-term health impacts of sustained poor air quality include respiratory illnesses, some cancers and heart disease.[45] Commenting on both the acute and chronic health effects of poor air quality, Doctors for the Environment Australia highlighted the cumulative effects of long term exposure:

> Air pollution has both acute and chronic health effects, however the effects of long term exposure on health are approximately 5 times greater. It is well established that on bad air days there are more heart attacks, but there is also an effect that bad air over months and years accelerates the progression of cardiovascular disease, and the resultant heart attack may well happen on a good air day. Fine particle air pollution adds to the

40 Submission 46, Asthma Australia, p 4; Submission 24, Doctors for the Environment Australia, p 3; Submission 44, Environmental Justice Australia, p 4.

41 Submission 24, Doctors for the Environment Australia, p 3.

42 Submission 31, Australian Medical Association (NSW), p 2.

43 Submission 31, Australian Medical Association (NSW), pp 4-5.

44 Submission 31, Australian Medical Association (NSW), p 3.

45 Submission 46, Asthma Australia, p 2.

> risk from all other known risk factors such as obesity, diabetes, smoking, family history, cholesterol, and renal disease. It is unlikely to ever be the sole cause of a health event. Thus, the sum of acute effects across the year is not the same as the chronic effect.[46]

Bushfire smoke

1.36 The Clean Air Society of Australia and New Zealand noted that although most of the available research evidence focuses on the health effects of poor air quality in general, there are additional unique toxins present in bushfire smoke emissions:

> To date, most epidemiological evidence is generated from investigating the link between health outcomes and particulate matter (PM), the pollutant deemed most detrimental to human health. However, general PM measurements are unable to account for the specific chemical composition of bushfire produced particulate matter which includes a unique suite of organic and inorganic compounds, and heavy metals. Bushfire emissions also include carbon dioxide, carbon monoxide, sulfur dioxide, nitrogen oxides and a wide range of airborne toxics including respiratory irritants, formaldehyde and acrolein and heavy metals of which mercury is a particular concern.[47]

1.37 Doctors for the Environment Australia documented the contents of fire smoke and their respective health effects, as set out in the table below.

Table 2 Contents of fire smoke[48]

Pollutant	Details	Principal effect	Reported by ambient monitors
NO2	Created during combustion	Respiratory irritant	Yes
Ozone	Secondary pollutant created from NO2 and VOC and sunlight	Respiratory irritant, and oxidative stress	Yes
Particles TSP	Total suspended particles		No
Particles PM10	The respirable subset of TSP	Respiratory effects	Yes
Particles PM 2.5	The smaller subset of PM10	Cardiovascular and systemic inflammatory effects	Yes
Polycyclic aromatic hydrocarbons (eg Benzo(a)pyrene)		Some are carcinogens	No
Formaldehyde. Acrolein	Exposure for firefighters	Respiratory and eye irritant.	No
Carbon monoxide	Firefighters	Acute toxicity. Impairs judgement.	No
VOC (benzene, toluene, xylenes, phenol)	Firefighters	Carcinogens. Also contributes to ozone formation.	No

46 Submission 24, Doctors for the Environment Australia, p 5.

47 Submission 43, Clean Air Society of Australia and New Zealand, p 3.

48 Submission 24, Doctors for the Environment Australia, p 2.

1.38 According to the Centre for Air pollution, energy and health Research (CAR), the long term effects of bushfire smoke are not well understood, nor the health effects arising from prolonged fire events such as those from the summer of 2019-20:

> The long-term effects of bushfire smoke exposure are largely unknown. Most studies focus on the immediate effect of bushfire smoke (same day of exposure or a lag of some days) rather than longer-term effects, months or years after exposure. Additionally, most research on bushfire smoke exposure in Australia is limited to bushfire incidents which last days rather than weeks or months.[49]

1.39 In the same vein, Clean Air Society of Australia and New Zealand highlighted the unprecedented severity and duration of the recent bushfires to suggest that it will be some time before their full impacts will be understood:

> Bushfires are generally acute events of short duration and evidence to date has only considered short-term impacts. The duration and extent of population exposure this past summer was unprecedented, extending beyond 'short term' exposure. It will be some time before the impacts are known.[50]

1.40 Clean Air Society of Australia and New Zealand further suggested that the greater length and severity of that season will mean that 'the associated impacts are likely to be greater than those reflected in the currently available research'.[51]

1.41 The Royal Australian and New Zealand College of Obstetricians and Gynaecologists highlighted a number of points from the research evidence on air quality generally and bushfire pollution specifically:

> There is an extensive body of literature on the reproductive health effects of exposure to urban air pollution, with relatively few studies specifically assessing outcomes to exposure to bushfires and dust. However, available evidence suggests that it is possible to cautiously extrapolate the evidence surrounding the health effects of urban and industrial air pollution to bushfire exposure, and that particulate matter from bushfire smoke and dust storms is at least as toxic as industrial air pollution.
>
> Background levels of air quality, pre and post exposure to events such as bushfires, will have a modifying effect on health outcomes.[52]

1.42 Clean Air Society of Australia and New Zealand commented on the differential impact of air pollution versus bushfire smoke:

> Evidence to date suggests there are differences in magnitude, pattern of effects, and specific sub-sets of vulnerable groups associated with bushfire pollution. For example, the asthma impacts of vehicle emissions are substantially stronger in children; however evidence to date indicates bushfire smoke exerts greater respiratory impacts on adults. It is unclear whether this is due to altered cellular responses or protective behaviour of parents, but it highlights that it is important where possible, to consider source specific

49 Submission 34, Centre for Air pollution, energy and health Research (CAR), p 3.

50 Submission 43, Clean Air Society of Australia and New Zealand, p 4.

51 Submission 43, Clean Air Society of Australia and New Zealand, p 1.

52 Submission 30, Royal Australian and New Zealand College of Obstetricians and Gynaecologists, pp 1-2.

impacts rather than assuming internationally established risk coefficients represent the Australian context of bushfire impacts.[53]

1.43 Clean Air Society of Australia and New Zealand reported that some of the general patterns of impact arising from Australian bushfires and vegetation burns are:

- Asthma impacts occurring on the same day as exposure, with the highest risk in adults. One study which stratified for sex, also found higher risks in women > 20 years.
- General respiratory impacts also have the greatest magnitude on the day of exposure with higher risks in the elderly
- Cardiac arrests occur predominantly in men within the first 48 hours of exposure
- Ischaemic heart disease (IHD) occurs more frequently in women at lagged intervals of two to three days post exposure
- Indigenous Australians were found to have significantly higher risks for same day respiratory outcomes including chronic obstructive pulmonary disease (COPD), respiratory infections and ischaemic heart disease (IHD) 3 days post exposure.[54]

Vulnerable or at risk groups

1.44 As noted above, there is sound evidence that certain population groups are at greater risk of adverse outcomes arising from exposure to poor air quality, including specifically from bushfire smoke.[55] Vulnerable or at risk groups include pregnant women, young children, older people, people with respiratory conditions, people with heart disease, indigenous people, people in lower socioeconomic groups and outdoor workers. Each is briefly discussed in turn below.

Pregnant women and children in utero

1.45 According to the Royal Australian and New Zealand College of Obstetricians and Gynaecologists, pregnant women are at increased risk of the general health effects of air pollution, given the physiological changes in pregnancy that significantly increase their ventilation rate and cardiac output, which in turn increase concentrations of pollutants in the bloodstream. Other physiological changes in pregnancy related to immune system functioning and insulin resistance may also increase the susceptibility of women to the effects of air pollution.[56]

53 Submission 43, Clean Air Society of Australia and New Zealand, p 2.

54 Submission 43, Clean Air Society of Australia and New Zealand, p 2.

55 See for example Submission 31, Australian Medical Association (NSW), pp 3-4; Submission 34, Centre for Air pollution, energy and health Research (CAR), pp 3-4; Submission 43, Clean Air Society of Australia and New Zealand, p 2.

56 Submission 30, Royal Australian and New Zealand College of Obstetricians and Gynaecologists, p 2.

1.46 There is also strong evidence that air pollution leads to an increased incidence of adverse pregnancy outcomes such as fetal growth restriction, preterm birth, hypertensive disorders including preeclampsia, gestational diabetes, congenital defects and stillbirth. Air pollution is also associated with reduced fertility and increased risk of miscarriage.[57]

1.47 The Royal Australian and New Zealand College of Obstetricians and Gynaecologists also highlighted the significant lifelong consequences for children that may arise from pregnancy complications related to air pollution:

> Pregnancy is a critical window during human development. Babies born premature, small for gestational age, and following pregnancies complicated by gestational hypertension or gestational diabetes, have an increased risk of chronic disease throughout the lifespan. For example, even babies classified as being born moderate to late preterm (32 to 36 weeks' gestation) have higher rates of academic underperformance, lower IQ and more respiratory health problems. In childhood, they often require more hospitalisation than term children for a variety of health problems, most commonly respiratory illnesses including asthma and respiratory infections. In adulthood, they need more treatment for hypertension and diabetes, have more psychiatric problems, require more economic assistance for health problems and have lower academic achievement.[58]

1.48 The Royal Australian and New Zealand College of Obstetricians and Gynaecologists continued:

> In humans, epidemiological studies have linked prenatal and early life air pollution exposure to delayed mental and motor development, behavioural disorders such as ADHD and autism, childhood obesity and insulin resistance, impaired lung function and growth, increased incidences of respiratory infections and asthma, increased risk of childhood leukaemia, and a predisposition towards cardiovascular disease in later life.[59]

Children

1.49 Age is a determining factor in the health risks associated with poor air quality. Young children are at greater risk because they breathe in more air for their bodyweight than others and their lungs are still developing.[60]

1.50 There are few studies of the impacts of bushfire smoke on children. Some have actually indicated that children are less likely than adults to attend hospital for asthma during periods of bushfire exposure. By contrast, the Hazelwood Health study (also discussed in paragraph 1.33) found that exposure to mine fire smoke in early life is associated with physiological abnormalities of both the lungs and blood vessels, as well as more reports of minor illnesses and antibiotics use.[61]

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57 Submission 30, Royal Australian and New Zealand College of Obstetricians and Gynaecologists, p 2; Submission 34, Centre for Air pollution, energy and health Research (CAR), p 4.

58 Submission 30, Royal Australian and New Zealand College of Obstetricians and Gynaecologists, pp 2-3.

59 Submission 30, Royal Australian and New Zealand College of Obstetricians and Gynaecologists, p3.

60 Submission 31, Australian Medical Association (NSW), p 3.

61 Submission 34, Centre for Air pollution, energy and health Research (CAR), p 5.

Older adults

1.51 Older people are at greater risk of adverse health effects from poor air quality than young people as they are more likely to have chronic medical conditions such as heart disease, diabetes, asthma, chronic obstructive pulmonary disease (COPD) or other respiratory conditions. There is strong evidence that during bushfires people aged over 65 are more likely to be hospitalized for all conditions and specifically asthma.[62]

People with respiratory conditions

1.52 People with chronic respiratory conditions such as asthma and COPD appear to be most sensitive to bushfire smoke, with inflammation of the air ways a key effect of exposure. There is strong evidence that short term increases in bushfire smoke are directly related to increases in respiratory-related hospital admissions and emergency department visits, particularly for those with asthma or COPD.

1.53 There is evidence that PM2.5 from bushfires has a stronger association with worsening asthma symptoms than does particulate matter from mixed urban sources such as vehicle emissions.

1.54 In addition to hospital admissions, exposure to bushfire smoke is associated with increased asthmatic symptoms and use of asthma medication.[63]

People with heart disease

1.55 There is mixed evidence on the effects of bushfire smoke on people with cardiovascular disease. Some studies have shown that increased bushfire exposure is associated with increased cardiovascular mortality, cardiac arrests and cardiac-related emergency department admissions. Other studies have shown limited evidence for this relationship.[64]

1.56 According to CAR, 'It may be that while the most immediate effect of bushfire smoke is via inflammation of the respiratory system, the cardiovascular system is affected in more subtle ways which may not be immediately apparent after exposure to bushfire smoke'.[65]

Indigenous Australians

1.57 Aboriginal and Torres Strait Islander communities experience significant health impacts from poor air quality, especially from bushfires and dust. Because Indigenous Australians experience higher rates of cardiovascular and other chronic health conditions, they are disproportionately susceptible to the health effects of poor air quality.[66]

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62 Submission 31, Australian Medical Association (NSW), pp 3-4; Submission 34, Centre for Air pollution, energy and health Research (CAR), p 5.

63 Submission 34, Centre for Air pollution, energy and health Research (CAR), p 5; Submission 46, Asthma Australia, p 5.

64 Submission 34, Centre for Air pollution, energy and health Research (CAR), pp 4-5.

65 Submission 34, Centre for Air pollution, energy and health Research (CAR), p 5.

66 Submission 31, Australian Medical Association (NSW), p 4.

People living with poverty and disadvantage

1.58 People living with poverty and disadvantage are at greater risk of the health impacts of poor air quality, including from bushfires, because they experience poorer health than the broader population including higher prevalence of pre-existing respiratory conditions.[67] Those in lower socioeconomic groups may also be more vulnerable to the effects of bushfire smoke because they may have poorer housing, health literacy, and less means to avoid bushfire smoke exposure.[68]

Residents of Greater Western Sydney

1.59 Due to the geographical and physical nature of Sydney, residents of Greater Western Sydney are exposed to much higher levels of air pollution than those in other parts of Sydney.

Outdoor workers

1.60 While outdoor workers are an apparently at risk group, being directly exposed to poor air quality, there is less evidence about this. The Centre for Air pollution, energy and health Research advised that while there is community concern about the health impacts of bushfire smoke on outdoor workers such as baggage handlers, sports people and trades people, it is not aware of any studies specifically focusing on the health effects of bushfire smoke on outdoor workers. While the health of US firefighters has been investigated, there is a question as to whether the findings are applicable to Australian firefighters because of the different vegetation between the two countries.[69]

1.61 The Centre for Air pollution, energy and health Research observed that workers without personal protective equipment are likely to experience greater exposure than those with, and are therefore at risk of greater health outcomes.[70]

1.62 Others who recognised the heightened impact on outdoor workers included the Clean Air Society of Australia and New Zealand, who stated that 'the severity and duration of fires over this past season made it virtually impossible for outdoor workers to avoid exposure'.[71]

1.63 Protective measures in respect of outdoor workers are discussed in detail in chapter 3.

67 Submission 29, NSW Council of Social Service, p 4.

68 Submission 34, Centre for Air pollution, energy and health Research (CAR), p 4.

69 Submission 34, Centre for Air pollution, energy and health Research (CAR), pp 5-6.

70 Submission 34, Centre for Air pollution, energy and health Research (CAR), pp 5-6.

71 Submission 43, Clean Air Society of Australia and New Zealand, p 3.

Committee comment

1.64 Before turning to the health impacts associated with poor air quality, the committee acknowledges the devastating impacts caused by the recent bushfires. As many have described, the fires were of an unprecedented scale and duration, and communities were ravaged by wildfires, with many losing their homes and some losing their lives.

1.65 During this period, we experienced some of the worst air quality we have known. It was not uncommon to wake up to a thick haze caused by bushfire smoke, which made it difficult to see, and for some, difficult to breathe. Even before this disaster, there were significant dust storms that had similar effects, requiring people to stay indoors and avoid the hazardous air quality around them.

1.66 All of these events have highlighted the need to respond effectively and manage the risks associated with poor or hazardous air quality. The evidence clearly shows that there are adverse health impacts associated with inhaling PM2.5. These tiny airborne particulates, found in air pollution and bushfire smoke specifically, can penetrate deep into the lungs, and into the blood stream, and increase the risk of a range of serious conditions, including heart attacks, strokes, cancers and respiratory diseases. Certain groups are at a greater risk or more vulnerable to these significant health impacts, including pregnant women, children, people with respiratory conditions and Indigenous Australians.

1.67 The committee is concerned that NSW Health did not emphasise the health impacts of exposure to any level of PM2.5 despite evidence from health professionals, including the Australian Medical Association (NSW) and Doctors for the Environment, that there is no threshold below which exposure to PM2.5 does not cause any health effects.

1.68 With the health risks well documented, this report is focused on the policy improvements and measures that can be implemented to enhance our response to the management of poor air quality in New South Wales. Our hope is that the recommendations contained in this report embed some of the lessons we have recently learnt, so that we can protect people from the harmful effects of air pollution, including dust storms and bushfire smoke.

Chapter 2 Monitoring and public information

This chapter examines two closely related policy areas - the monitoring of air quality and the provision of information and health advice to the public about air quality during times of hazard. In looking at these two areas, this chapter will consider ways in which we can enhance the measuring and reporting framework currently in place in New South Wales, with a focus on improving consistency, timeliness and the provision of more localised and helpful information to the public.

Enhanced measurement and monitoring

2.1 As a foundational step in mitigating the health risks of poor air quality in general, and bushfires in particular, many inquiry participants emphasised the need for enhanced measurement and monitoring of air quality on an ongoing basis. Specifically, inquiry participants advocated for an expansion of the air quality monitoring network, greater sampling of particulate matter and a move towards nationally consistent measurement and reporting.

Measuring and reporting framework

2.2 The Department of Planning, Industry and Environment (DPIE) operates the Air Quality Monitoring Network in New South Wales. According to the NSW Government, New South Wales has led air quality monitoring and reporting in Australia with the most comprehensive air quality calibration laboratory. It stated that this 'is the first near real-time air pollution alert system', with open access to air quality data. DPIE monitors, maps and forecasts air pollution, characterises the impacts of air pollution and develops an evidence base for improving air quality.[72]

2.3 As part of the Air Quality Monitoring Network, there are a number of air quality monitoring sites spread across the state. These sites act as early warning systems stations for potential air pollution events moving in from other jurisdictions, for example, dust events. Sitting alongside this is the Rural Air Quality Monitoring Program, run by DPIE, which is a citizen-science program that gathers data about dust storms to monitor wind erosion.[73]

2.4 Under the NSW Air Quality Forecasting Framework, also operated by DPIE, modelling systems are used to forecast air pollution in Sydney and the Greater Metropolitan Region up to 72 hours ahead. This system includes the capability for trajectory and plume modelling. All models are coupled with the Bureau of Meteorology's meteorological forecast system. The smoke modelling is used in parallel with the NSW Rural Fire Service's smoke modelling to assist in understanding the impacts of planned hazard reduction burns, particularly on large population centres.[74]

72 Submission 47, NSW Government, p 5.

73 Submission 47, NSW Government, p 8.

74 Submission 47, NSW Government, p 6.

Expansion of air quality monitoring across the state

2.5 The NSW Government operates a number of fixed air monitoring stations across New South Wales. The committee was provided with a list of where stations are located, included at Appendix 1.[75]

2.6 According to this list, there are 14 air quality monitoring sites in the Upper Hunter, 8 in the Lower Hunter and Central Coast, 3 in the Illawarra and 19 across Sydney. In terms of regional areas, there are air quality monitoring sites in Albury, Armidale, Bathurst, Tamworth, Wagga Wagga North, Narrabri, Goulburn, Gunnedah, Orange, Port Macquarie and Coffs Harbour. Further, there are 39 air monitoring stations in rural NSW, including in the Central West, Murray, Riverina, North Coast and North West regions of the state. Roadside monitoring along the Bradfield Highway in Sydney East is also undertaken.[76] See Figures 1 and 2.

2.7 Based on the list provided by the NSW Government, many of these stations, but not all, monitor particles less than 2.5 micrometres in diameter.[77] It is also worth noting that during the recent bushfire event, instead of reporting a 24 hour average, the department moved to the reporting of hourly-average PM2.5 concentrations.[78]

2.8 Also during the recent bushfire season, nine temporary stations were deployed at Batemans Bay, Coffs Harbour, Grafton, Lismore, Merimbula, Port Macquarie, Taree and Ulladulla. The NSW Government said that these were established at short notice to 'provide the community with near real-time information about local or transported smoke impact via the NSW Government air quality website'.[79] Several of these sites have been retained after the bushfires were extinguished.[80]

2.9 The NSW Government also advised that it has committed to the establishment of new monitoring stations in Sydney, Parramatta and Penrith, as well as to an expansion and upgrade of the Rural Air Quality Monitoring Network.[81]

2.10 This is consistent with the plans announced by the NSW Government committee at the Clean Air Summit in June 2017 in terms of expansion. The commitment at that time was also to:

- Monitor at a busy roadside location
- Expand the air quality monitoring network in regions, with additional monitors placed in towns along the Tablelands where wood smoke in winter is concern for residents

75 Answers to questions on notice, Department of Planning, Industry and Environment, 10 July 2020, Attachment 1.

76 Answers to questions on notice, Department of Planning, Industry and Environment, 10 July 2020, Attachment 1.

77 Answers to questions on notice, Department of Planning, Industry and Environment, 10 July 2020, Attachment 1.

78 Submission 47, NSW Government, p 7.

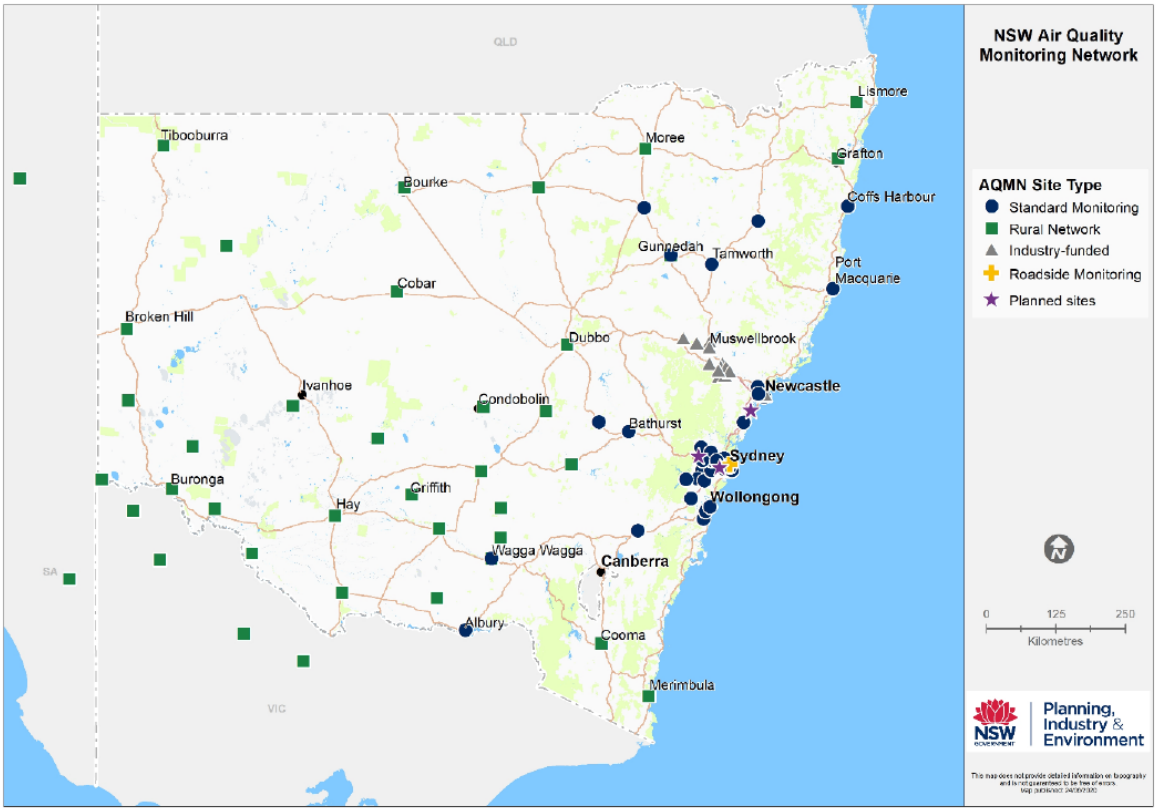
79 Submission 47, NSW Government, p 5.

80 Answers to questions on notice, Department of Planning, Industry and Environment, 10 July 2020, p 5.

81 Submission 47, NSW Government, p 5.

- Consider monitoring in the North Coast, such as at Coffs Harbour and Lismore, to better understand air pollution in these communities
- Establish a new North West network with monitoring stations at Gunnedah and Narrabri
- Integrate and expand the Community DustWatch network into the Rural Air Quality Monitoring Network.[82]

Figure 1 Station locations in the NSW Air Quality Monitoring Network[83]



82 Answers to questions on notice, Department of Planning, Industry and Environment, 10 July 2020, p 8.

83 Answers to questions on notice, Department of Planning, Industry and Environment, 10 July 2020, p 3.

Figure 2 Station locations in the Greater Metropolitan Region of New South Wales[84]

2.11 During the inquiry, several stakeholders called for the expansion of air quality monitoring stations in New South Wales, in order to provide more localised and useful information to the public.

[84] Answers to questions on notice, Department of Planning, Industry and Environment, 10 July 2020, p 4.

2.12 Doctors for the Environment Australia called for the monitoring of air quality to be enhanced through the establishment of more monitoring sites across New South Wales, especially in high risk areas:

> NSW for many years had Australia's best network of monitors, and the most open public access to current and historical data, with other states only recently catching up. This resource could be improved by more monitoring sites, especially at towns that host polluting industries with Lithgow and southern Lake Macquarie the most obvious blind spots. …
>
> Increasing monitoring stations would have several benefits – firstly to allow communities to know their local air pollution levels which helps in decision making with sports events, schools, outdoor work and individual choices in terms of their risk; and secondly to improve knowledge around the benefits of air pollution reduction measures and aid in further research opportunities. These monitors need to be situated in areas that both measure background levels, and also in populated air pollution hotspots. DEA has previously advocated for roadside monitoring in key hotspots that have likely high population exposure, such as next to busy roads.[85]

2.13 Similarly, Asthma Australia contended that there is a need to increase the number of air quality measuring stations in New South Wales, particularly in rural, regional and remote areas. It recommended this occur, even if temporary portable stations are used during periods of hazardous air quality:

> Consideration should be given to increasing the number of portable stations at times when there are extended periods of poor and hazardous air quality, even if these stations are not used in national reporting and are only available temporarily. This will help to provide localised information about air quality to people in areas with greater vulnerability to air pollution.[86]

2.14 The Menzies Institute for Medical Research with the University of Tasmania also recommended an expansion of the air quality monitoring network, calling for the 'increased density of air quality monitoring stations'.[87]

2.15 Associate Professor Fay Johnston, Founding Research Lead with the Environment Health Group at the Menzies Institute for Medical Research, acknowledged that New South Wales has been rapidly expanding its network but stated that 'there are still gaps'. She added that 'there are a lot of smaller towns where this issue is really crucial, where there still are not monitors'.[88]

2.16 Associate Professor Johnston stated that 'the current air quality monitoring network has inadequate reach, failing many vulnerable individuals in regional and remote areas who need access to air quality information to protect their health'.[89]

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85 Submission 24, Doctors for the Environment Australia, p 7.

86 Submission 46, Asthma Australia, p 8.

87 Submission 35, Environmental Health Group, Menzies Institute for Medical Research, University of Tasmania, p 2.

88 Evidence, Associate Professor Fay Johnston, Head of the Environmental Health Group, Menzies Institute for Medical Research, University of Tasmania, 12 June 2020, p 4.

89 Submission 35, Associate Professor Fay Johnston, Environmental Health Group, Menzies Institute for Medical Research, University of Tasmania, p 2.

2.17 According to Association Professor Johnston, there is value in even having low-cost sensors in some locations, as long as they are calibrated appropriately:

> There are different ways of monitoring. There are very low-cost sensors, which are less accurate, but they can work well if they are looked after properly and calibrated. That is actually a way to get huge reach for air quality monitoring. Then there are better calibrated and maintained but far more expensive reference monitors that government departments will be able to tell you a lot more about this afternoon. But between all those kinds of monitors, I think we can get actually very good population coverage. That is what we should be aiming for.[90]

2.18 Echoing these views, Environmental Justice Australia also recommended that the NSW Government 'expand the NSW air quality monitoring network to monitor in areas with particular risks to health from significant air pollution sources, such as at Lake Macquarie and Lithgow'.[91] It stated:

> Ambient air pollution monitoring and regulation must protect people wherever they live. This is especially so for people who live closest to heavily-polluting facilities such as coal-fired power stations and major roads. To accurately reflect population exposure, the NSW network of air quality monitors should be expanded to more effectively evaluate the exposure of communities vulnerable to frequent air pollution exposure. People have a right to know what they are breathing. All air pollution monitoring data must be made publicly available to community members via the web, allowing access to real-time and historical data.
>
> This expansion requires making monitoring requirements in high-risk areas mandatory rather than discretionary. In order to improve air quality and minimise the risk of adverse health impacts from exposure to air pollution, we must first understand what people are exposed to. This cannot be achieved if air pollution monitors are not installed in the areas where people are exposed to regular and high levels of air pollution.[92]

2.19 Environmental Justice Australia also highlighted how the air quality monitoring system installed in Katoomba, and three smaller locations near Lithgow, are temporary, despite being near two coal-fired power stations. It stated that '… this program is not permanent. Many members of the community would like to see permanent 24/7 air monitoring in the Lithgow region once the 12-month program comes to an end'.[93]

2.20 Based on mapping the Grattan Institute had undertaken in relation to locations where air quality monitoring is occurring, it posited that there are 17 monitors in Sydney and surrounds, with the remainder located in major towns. It contended that 'there is no PM2.5 monitoring in the state's west, where population density is low'.[94]

90 Evidence, Associate Professor Johnston, 12 June 2020, pp 5-6.

91 Submission 44, Environmental Justice Australia, p 13.

92 Submission 44, Environmental Justice Australia, p 16.

93 Submission 44, Environmental Justice Australia, pp 16-17.

94 Submission 38, Grattan Institute, p 5.

2.21 At a hearing, Dr Stephen Duckett, the Health Program Director from the Grattan Institute, highlighted these gaps:

> You can see that there are almost zero in the west of the State, and also not many along the Great Dividing Range. Especially in the south, in the south-east of the State, where there is extensive forestation, there are not very many air quality monitors.[95]

2.22 Councillor Jess Miller from the City of Sydney Council called for air quality to be monitored at 'street level' from numerous sites within local communities, so that local government is better able to limit and respond to air pollution:

> The community does not trust the current methodology used by the NSW EPA to measure air quality because it only measures ambient air quality and not what they are breathing at a human level where pollution is present … Without accurate air pollution monitoring at the street level, roadside, on construction sites, in classrooms, childcare centres and among vulnerable communities the City of Sydney is severely limited in what we can do at a local level to counter these negative effects and mitigate the health risks and financial and reputation costs of polluted air …[96]

2.23 In response to stakeholders concerns, the committee explored with government representatives the extent of the air quality monitoring network in New South Wales, the plans for expansion and the framework for determining new locations for air monitoring stations.

2.24 Mr Matthew Riley, Director, Climate and Atmospheric Science, Environment Energy and Science Group, Department of Planning, Industry and Environment, advised the committee that New South Wales has the 'largest air quality monitoring network', with 92 air quality monitoring stations spread throughout the state. Mr Riley added that the NSW Government also maintains some monitoring stations across the border in South Australia and Victoria 'so that we can be pre-warned of when dust storm events are likely to impact the State'.[97]

2.25 Mr Riley rejected the notion that a majority of the stations are in metropolitan Sydney, Wollongong and Newcastle. He also disagreed that there are not any stations beyond the Great Dividing Range, commenting that that 'west of the range are more than 50 monitoring stations'.[98]

2.26 On the issue of expansion, including plans for the future, the NSW Government noted:

> The recent expansion of the NSW air quality monitoring network (AQMN) is a result of multiple factors that increase the need for enhanced data and information on air quality in NSW, such as population and industry growth, Government development planning and land use, changing community expectation and Government commitment for improving air quality management in NSW.

95 Evidence, Dr Stephen Duckett, Health Program Director, Grattan Institute, 12 June 2020, p 4.

96 Submission 49, Ms Jess Miller, Councillor, City of Sydney Council, p

97 Evidence, Mr Matthew Riley, Director, Climate and Atmospheric Science, Environment Energy and Science Group, Department of Planning, Industry and Environment, 12 June 2020, p 28.

98 Evidence, Mr Riley, 12 June 2020, p 28.

> The expansion delivers on the Government's commitments to new air quality monitoring stations in a number of metropolitan and regional locations at the Clear Air Summit in June 2017 and was a key part of the Government's immediate response to the recent 2019–2020 bushfires.[99]

2.27 The NSW Government also stated that it 'regularly assesses air quality monitored needs and will consider the needs of communities in the next Air Quality Monitoring Plan, due in 2020'.[100]

2.28 In terms of the framework for determining the location of new monitoring sites, the committee was advised that the process is guided by 'objectives, principles, regulations and standards for air quality monitoring', as described in the NSW Air Quality Monitoring Plan. This plan, due to be released late 2020, will address findings from a number of reviews undertaken in relation to the air monitoring network.[101]

2.29 During a hearing, Mr Riley noted that the Department is also guided in the design of air quality monitoring networks by the National Environment Protection (Ambient Air Quality) Measure (NEPAM). This sets population thresholds that inform the 'likely amount of monitoring required within a certain air shed or a certain community'. Beyond this, other factors are considered, including the needs of a community, sources of air pollution within that community, their likely size and community impacts.[102]

2.30 Reflecting on the population thresholds set by NEPAM, Mr Riley noted that the Department had led a review of how other jurisdictions set population thresholds for monitoring need. Reporting how favourable the outcomes of this review were, Mr Riley stated:

> In essence what it [the review] found is that the population thresholds set by the Australian National Environment Protection (Ambient Air Quality) Measure were the strictest in the world. We require more monitoring per head of population than basically any other jurisdiction or indeed any of the eight jurisdictions we reviewed as part of that review work.[103]

Enhanced sampling and differentiation of the types of particulates

2.31 In addition to calls for an expansion in the air quality monitoring network across New South Wales, there were also calls for increased sampling of particulate matter in the air, to identify the source of pollution, for example, whether it originates from coal-fired power stations, automobiles, dust storms or bushfires. The benefits of doing this in terms of managing the health impacts associated with poor air quality were highlighted to the committee.

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99 Answers to questions on notice, Department of Planning, Industry and Environment, 10 July 2020, p 5.

100 Answers to questions on notice, Department of Planning, Industry and Environment, 10 July 2020, p 6.

101 Answers to questions on notice, Department of Planning, Industry and Environment, 10 July 2020, p 6.

102 Evidence, Mr Riley, 12 June 20202, p 31.

103 Evidence, Mr Riley, 12 June 20202, p 31.

2.32 The Australian Nuclear Science and Technology Organisation (ANSTO) explained the importance of differentiating the types and sources of particulate matter in the air:

> Public perception is that visibly bad pollution days during the fire seasons are largely due to the smoke. However, ANSTO research shows there may be other sources such as dust or topsoil (often present during bushfire seasons because of dry and windy conditions) that may contribute. Differentiation of the types and sources of particulates, particularly during times of significantly elevated levels of air pollution, is important in managing the health risks associated with bushfire conditions.[104]

2.33 ANSTO advised that there are nine long term sampling sites around NSW, most of which are located in Sydney and the Hunter:

> There are nine long-term Australian sampling sites with continuous bi-weekly data from 1998 to the present - at Warrawong, Mascot, Lucas Heights, Richmond, Liverpool, Mayfield, Stockton, Muswellbrook and Cape Grim. As can be seen, eight of those sites are located in Sydney, the Illawarra or the Hunter Valley. Research and industry partners include BHP, Alcoa, some State EPAs, mining companies in the Hunter Valley and local councils in Sydney and Newcastle.[105]

2.34 Reflecting on ANSTO's work with the NSW Office of Environment and Heritage and the NSW Environment Protection Authority in this area, including major PM2.5 pollution studies in the Upper Hunter, Lower Hunter Greater Sydney Basin and Canberra, ANSTO suggested that a NSW Aerosol Sampling Program be developed. In its view, this 'would be the most effective approach in advancing the NSW approach to air quality' and could be achieved by expanding the existing ANSTO network of sampling stations to include locations in regional NSW. ANSTO explained the benefits of this program:

> The management of sampling sites is typically low maintenance, and therefore could be undertaken by a local farmer, business, council or mining representative who has received the relevant half-day training by ANSTO staff. Expanding to a state-based program would facilitate greater connectivity into regional and rural areas throughout NSW, working with locals and enabling coverage of the entire state in the management and understanding of air quality.
>
> A NSW-wide Aerosol Sampling Program would enable analysis of a wider range of samples, improving understanding of the impact of natural disasters and fires, as well as man-made pollutants, on air quality throughout the state. These types of results would provide health experts and policy makers with the information required to make informed decisions in response to the environmental and health impacts of extreme climate events. These results could also be used to inform proactive mitigation strategies for future fire seasons and drought periods.[106]

104 Submission 33, Australian Nuclear Science and Technology Organisation, p 4.

105 Submission 33, Australian Nuclear Science and Technology Organisation, p 5.

106 Submission 33, Australian Nuclear Science and Technology Organisation, p 5.

2.35 ANSTO went on to suggest that state wide sampling would enable comprehensive reporting to government:

> ANSTO collects and keeps comprehensive records related to the Aerosol Sampling Program, the majority of which are made publically available through an online ANSTO database and the Australian National Data Service. This includes monthly summary sheets for a number of sampling sites in Australia and across Asia, with historical records dating back to 2001. This data can be supplied to support NSW Government reporting and analysis. However, as noted above, it would become even more valuable if a state-wide sampling program was established. This would support comprehensive reporting for Government, as well as public communications, and would complement the EPA's current ability to provide near real-time data on concentrations of PM2.5 particles.[107]

2.36 Professor David Cohen, Distinguished Research Scientist, Nuclear Science and Technology and Landmark Infrastructure, Australia Nuclear Science and Technology Organisation, explained that 'long-term sampling' is important, given particles can 'hang around for days and weeks'. He highlighted how the particles from the bushfires 'took three weeks to go around the globe and come back again'.[108]

2.37 When appearing before the committee, Professor Cohen also emphasised the importance of not only measuring air quality but understanding 'what is in the mass'. He noted that in the Hunter Valley a two year study was conducted which looked at the air quality and even though they had coal trains and dust, sampling showed the particulate matter originated instead from smoke from domestic burning. He stated:

> That was a real lesson in understanding what is actually in the air and which ones might be related to health. I think these two aspects are very important—to have the instantaneous turnaround, but also to understand what the composition is and what we are working with. That will help the health people.[109]

2.38 Another example was also provided, relating to black carbon and how it can originate from different sources, including bushfires and diesel vehicles. Professor Cohen explained that it is important to distinguish black carbon in this regard, given the health impacts of 'fine fractions' of black carbon from bushfires.[110]

2.39 Professor Guy Marks, Chief Investigator and Head, Centre for Air pollution, energy and health Research, also emphasised the importance of understanding fine particles from a health perspective:

> Fine particles that can enter the lower respiratory tract are important for health. Much of what we know about the adverse health effects of fine particles comes from the particles that Professor Cohen was referring to, mainly from combustion and fossil fuels—in other words, urban ambient air pollution, which is from traffic and from

107 Submission 33, Australian Nuclear Science and Technology Organisation, pp 5-6.

108 Evidence, Professor David Cohen, Distinguished Research Scientist, Nuclear Science and Technology and Landmark Infrastructure, Australia Nuclear Science and Technology Organisation, 12 June 2020, p 11.

109 Evidence, Professor Cohen, 12 June 2020, p 12.

110 Evidence, Professor Cohen, 12 June 2020, p 12.

> power stations and in other industrial processes. The fine particles that are coming from bushfire smoke are obviously a different source. What we know so far is that they have relatively similar adverse health effects, but most of the data we have is from traffic-related and industry-related air pollution. We need more data actually about the adverse health effects of the fire smoke-related fine particles.[111]

2.40 Professor Marks also provided evidence about the availability of low cost sensors that 'are now able to be deployed quite widely and give us much more nuances in spatial and temporal resolution on the distribution of the particles'. He explained the benefits of this:

> This together with data science and mapping technology—including information from satellites—is enabling us to get a much better picture of what the distribution of air pollution is over space and time, in real time, than we used to have. I think we need to invest further in this technology and make use of it, both for informing the general community, and for informing government agencies and other stakeholders in this process. There is much better capacity now to have knowledge about the quality of the air that we are breathing.[112]

2.41 Dr Suzanne Hollins, Head of Research at ANSTO, contended that there are benefits to having a collaborative and coordinated approach to sampling, as ANSTO can assist with the collection and analysis of data, which can then be provided to health experts to help understand the health effects.[113]

Nationally consistent measurement and reporting

2.42 Nationally consistent air quality standards under the National Environment (Ambient Air Quality) Protection Measure guide jurisdictional policy on air pollution. The National Environment Protection Council set these standards and assess and report on the implementation and effectiveness of the measures in participating jurisdictions.[114]

2.43 Against this national framework, each jurisdiction is responsible for monitoring and managing air quality against these standards. In this regard, the NSW Environment Protection Authority (EPA) and DPIE play a significant role.

2.44 As outlined earlier, DPIE runs a comprehensive air quality network and program to monitor, map and forecast air pollution, characterise the impacts of air pollution and develop an evidence base for improving air quality. The EPA has a regulatory role, focusing on compliance and enforcement.[115]

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111 Evidence, Professor Guy Marks, Chief Investigator and Head, Centre for Air pollution, energy and health Research (CAR), 12 June 2020, p 12.

112 Evidence, Professor Marks, 12 June 2020, p 15.

113 Evidence, Dr Suzanne Hollins, Head of Research, Nuclear Science and Technology and Landmark Infrastructure, Australia Nuclear Science and Technology Organisation, 12 June 2020, p 15.

114 National Environment Protection Council, *National Environment Protection (Ambient Air Quality Measure),* http://www.nepc.gov.au/nepms/ambient-air-quality

115 Submission 47, NSW Government, p 5.

2.45 The committee heard from several stakeholders that greater consistency across jurisdictions is needed, particularly in terms of air quality monitoring and reporting. Even though there are national measures, Asthma Australia called for a nationally consistent approach, noting that 'there are variations in the way in which jurisdictions report on air quality data'. For example, in relation to the interval in which air quality is reported, the terminology and thresholds used to describe the different categories of air quality and what is being measured.[116]

2.46 Asthma Australia recommended that environment ministers develop a uniform approach to measuring and reporting air quality, including separating out PM2.5 in reporting of air quality data, requiring PM2.5 to be reported as an hourly average, the use of consistent terminology and measures to describe categories of air quality and stronger compliance measures.[117]

2.47 It also called for the NSW Chief Health Officer to work with the Commonwealth Chief Medical Officer and counterparts in other jurisdictions 'to develop a national policy framework to guide institutional responses relating to air quality protection'.[118]

2.48 Given the health risks posed by small particulate matter, Asthma Australia stated:

> We think it is time, especially given the crisis, that the standards be revisited, the standard at which you would assess whether or not there is exceedance and the actions to enforce where there are exceedances.[119]

2.49 The Clean Air Society of Australia and New Zealand also emphasised that enhanced measurement and monitoring will improve the public's access to real time data, which will in turn improve public awareness and enable community members to reduce their exposure:

> During the bushfire event, regular monitoring of air pollutants was carried out to trigger action to reduce pollution exposure. It is important to maintain and extend these measurements, monitoring and reporting so that the all the Australian public has access to real-time data informing them of all sources of localised air pollution sources in a manner that is consistent across Australian jurisdictions. This will further enhance public awareness on the relevance of air monitoring data and enable action to reduce air pollution exposures.[120]

2.50 Two particular areas of difference in air quality measurement and reporting were discussed during the inquiry. The first related to jurisdictional differences in the reporting of air quality, with jurisdictions using either a 24 hour average or hourly reporting method. The second related to the rating system being used in each jurisdiction to describe levels of air quality.

116 Submission 46, Asthma Australia, p 7.

117 Submission 46, Asthma Australia, pp 7-8.

118 Submission 46, Asthma Australia, p 6.

119 Evidence, Ms Michele Goldman, Chief Executive Officer, Asthma Australia, 10 June 2020, p 7.

120 Submission 43, Clean Air Society of Australia and New Zealand, p 4.

2.51 On the first of these points, several inquiry participants highlighted the benefits of having hourly reporting, including Asthma Australia, Associate Professor Fay Johnston, Head of the Environmental Health Group, Menzies Institute for Medical Research, University of Tasmania and Dr Ben Ewald, Convenor, Special Interest Group on Air Pollution, Doctors for the Environment.[121]

2.52 The committee also heard how the use of different descriptors for categories of air quality can be problematic, particularly for areas on the border between jurisdictions. The Grattan Institute highlighted the different air quality categories used in NSW in comparison to the ACT. In the ACT, ACT Health use the following categories to describe air quality: Good, Standard, Unhealthy (Sensitive Groups), Unhealthy (for all), Very unhealthy for all, Hazardous High, Hazardous Extreme. In NSW, the Department of Planning, Industry and Environment use an Air Quality Index that categorises air quality by these ratings: Very good, Good, Fair, Poor, Very poor and Hazardous.[122]

2.53 Dr Stephen Duckett, Health Program Director at the Grattan Institute, called for a consistent rating system in air quality to apply across the country, given problems that can occur at the borders between states. He stated:

> My preference would be that you have the same system, but I could understand why different jurisdictions might argue for different ones. But I think this is the case where jurisdictional agreement on what the best categorisation would be would be a good thing.[123]

Improved public health information and advice

2.54 Many participants highlighted the need for enhanced health messages to the public at times of high risk, in order to assist individuals to manage the health impacts of poor air quality. It was understood that this was predicated on having more localised data gathered via an enhanced network of monitoring stations and improved overall consistency in monitoring and reporting.

The current approach

2.55 As discussed in the last section, the Air Quality Monitoring Network across the state measures air quality at various locations. This information is reported via a number of ways, including on the NSW Government air quality website, which provides daily forecasts for Sydney and near real-time information for other regions where air quality is monitored. Members of the public can sign up to receive a daily SMS or email with air quality ratings and forecasts.[124]

121 Submission 46, Asthma Australia, p 7; Evidence, Associate Professor Johnston, 12 June 2020, p 7; Evidence, Dr Ben Ewald, Convenor, Special Interest Group on Air Pollution, Doctors for the Environment, 10 June 2020, p 26.

122 Submission 38, Grattan Institute, p 10.

123 Evidence, Dr Duckett, 12 June 2020, p 3.

124 Submission 47, NSW Government, p 7.

2.56 Currently, air quality information is provided in a colour coded Air Quality Index that displays levels of observed air pollution against national standards. The NSW Government explained:

> An AQI of 100 or more (POOR) indicates that air pollution has exceeded national standards and triggers air quality alerts. When values exceed 200, air quality is reported as HAZARDOUS. The other main categories are VERY GOOD (0-33), GOOD (34-66) and FAIR (67-99).[125]

2.57 It also advised that NSW Health provides a range of health information and advice to assist people to make decisions about how to manage their health and reduce exposure to poor air quality. Some of the messages given during periods of poor or hazardous air quality are outlined below:

- Follow medical advice about medicines and asthma management, and keep reliever medication close at hand.
- Monitor air quality and health messages available on the NSW Department of Planning, Industry and Environment website.
- Avoid vigorous outdoor activity when conditions are smoky.
- Spend more time indoors with doors and windows shut to keep out smoke. Open windows and doors when smoke clears to reduce smoke that may have entered the home.
- Spend time in air-conditioned venues such as cinemas, libraries and shopping centres.
- Avoid indoor sources of air pollution such as cigarettes, candles and incense sticks.
- P2 face masks can filter out PM2.5 from smoke when worn correctly. To be effective, a P2 face mask must maintain a good seal with the face.
- Air purifiers with a high efficiency particle (HEPA) filter can reduce PM2.5 indoors. For the air purifier to work well, the purifier must be appropriate for the size of the room and the room should be well sealed.[126]

2.58 NSW Health stated that 'these measures are generally low cost and likely to reduce exposure'.[127]

2.59 A key point to note in relation to the Government's provision of information is the recent transition to hourly reporting of air quality levels. As noted earlier, during the recent bushfire season, changes were made to allow for the reporting of hourly-average PM2.5 concentrations on the NSW Government's air quality website.[128]

2.60 The committee also heard that a number of additional strategies were used during the recent bushfire season to provide information to the public about air quality. For example, NSW Health used general and social media channels to provide information messages and videos, particularly targeted to groups at higher risk from exposure to air pollution. Some of this was provided by local health districts. Further, NSW Health provided specific information about air pollution and health to general practitioners, pharmacists and local health districts, and to the

125 Submission 47, NSW Government, p 7.

126 Submission 47, NSW Government, p 4.

127 Submission 47, NSW Government, p 4.

128 Submission 47, NSW Government, p 7.

NSW Department of Education, in order to provide information relevant to schools and child care centres.[129]

2.61 More specifically for smoke events, the committee was advised that NSW Health follows the *Public Health Response to Prolonged Smoke Events* guidelines, which were published on 1 June 2017. Dr Richard Broome, Acting Executive Director, Health Protection NSW, provided some context to how these guidelines inform the health advice and information provided during times of hazardous air quality:

> … But broadly, the idea is that if you know that people are going to be exposed for a more prolonged period of time to a certain level of air pollution, the level of guidance increases. For example, our first level is to say—and I have to refer to the table—if you are outdoors or if you are in a high-risk category you should reduce outdoor physical activity.
>
> The second level, which is moderate, and I believe that would have been the category that we were in for most of the time during the prolonged event, if you look at the numbers or calculated the numbers, it is to increase that level of information to try and sort of support people in a more prolonged situation. For example, it advises people to take advantage of periods of time when the air is clear to aerate your house. So it is increasing the level to avoid indoor sources of air pollution, those kind of things. Then there is a higher level, which is when we think the risk is greater than one per 10,000, which talks about rescheduling outdoor events. Most of these we did actually start to provide this advice as well fairly early on in the event. So it is a gradual escalation, I suppose, of the response based on the prolonged nature of the event and not just what it is on a particular day.[130]

2.62 Dr Broome expanded on the use of these guidelines, particularly given the prolonged bushfire event in 2019-20 and the large expanse of bushfires experienced across the state:

> This is a guideline; we referred to it throughout and I would say—I do not know how many times this has been used in the past, but it was designed around, I guess, a more specific situation where you might have a point source of pollution. So there are some challenges to the application of this guideline in a bushfire event when essentially there are very, very large areas of exposure—for example, the advice to relocate within New South Wales could be challenging. Having said that, we were mindful of the guidance and we followed it, tailoring it to the situation that was facing us at the time.[131]

More consistent, timely and helpful information

2.63 To assist in managing the health impacts associated with poor air quality, the committee heard that there needs to be greater consistency in terms of health information and messaging, and in particular more timely, helpful and nuanced messaging and health advice.

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129 Submission 47, NSW Government, p 8.

130 Evidence, Dr Richard Broome, Acting Executive Director, Health Protection NSW, Health NSW, 15 July 2020, p 3.

131 Evidence, Dr Broome, 15 July 2020, p 3.

2.64 In terms of improving consistency, several stakeholders connected this issue to jurisdictional differences which can create confusion in terms of the messages given to the public, as well as the importance of ensuring health information and advice during periods of poor air quality do not conflict. Generally, views put forward on this point were connected to the need for nationally consistent air quality measurement and reporting, previously discussed in paragraphs 2.42 – 2.53.

2.65 For example, Asthma Australia highlighted as an ongoing issue inconsistencies in the health information provided to the community during times when air quality is poor or hazardous. It advised that while NSW and the ACT provide health information and advice alongside air quality data, other jurisdictions do not.[132]

2.66 Reflecting on the differences between the ACT and NSW, particularly for people at the border affected by the same bushfire smoke, Dr Stephen Duckett, Health Program Director, Grattan Institute, noted:

> The air quality in the ACT was worse than that in New South Wales. The staggering thing is that the advice to residents of the ACT and the advice to residents of Queanbeyan was totally different, even though there is a bus that goes from one to another. What we are trying to show there is that you can be much more nuanced in the provision of information to the public.[133]

2.67 Showing that ACT Health provided more detailed guidance for high air pollution days, in Figure 3, the Grattan Institute called for guidance to be provided in a range of ways, including on:

- how to minimise air pollution in the home during short and long term exposure periods
- the types of face masks to be used and when they should be used (discussed in chapter 3)
- how to minimise exposure to air pollution if staying at home is not possible
- advice to employers, schools and other organisations about reducing exposure risks, including whether outdoor activity should be prohibited.[134]

2.68 On the issue of consistency, the Centre for Air pollution, energy and health Research contended that the messaging to community members during the recent bushfires was inconsistent, largely because the real life effectiveness on ways for individuals to protect themselves is poorly understood:

> During the 2019-20 bushfire season, the community was provided with inconsistent messages on ways to protect themselves from bushfire smoke. This is largely because the effectiveness, particularly in real-world settings, of these interventions is still unknown. All suggested strategies have advantages, disadvantages and unknowns that must be clearly communicated to the public to allow informed decision making.

132 Submission 46, Asthma Australia, pp 8-9.

133 Evidence, Dr Duckett, 12 June 2020, p 3.

134 Submission 38, Grattan Institute, p 11.

> For example, some authorities recommended wearing face masks and members of the public did resort to using both surgical and P2/N95 masks. However, CAR did not recommend the use of face masks.[135]

2.69 The Centre for Air Pollution, energy and health Research stressed the need for effective public health messaging, stating:

> In the 2019-20 bushfire season, communities received messaging which was inconsistent and not sufficiently nuanced for different groups in the community. CAR believes that public health communication should be timely, consistent across jurisdictions, nuanced and easily accessible and digestible.[136]

Figure 3 ACT Health advice from February 2020[137]

Health advisory categories	$PM_{2.5}$ (24 hour) µg/m3	Potential health effects without following advice or actions	Cautionary health advice/actions**
Good	0-8.9	N/A – Below the relevant air quality standard	None
Meets air quality standard	9-25.9	N/A – Meets the relevant air quality standard	No tailored advice necessary
Unhealthy for sensitive groups	26-39.9	Symptoms may occur in sensitive groups	**Sensitive groups[#] should reduce prolonged or heavy physical activity. Where possible, these people in the community should also limit the time spent outdoors** Anyone with a heart or lung condition should take their medication as prescribed by their doctor. People with asthma should follow their asthma action plan. Anyone with concerns about their health should seek medical advice from their doctor. Anyone experiencing wheezing, chest tightness or difficulty breathing should seek urgent medical attention
Unhealthy for all	40-106.9	Increased likelihood of effects for sensitive groups Symptoms may occur in the general population	**Everyone should reduce prolonged or heavy physical activity** **Sensitive groups[#] should avoid prolonged or heavy physical activity altogether** Anyone with a heart or lung condition should take their medication as prescribed by their doctor. People with asthma should follow their asthma action plan. Anyone with concerns about their health should seek medical advice from their doctor. Anyone experiencing wheezing, chest tightness or difficulty breathing should seek urgent medical attention
Very unhealthy for all	107-177.9	Significant likelihood of effects for sensitive groups Symptoms among general population common	**Everyone should avoid prolonged or heavy physical activity** **Sensitive groups[#] should avoid all physical activity outdoors** Anyone with a heart or lung condition should take their medication as prescribed by their doctor. People with asthma should follow their asthma action plan. Anyone with concerns about their health should seek medical advice from their doctor. Anyone experiencing wheezing, chest tightness or difficulty breathing should seek medical attention
Hazardous high	>177.9	Serious likelihood of effects for sensitive groups Symptoms among general population very common	**Everyone should avoid all physical activity outdoors** **Sensitive groups[#] should temporarily relocate to a friend or relative living outside the affected area. If this is not possible, remain indoors and keep activity levels as low as possible** Anyone with a heart or lung condition should take their medication as prescribed by their doctor. People with asthma should follow their asthma action plan. Anyone with concerns about their health should seek medical advice from their doctor. Anyone experiencing wheezing, chest tightness or difficulty breathing should seek medical attention Anyone experiencing symptoms which may be due to smoke exposure should consider taking a break away from the smoky conditions
Hazardous extreme	> 250	Serious likelihood of effects for sensitive groups Symptoms among general population very common	**Cautionary health advice and actions are the same as for Hazardous high above**

Source: ACT Health (2020)

135 Submission 34, Centre for Air pollution, energy and health Research (CAR), p 6.

136 Submission 34, Centre for Air pollution, energy and health Research (CAR), p 8.

137 Submission 38, Grattan Institute, p 11.

2.70 Several other inquiry participants expressed similar views, and emphasised the importance of having direct, helpful and clear health information and advice on air quality risks, particularly during hazardous events. For example, the Grattan Institute stated:

> The NSW DPIE should actively communicate these air quality risks with the public. This should include targeted, direct messaging to sensitive groups on days with forecasted dangerous air quality. The current system of direct messaging offered by NSW DPIE is commendable, but requires people to opt-in. If uptake of this service is low, alternative methods of delivery should be tried. The messages should be targeted and tailored to at-risk groups. Messages to people with asthma should provide different relevant information than to pregnant women.
>
> There should also be clear communication about air quality *before* planned hazard reduction burns which have been shown to increase PM2.5 significantly.[138]

2.71 Asthma Australia also highlighted limitations to the advice that was provided during the bushfire season in relation to bushfire smoke, including:

- the health advice being unsuitable for sustained periods of poor and hazardous air quality, as people need to go to school or work
- the health advice relies on a person's ability to read, understand and interpret air quality data, and the ability of people to do this will vary considerably
- no advice that refers to medical preventative strategies, specific risk predictions and advice targeted at specific at risk groups in the community
- there were questions in the media about the efficacy of P2 masks in protecting people from bushfire smoke, given their effectiveness can depend on facial fit.[139]

2.72 According to Ms Michele Goldman, Chief Executive Officer, Asthma Australia, improvements could be made in terms of the level of information available to the public about air quality and the accessibility of this information. She contended that the data needs to be accessible via mobile phones and that there needs to be another layer of detail to the reporting, which gives greater guidance to those who really need it. Ms Goldman discussed the AirRater App as an example, highlighting how this type of tool, where people can record health symptoms as well, may assist to create a 'mega dataset'. She explained:

> Over time what AirRater is trying to do is develop an algorithm so it learns when you have symptoms and it can correlate, "at this level of air quality, you are going to experience symptoms." It can then be proactive in giving you messages like "avoid going outside today" or "avoid exercising today". We think that is the way forward. The bushfire crisis should accelerate investment in really useful research and health education information tools like this.[140]

2.73 Both the National Asthma Council of Australia and Asthma Australia highlighted as a policy priority the need to 'provide timely and appropriate information on air quality, including approaches to reduce the risk of adverse health impacts from exposure to poor air quality'.[141]

138 Submission 38, Grattan Institute, p 11.

139 Submission 46, Asthma Australia, pp 9-10.

140 Evidence, Ms Goldman, 10 June 2020, p 6.

141 Submission 37, National Asthma Council Australia, p 1; Submission 46, Asthma Australia, p 6.

2.74 The Australian Medical Association (NSW) concurred that more specific, timely and relevant information would be of benefit to those requiring advice by enabling them to proactively plan their activities in a way that minimized their exposure:

> Giving residents more specific information regarding air quality forecasts and patterns of PM2.5 concentrations would help people to plan their daily activities and exercise to coincide with lower levels of smoke exposure.[142]

2.75 Dr Danielle McMullen, President of the Australian Medical Association, stated:

> Communication is key in protecting the health of New South Wales residents. We think that information must be timely and relevant for different populations, taking into account their differing ability to use electronic technologies. Specific information regarding air quality forecasts and pattern of PM2.5 concentrations would help people make decisions about their outdoor activities and workplace risks.[143]

2.76 The Australian Medical Association (NSW) also noted that the communication of health messages to community members must be timely and relevant for different populations, especially at risk groups.[144] In addition, it cautioned that, 'It's important to recognise information in electronic media may not reach groups such as older people, and therefore a means of more effective communication targeting that population is necessary'.[145]

2.77 With regard to the content of messages, the Australian Medical Association (NSW) further noted that the input of health professionals is essential:

> Coordination with health professionals is necessary to ensure early warning systems incorporate relevant information, such as preventative health and protective actions, and are communicated appropriately.[146]

2.78 The Australian Medical Association (NSW) also reflected that the advice to stay indoors for long periods is impractical and ultimately unhelpful because many people must work outside, while others are unable to access optimal indoor environments:

> Advising residents – particularly outdoor workers – to stay indoors is impractical for long periods of time, as it limits a range of necessary daily activities. As well, it impacts on residents' ability to exercise, particularly those without access to indoor sports facilities.
>
> Furthermore, advising NSW residents to stay indoors is also made problematic due to the housing construction in Australia – with older homes allowing bushfire smoke to leak indoors over time creating unhealthy indoor air quality conditions. Modern apartments, shopping centres, new office buildings, and some public places such as libraries, typically have well sealed, air conditioned environments; however, these are not accessible to all residents – particularly those with restricted mobility or older residents. Other measures, such as temporarily relocating vulnerable groups to safe

142 Submission 31, Australian Medical Association (NSW), p 9.

143 Evidence, Dr Danielle McMullen, President, Australian Medical Association (NSW), 10 June 2020, p 24.

144 Submission 31, Australian Medical Association (NSW), pp 6 and 9.

145 Submission 31, Australian Medical Association (NSW), p 7.

146 Submission 31, Australian Medical Association (NSW), p 6.

> indoor locations could be impractical for large population centres, expensive and potentially stressful for residents.[147]

2.79 This issue was also highlighted by Professor Marks from the Centre for Air Pollution. He stated:

> I think the issue around the messaging is that we need to investigate better ways of informing the community about what is going on during the bushfires. Part of our problem was there was a lot of uncertainty in what messages we wished to convey, and this really comes back to what I said in my introduction that this was a first-ever event such as this and so we were trying to extrapolate from short-term exposures that had happened with previous bushfires, and much of the advice was difficult to translate to very long periods of time. For example, we were giving people advice like stay indoors and do not exercise. That might make sense when the bushfires are operating and the smoke is around for one day, but it is very difficult to sustain that when it is going for three months. So I think that is what we were referring to in that part of the submission, the fact that we really need better quality of evidence about what advice to give and then be consistent.[148]

2.80 With regard to improving the provision of information to target groups, the Clean Air Society of Australia and New Zealand noted that there is an evidence base for the effectiveness of widespread public health warnings. It called for future warnings to target high risk groups, and include advice on effective strategies, which themselves need ongoing research with regard to efficacy:

> Research of pollution events that were accompanied by widespread public health warnings indicates these warnings were successful in reducing the associated disease burden (Morgan et al., 2010, Barnett et al., 2012). Future warnings that specifically target the most vulnerable groups and provide constructive advice on best mitigation strategies are of likely to be of key importance. In order to achieve this and ensure the advice is indeed constructive, further research and innovation is required, particularly with respect to reducing the indoor penetration of air pollution and the provision of practical effective options such as 'clean air shelters'.[149]

2.81 Observing that, 'specific information for pregnant women exposed to bushfire smoke over the summer 2019-20 was limited', the Royal Australian and New Zealand College of Obstetricians and Gynaecologists observed that it is important that messages also be sensitive to the possibility of raising anxiety:

> RANZCOG considers that it is vital that women be informed of potential dangers and steps that they can take to protect themselves and their children. However, given that the steps that can be taken are essentially limited to staying indoors in a sealed environment, and avoiding other sources of air pollution, it is also important to avoid creating unnecessary anxiety. It should be recognised that, as an isolated variable, the adverse consequences of air pollution exposure in pregnancy are relatively minor for most women – less marked than the consequences of cigarette smoking in pregnancy, for example.[150]

147 Submission 31, Australian Medical Association (NSW), p 6.

148 Evidence, Professor Marks, 12 June 2020, p 9.

149 Submission 43, Clean Air Society of Australia and New Zealand, p 4.

150 Submission 30, Royal Australian and New Zealand College of Obstetricians and Gynaecologists, p 4.

2.82 The importance of having air quality information in 'real time' was also highlighted. On this aspect, the Menzies Institute for Medical Research at the University of Tasmania discussed the development of the AirRater App which 'supports vulnerable sectors of the community to reduce their exposure to environmental health hazards by providing local information in near-real time'. It explained that this included the provision of hourly PM2.5 pollution information from government monitoring networks.[151]

2.83 The Menzies Institute advised that the app, which is currently funded to operate in Tasmania, ACT and Northern Territory[152] was downloaded by more than 30,000 residents of NSW, primarily in Sydney, and suggested that this demonstrated 'strong public demand for easily accessible, near-real time air quality information'. It told the committee that, 'Our team was inundated with hundreds of emails from individuals seeking personal advice and support, and in addition, we were contacted by numerous organisations, including the Maritime Union of Australia, the Transport Workers Union and multiple sporting bodies, all in need of health protection decision-making advice'. [153]

2.84 Correspondingly, the Menzies Institute recommended the provision of timely air quality information and support for tools, such as apps, to make environmental information such as real time air quality and air quality forecasts readily accessible to community members. It also recommended the provision of nationally consistent air quality information.[154]

2.85 Associate Professor Johnston also reflected on the value of AirRater, and agreed that 'we need better information for the public and for the workers, more monitors, information in real time, and good forecasts. She stated:

> It needs to be accessible and understandable to the public. We also need community education. Everybody is different. There is a lot of complexity with the health advice we give. Simple advisories based on simple thresholds do not quite capture it. We need a much more systematic way of doing it.[155]

Greater education and awareness

2.86 In addition to having more timely, consistent and helpful public information about air quality levels and the potential health impacts, stakeholders also discussed the need for greater education and awareness in the community more broadly.

151 Submission 35, Environmental Health Group, Menzies Institute for Medical Research, University of Tasmania, pp 1-2.

152 Submission 34, Centre for Air pollution, energy and health Research (CAR), pp 7-8.

153 Submission 35, Environmental Health Group, Menzies Institute for Medical Research, University of Tasmania, p 2.

154 Submission 35, Environmental Health Group, Menzies Institute for Medical Research, University of Tasmania, p 2.

155 Evidence, Associate Professor Johnston, 12 June 2020, p 3.

2.87 Asthma Australia emphasised the importance of improving 'health literacy' and having ongoing education programs to reduce the risk of adverse health impacts from poor air quality. It contended:

> The provision of health information about poor or hazardous air quality should not be left to times of crisis. Instead, information on air quality should be provided year-round, with a focus on improving environmental health literacy so that the community is able to interpret health advice when it is provided in times of crisis.[156]

2.88 Stressing how the provision of health advice at times leading up to bushfire season can assist people to manage their own health and risks, Asthma Australia stated: 'During times of crisis, such as sustained periods of poor and hazardous air quality due to bushfires, there is a need to increase health information and advice messaging and ensure that the messaging is targeted based on the conditions'.[157] In particular, Asthma Australia stated that people with asthma should be encouraged through ongoing education campaigns to ensure that their Asthma Management Plans are up to date ahead of the bushfire season. It added:

> People with asthma can also be advised more frequently to take their preventer medication the two to three weeks leading up to an event. Asthma Australia is well placed to deliver an ongoing education campaign, given the links to the community and those that are living with asthma.[158]

2.89 Asthma Australia stated that it is well placed to provide information to people on the risks associated with poor air quality due to their large networks of health professionals, health agencies and people with asthma. To ensure that this support is maintained, it called for funding to be provided for ongoing information provision and preparation for a crisis event and for increasing support at high risk times, such as during the bushfire season and other foreseeable crises. It also highlighted the need for health information or advice to be tailored, so that it can reach culturally and linguistically diverse communities and people with lower environmental health literacy. [159]

2.90 During a hearing, Ms Michele Goldman, Chief Executive Officer, Asthma Australia, drew an analogy between sun smart campaigns and a potential 'air smart' campaign to improve health literacy, stating that a 'comprehensive campaign', incorporating strategies to improve mental health and wellbeing, can educate people on the risks so that they can steps to minimise those risks.[160]

2.91 Doctors for the Environment Australia argued that more needs to be done, particularly by NSW Health, to educate the community about the dangers of air pollution. It observed that during the 2019-20 fires, there was variable response to the poor air quality, reflected in, for example some sports events being cancelled and other going ahead, on days with hazardous levels of pollution. It proposed that, 'More deliberate public awareness campaigns would be beneficial in

156 Submission 46, Asthma Australia, p 9.

157 Submission 46, Asthma Australia, p 10.

158 Submission 46, Asthma Australia, p 10.

159 Submission 46, Asthma Australia, p 10.

160 Evidence, Ms Goldman, 10 June 2020, pp 3 and 8.

ensuring that everyone has the correct information, and is aware of the health risks and recommended actions'.[161] It continued:

> The NSW Daily Air Quality Index (AQI) table is a good communication tool in amalgamating air pollution information into easily interpretable numbers and risks, but an extension to advice based on hourly PM2.5 is warranted. The community needs a simple message about when air pollution reaches levels at which outdoor sporting events should be cancelled. There is not much epidemiological data about 1 hour exposures to fine particles, so setting a threshold is not based on strong science. For PM2.5 choosing a value of 50ug/m^3, ie double the 24 hour standard seems reasonable, and NSW has recently introduced an interim 1 hour standard of 62. Examining the hourly data for 13 Sydney sites from July 2019 to March 2020 shows that of hours that were over 50, 70% to 82% were also over 62 so the choice of cut point in this range is not critical. More precise prediction of air quality based on local meteorology would help the community plan outdoor activity, including sports, manual labour, and active transport.[162]

2.92 Doctors for the Environment Australia recommended:

- Increased public awareness – so that at-risk people know they are at risk, what the risks are, and have up to date information about the current air pollution levels and how to respond to keep themselves safe. This includes prompt distribution of air pollution exceedance alerts and advice.
- Upskilling of health professionals – so that this health education can be delivered by all frontline health professionals such as nurses, GPs, emergency department staff, pharmacists and community health workers.[163]
- Public education and clear guidance about when and why to cancel/postpone sporting events and outdoor work on days of hazardous air pollution.[164]

2.93 Dr Danielle McMullin, President of the Australian Medical Association (NSW), also supported the need for an improved education campaign, stating:

> In terms of communication with the general public about air quality, yes, we would be supportive of an education campaign to teach the public what air quality means, who is at risk and come up with a consultative framework—obviously with peak bodies—to work out how best to communicate with people, especially those at risk, as to what to do in the event of poor air quality days.[165]

161 Submission 24, Doctors for the Environment Australia, p 6.

162 Submission 24, Doctors for the Environment Australia, pp 6-7.

163 Submission 24, Doctors for the Environment Australia, pp 9-10

164 Submission 24, Doctors for the Environment Australia, p 10.

165 Evidence, Dr McMullen, 10 June 2020, p 29.

The Government's response

2.94 The committee questioned government representatives about the effectiveness of public information provided during periods of recent hazardous air quality, including the bushfires. It also looked at what policy improvements have been implemented in this area by the NSW Government.

2.95 Dr Richard Broome, Acting Executive Director, Health Protection NSW, NSW Health, confirmed that NSW Health is reviewing its approach to the provision of public information on air quality, based on their recent experience. He stated that the agency is 'working with various groups to try and improve our messaging around providing good, helpful and not alarmist advice for pregnant people, for example'.[166]

2.96 Dr Broome acknowledged that information needs to be more nuanced and effective in communicating messages. He also explained the need for messages to be balanced, highlighting to the committee the importance of communicating clearly the difference between a 'hazard' and a 'risk'.[167]

2.97 The committee also heard about steps the NSW Government has taken to ensure information and advice is evidence based and relevant. Dr Broome noted that the department has consulted with air pollution experts and took on feedback to move to hourly reporting of PM2.5 concentrations. He reflected how the differences in this area highlighted 'the lack of national consistency around the way air pollution is reported and communicated'. He added:

> I think we are all completely agreed that this inconsistency has to be addressed. We are currently working with other jurisdictions through the environmental health subcommittee of the Australian Health Protection Principal Committee [AHPPC], which is part of the COAG process, or the COAG health council, and also the national air technical group to make that happen as soon as possible. We have already met with other jurisdictions to discuss how we are going to progress that and obviously it is a priority for all of us.[168]

2.98 Dr Broome acknowledged that it is important to have 'a system that makes it easy for people to understand and interpret information … because we recognise … that these risks are increasing'.[169]

2.99 Also consistent with this work, the committee notes that one area of future focus for the NSW Government, following the unprecedented 2019-20 bushfire season, is to update the Air Quality Index to better address the public's need for near real-time air quality information and to increase consistency between jurisdictions.[170]

166 Evidence, Dr Broome, 15 July 2020, p 5.
167 Evidence, Dr Broome, 15 July 2020, p 5.
168 Evidence, Dr Broome, 12 June 2020, p 27.
169 Evidence, Dr Broome, 15 July 2020, p 12.
170 Submission 47, NSW Government, p 10.

2.100 In terms of the *Public Health Response to Prolonged Smoke Events* guidelines, outlined in paragraph 2.61, Dr Broome acknowledged that there were challenges in applying this framework during the recent prolonged bushfire event. An example discussed was prolonged exposure to bushfire smoke over a two week period, where vulnerable people are advised to seek shelter in public air conditioned indoor venues, like libraries and shopping centres. Acknowledging that this may not be practical advice for a sustained period, Dr Broome stated:

> I think all these things are things that need to be considered going forward. As you know, this last summer period was unprecedented and we learnt a lot of lessons. We have had feedback from the community and we are responding to that. A lot of the feedback was specifically in relation to the communication and the need for real-time information so that people could make informed decisions right there and then.[171]

Committee comment

2.101 The committee acknowledges that the NSW Government has been expanding its air quality monitoring network. In terms of managing the health impacts associated with poor air quality, and in particular bushfire smoke or dust events, extensive air monitoring across the state is absolutely imperative. We acknowledge the challenge of monitoring across an expansive area of the state but nevertheless underscore the need to protect the health of people across all communities in New South Wales.

2.102 We note stakeholders concerns that there are certain gaps in the air quality monitoring network, and that additional air monitoring stations would be beneficial, particularly in areas with significant air pollution or areas likely to experience events that impact air quality, such as bushfires or dust storms. While fixed sensors in additional locations would be ideal, the committee agrees that even low-cost sensors, or mobile, temporary sensors, can be useful if managed appropriately.

2.103 The committee believes that there needs to be an ability to produce, as broadly as practicable, real-time notifications of dust and smoke levels, particularly during bushfires. The committee acknowledges the NSW Government's work up to this point regarding smoke and dust monitoring, but believes that much more needs to be done. Monitoring of air quality must occur on an ongoing basis, as opposed to being instigated by an emergency situation.

2.104 Therefore, we recommend that the NSW Government continue to expand its Air Quality Monitoring Network, and consider the placement of additional permanent monitoring sensors in locations known to have emission producing industries and those likely to experience air pollution events, including Lake Macquarie and Lithgow. The NSW Government should also consider the enhanced use of mobile sensors, including unmanned aerial vehicles, that can be rapidly deployed as required, for example, during significant events such as bushfires. Even low cost sensors should be used, if necessary, in order to ensure the measurement of air quality in as many localities across the state as possible.

[171] Evidence, Dr Broome, 15 July 2020, pp 12-13.

Recommendation 1

That the NSW Government continue to expand its Air Quality Monitoring Network, and consider:

- the placement of additional permanent monitoring sensors in locations known to have emission producing industries and those likely to experience air pollution events, including Lake Macquarie and Lithgow
- the enhanced use of mobile sensors, including unmanned aerial vehicles, that can be rapidly deployed and relocated as required
- the use of low cost sensors if necessary, in order to ensure the measurement of air quality in as many localities as possible.

2.105 While measuring air quality across the state is critical, so too is enhancing our understanding of the particulate matter being measured. In this regard, we acknowledge the work of the Australian Nuclear Science and Technology Organisation (ANSTO) in differentiating sources of pollution. This is important work that will help us to gain a better understanding of what is in the air, which will only enhance our efforts to mitigate the health risks posed by such fine particles. We support more state wide sampling to occur, and propose that the NSW Government work with ANSTO in this regard.

Recommendation 2

That the NSW Government work with the Australian Nuclear Science and Technology Organisation (ANSTO) to expand the sampling of particulate matter in the air statewide.

2.106 The committee also supports the need for nationally consistent measurement and reporting. It is problematic to have jurisdictions adopting different approaches, particularly in the reporting and provision of information and health advice. There needs to be consistency in terms of terminology and thresholds used to describe categories of air quality, as well as in terms of the interval in which air quality is reported.

2.107 On this last aspect specifically, the committee supports hourly reporting rather than the use of a 24 hour average. Many inquiry participants highlighted how this change was more effective and helpful for individuals in mitigating the health risks associated with poor air quality, and the committee commends the NSW Government for making this change.

2.108 While this was a positive step, more work needs to occur to achieve national consistency. Smoke, from whatever source, and dust do not recognise boundaries between states and territories. Therefore, the committee recommends that the NSW Government prioritise working with other jurisdictions to achieve nationally consistent air quality measurement and reporting, including ensuring that PM2.5 is reported separately and hourly. Our hope is that we will see improvements in this regard in time for the 2020/21 summer fire season.

Recommendation 3

That the NSW Government prioritise working with other jurisdictions to achieve nationally consistent air quality measurement and reporting, including ensuring that PM2.5 is reported separately and hourly.

2.109 The committee also agrees that messages to the public during times of hazardous air quality must be clear, direct and helpful. There cannot be confusion for those living on the borders between states, and high-risk groups must be better informed so that they can take appropriate steps to mitigate the impacts posed by poor air quality.

2.110 While there is a place for technology and apps, and clearly a need for timely accessible information about air quality levels, consideration must also be given to how best to provide information to particular groups, including pregnant women, older people and those with serious health conditions. Different strategies may be needed for different groups, but the messaging must ultimately be consistent, balanced, direct and practical.

2.111 In this regard, the committee acknowledges encouraging evidence from the NSW Government about their commitment to improving the provision of air quality information and advice. However, other than the move to hourly reporting, we are not clear to what extent any review or process underway in this area is contributing to helpful changes. Therefore, we recommend that the NSW Government commission a review on how effective air quality information and health advice is communicated to and comprehended by the public, with the review and any findings to be published. This review should consider measures that can be implemented to achieve more effective, consistent, timely and nuanced messaging on air quality risks.

Recommendation 4

That the NSW Government commission a review on how effective air quality information and health advice is communicated to and comprehended by the public, with the review and any findings to be published.

2.112 It is also vital for broader community education strategies to be implemented. The need for an 'air smart' campaign, similar to the 'sun smart' campaign we have had for years, is clear. We must do more to educate the public about the health risks associated with poor air quality, particularly arising from bushfires and drought, as well as ongoing air pollution. Individuals and communities need to understand what steps can be taken to mitigate the health risks associated with exposure to poor or hazardous air quality, particularly in relation to PM2.5. It is imperative that we lift community awareness and understanding in terms of how to interpret air quality health information and risks.

Recommendation 5

That the NSW Government develop an air-smart public education campaign, and identify and implement other strategies that will enhance public awareness and education in relation to managing and interpreting the health risks associated with exposure to poor air quality.

Recommendation 6

That the NSW Government provide additional resources to ensure that the air-smart public education campaign is widely advertised, particularly to vulnerable and at-risk groups.

Chapter 3 Managing adverse health impacts

While the previous chapter focused on the monitoring and reporting of air quality, this chapter focuses on additional actions that the government can take to mitigate and manage the health impacts associated with poor air quality, especially with respect to hazardous events such as bushfires but also ongoing air pollution. In particular, it will examine policy improvements that could be made in relation to protecting vulnerable groups from the harmful effects of inhaling PM2.5, including people with asthma and people experiencing poverty and/or insecure housing. The chapter also considers protective measures for people living or working indoors, and those working outdoors, particularly during periods of prolonged exposure to poor air quality.

Mitigating the impacts on vulnerable groups

3.1 Underpinning many inquiry participants' views was an understanding that government has a strong, proactive role to play in managing the adverse health impacts of poor air quality, especially among vulnerable groups.

3.2 Asthma Australia highlighted the disproportionate health impact that the vulnerable groups documented in chapter 1 experience during periods of poor air quality – that is, people with respiratory conditions, pregnant women, infants and children, older people, people with cardiovascular disease and people with type 2 diabetes. Asthma Australia contended:

> People who are particularly vulnerable to the adverse health impacts of poor and hazardous air quality require additional supports to ensure that they receive the help that they need to avoid health complications.[172]

3.3 Similarly, the Australian Medical Association (NSW) called for a 'precautionary principle' to underpin the approach to vulnerable groups. It stated:

> That a precautionary principle should guide the development and implementation of air quality standards and management policies relating to vulnerable or disadvantaged groups, including Indigenous communities, children, and people from low socio-economic backgrounds. [173]

3.4 Associate Professor Johnston explained how vulnerable groups are disproportionately affected by the health effects of poor air quality. She stated:

> Particles are the most important for health but they are not the only determinant. The health effects are not equal and underlying risks in an individual person could be even more important than the absolute concentration of smoke in the air. There are lots of well-recognised, different vulnerable groups who need specific advice for their situation—pregnancy as opposed to age as opposed to lung disease, for example. A lot of the health impacts occur at lower levels. That is very important that there is no safe lower threshold. Managing the very extreme days will not help us avert the impacts of bushfire smoke pollution in Australia.[174]

172 Submission 46, Asthma Australia, p 5.

173 Submission 31, Australian Medical Association (NSW), p 9.

174 Evidence, Associate Professor Fay Johnston, Head of the Environmental Health Group, Menzies Institute for Medical Research, 12 June 2020, p 2.

3.5 In terms of mitigating the health risks for vulnerable groups, several stakeholders highlighted the need for more targeted messaging and education for people at risk, as discussed in the previous chapter.[175] Alongside these improvements, other protective measures for vulnerable groups were suggested by stakeholders, and these are discussed in the sections below.

People with asthma

3.6 People with asthmas are particularly vulnerable to hazardous air quality, including bushfire smoke. According to Asthma Australia, in New South Wales, 11 per cent of people aged 16 and over, and 21 per cent of children, have asthma. It is a serious condition, and sometimes life-threatening.[176]

3.7 Asthma Australia reported on the findings of a survey of people with asthma during the 2019-20 bushfires with regard to the actions they reported taking to manage or relieve their symptoms caused by the bushfire smoke. This is captured in the table below.

Figure 4 Actions taken by people with asthma to manage/relieve symptoms due to bushfire smoke, December 2019 to January 2020[177]

Actions taken by people with asthma to manage/relieve symptoms due to bushfire smoke	Numbers	Percentage (%)
Increased reliever inhaler	5,508	76
Increased existing preventer dose/frequency	3,011	41
Visit a GP	1,699	23
Steroids (oral or injection)	1,189	16
Administered asthma first aid	587	8
Was prescribed a preventer	522	7
Attended ED	431	6
Hospital admission	175	2

3.8 Asthma Australia also reported that '94 per cent of people with asthma were experiencing asthma symptoms and were four times more likely to attend emergency departments during the fires'. Ms Michele Goldman, Chief Executive Officer, Asthma Australia also explained that there were mental health impacts as well, and that 'anxiety is a very common trigger for asthma'.[178]

175 Evidence, Ms Clare Walter, Member, Clean Air Society of Australia and New Zealand, 12 June 2020, p 17; Evidence, Dr Stephen Duckett, Health Program Director, Grattan Institute, 12 June 2020, p 2.

176 Submission 46, Asthma Australia, p 2.

177 Submission 46, Asthma Australia, p 5.

178 Evidence, Ms Michele Goldman, Chief Executive Officer, Asthma Australia, 10 June 2020, p 2.

3.9 Ms Goldman explained that Asthma Australia is calling for a 'comprehensive platform of policy reforms that will require a whole-of-government approach and collaboration between State and Federal governments'.[179]

3.10 Asthma Australia, and National Asthma Council Australia, recommended targeted support, stating that is necessary to 'manage the adverse health impacts of poor air quality through targeted support, particularly for people who are at greater risk, including people with asthma'.[180]

3.11 Among a number of other suggestions for policy improvements, Asthma Australia also recommended that the NSW Government provide support to people with asthma towards the costs associated with using air purifiers with a HEPA filter to avoid asthma flare ups'.[181] Mrs Judy Wettenhall, a person with asthma and Chair of the Asthma Australia Consumer Advisory Council, also called for additional resources to help vulnerable individuals, and funding for air filtering systems.[182]

3.12 In terms of policy planning and the NSW Government's approach to hazard reduction burning, Asthma Australia also called for health impacts to be considered in the planning and execution of such burns. It noted that for people with asthma, hazard reduction burning activities 'can be extremely hazardous and can lead to life-threatening symptoms'. It called for health impacts to be considered in the planning of hazard reduction burns, along with improve communication to affected communities:

> Hazard reduction burns planning needs to balance health consequences against the need to conduct hazard reduction burning. Agencies responsible for hazard reduction burns across the country need to appropriately consider the health impacts on the community and particularly people experiencing respiratory conditions such as asthma. Strategies include burning at the right time of day and staggering hazard reduction activities so prolonged periods of poor or hazardous air quality are avoided.
>
> Communication relating to hazard reduction burning needs to occur between environmental or emergency agencies responsible for the activity and health agencies who are responsible for communicating advice to people about reducing their risk of exposure. Communities potentially affected by hazard reduction practices should have appropriate warning and capacity to reduce their risk exposure. With adequate warning, people with asthma can start planning for the event, including effectively using prescribed preventer medication two to three weeks before hazard reduction burn season. This is another important measure to build community and personal resilience to airborne triggers.[183]

3.13 Correspondingly, Asthma Australia recommended that the NSW Rural Fire Service and State Emergency Services should:

- include health authorities and a consumer representative in planning for burning so that health impacts are considered

179 Evidence, Ms Goldman, 10 June 2020, p 2.

180 Submission 37, National Asthma Council Australia, p 1; Submission 46, Asthma Australia, p 5.

181 Submission 46, Asthma Australia, p 11.

182 Submission 21, Mrs Judy Wettenhall, p 1.

183 Submission 46, Asthma Australia, pp 13-14.

- coordinate activities with health authorities so that health messages can be provided to the community ahead of the planned burn to ensure that the potential for adverse health impacts is minimized, and
- where possible, stagger burns and ensure they do not result in prolonged periods of poor and hazardous air quality.[184]

People experiencing poverty and/or insecure housing

3.14 Another vulnerable cohort to the health risks posed by poor air quality are people experiencing poverty, insecure housing or homelessness.

3.15 The NSW Council of Social Service highlighted that people living with poverty and disadvantage were particularly at risk to the health impacts associated with hazardous air pollution levels, 'given they experience poorer health outcomes and a higher prevalence of pre-existing respiratory conditions'.[185]

3.16 The NSW Council of Social Service told the committee that its members had reported vulnerable clients struggling to access health care and evacuation support during the 2019-20 bushfires, despite their clear need and pre-existing health conditions:

> We saw issues in homeless individuals who were struggling to breathe with the smoke in the air … One in particular struggles with asthma and the evacuation centre refused to allow her to stay with them even though she presented to them and stated she was struggling with breathing in the smoke no matter how much medication she takes … she asked if she could just take a break in the evacuation centre and they turned her away stating she was homeless due to other reasons than the fire so she did not qualify to stay. This put her on the street with a breathing condition as even the hospital stated they had no beds ...
>
> … We also have a lot of people in this area who are elderly, the hospital staff stated they were full with elderly who were struggling to breathe and people were being sent to Canberra. Our little area was definitely not prepared.
>
> – Mission Australia specialist homelessness service, Cooma[186]

3.17 Based on the above account, the NSW Council of Social Service voiced strong concerns about the apparent ability of evacuation centres to turn people away if they do not meet certain criteria, stating: 'If someone is seeking shelter from the bushfires and/or smoke, it should not matter what their personal or financial situation is or whether their state of homelessness was pre-existing, or due to, the bushfires'.[187]

184 Submission 46, Asthma Australia, pp 13-14.

185 Submission 29, NSW Council of Social Service, p 4.

186 Submission 29, NSW Council of Social Service, p 4.

187 Submission 29, NSW Council of Social Service, p 5.

3.18 Noting member reports that many evacuation centres were challenging environments for people with disability or mental health issues, it also recommended that the NSW Government explore the need for 'specialist' evacuation centres to support people with complex needs, and review policy and protocol for all centres, including the appropriateness of venue and conditions around admittance to ensure no one seeking assistance is turned away'.[188]

3.19 The NSW Council of Social Service further pointed to the higher risk of exposure to environmental conditions detrimental to health among people experiencing or at risk of homelessness. It documented a number of particular challenges encountered by specialist homelessness services and their clients during the recent bushfires:

> Many services providing assertive outreach support during the bushfires were unable to obtain face masks for their clients for days, if at all. Clients housed in temporary accommodation were in older properties that could not keep the smoke out. Motels and hotels were fully occupied by volunteers and emergency personnel, meaning clients seeking temporary accommodation through Link2Home had even less options than usual. It is likely that the number of people being forced to 'sleep rough' in hazardous air quality conditions – including those who would ordinarily be housed in temporary accommodation – rose during this time.[189]

3.20 Noting the waiting list of over 50,000 people seeking social housing, the NSW Council of Social Service recommended that investment in social and community housing be boosted across the state and in fire-affected areas.[190] It also called for improvements to residential tenancies legislation to ensure rental properties have adequate ventilation, thus recommending that there be a review of minimum housing standards with respect to managing external environmental conditions including hazardous air quality.[191]

Mitigating the impacts for workers

3.21 The inquiry also explored the impact poor air quality can have on those working outdoors, and potential protective measures that could be adopted in an employment context. Interestingly, it also considered challenges facing those living or working indoors, for example, teachers and childcare workers, particularly during periods of prolonged exposure to poor air quality.

Protection for outdoor workers

3.22 Concerns were raised about the level of protection afforded to outdoor workers during periods of poor and/or hazardous air quality.

3.23 A number of inquiry participants spoke of the need to improve and strengthen workplace standards in respect to air quality as a result of the 2019-20 bushfire season.[192]

188 Submission 29, NSW Council of Social Service, p 5.

189 Submission 29, NSW Council of Social Service, p 6.

190 Submission 29, NSW Council of Social Service, p 6.

191 Submission 29, NSW Council of Social Service, p 7.

192 Submission 31, Australian Medical Association (NSW), p 9; Submission 40, Australian Services Union NSW & ACT (Services) Branch, p 4.

3.24 For example, the Australian Medical Association (NSW) was concerned by the 'uneven application of current occupational and health safety regulations', particularly given that '[w]orkers in certain industries and occupations, particularly outdoor workers, are at heightened risk of adverse health outcomes during bushfires and periods of drought'.[193]

3.25 The Australian Services Union NSW & ACT (Services) Branch shared similar sentiments with respect to the health of workers:

> The increased level of air pollutants and the increased number of days with high levels of air pollution has caused ASU members concern about their ongoing respiratory health. The changes to air quality in NSW require a review of current standards, guidelines and rules that regulate worker health and safety related to poor air quality.[194]

3.26 Associate Professor Fay Johnston, Head of the Environmental Health Group, Menzies Institute for Medical Research, expressed the view that there was an 'overwhelming need for clear guidance for outdoor workers … and for employers, to help employers and employees' in relation to air quality.[195]

3.27 Unions called for SafeWork NSW to develop appropriate workplace health and safety guidance for outdoor workers. For example:

- 'there are some inadequacies in the current WHS framework dealing with poor air quality in workplaces … there …[needs to be] a code of practice for outdoor work in the context of bushfire smoke issued by the regulator before the next fire season'.[196]
- 'SafeWork NSW needs to develop much more detailed guidance for workplaces on how to apply the hierarchy of controls for air pollution, and employers must be directed to cease outdoor work and reschedule to times of better air quality'.[197]
- there needs to be '… provisions allowing workers to cease work when they perceive work to be unsafe …'.[198]

3.28 Both the Australian Medical Association (NSW) and the Australian Services Union NSW & ACT (Services) Branch, called for the introduction of health monitoring and assessments of outdoor workers for occupational illnesses related to poor air quality.[199] The Australian Medical Association (NSW) stated this would 'facilitate targeted preventative measures'.[200]

193 Submission 31, Australian Medical Association (NSW), p 8.

194 Submission 40, Australian Services Union NSW & ACT (Services) Branch, p 4.

195 Evidence, Associate Professor Johnston, 12 June 2020, p 7.

196 Evidence, Mr Alistair Sage, Senior Legal Officer, Australian Workers Union, NSW Branch, 10 June 2020, p 9.

197 Evidence, Mr Jake Field, National Safety and Training Officer, Maritime Union of Australia Division, Construction Forestry Maritime Mining and Energy Union, 10 June 2020, p 10.

198 Evidence, Ms Natasha Flores, Industrial Officer, Unions NSW, 10 June 2020, p 16.

199 Submission 31, Australian Medical Association (NSW), pp 8-9; Submission 40, Australian Services Union NSW and ACT, p 5.

200 Submission 31, Australian Medical Association (NSW), pp 8-9.

3.29 Further, Unions NSW and Australian Services Union NSW & ACT (Services) Branch urged the state government to update Work Health and Safety rules in respect of the health risks of working in bushfire smoke.[201] Both unions advocated for the establishment of a 'new set of obligations on employers when AQI exceeds 150' in order to reduce the reduce the short term and long-term health impact on workers.[202]

3.30 On the other hand, Asthma Australia was of the view that a national approach was required, with the NSW Chief Health Officer working with the Commonwealth Chief Medical Officer and state and territory counterparts to develop a national policy framework to guide institutional responses relating to air quality protection.[203]

Ceasing work in hazardous conditions

3.31 Some inquiry participants argued that outdoor workers were not adequately protected by legislation when it came to cessation of work due to poor air quality.

3.32 Unions NSW referred to provisions for the 'Right to cease or direct the cessation of unsafe work' under Division 6, ss 83-87 of the *Work Health and Safety Act 2011* (NSW), with sections 84 and 87 stating:

> **84 Right of worker to cease unsafe work**
>
> A worker may cease, or refuse to carry out, work if the worker has a reasonable concern that to carry out the work would expose the worker to a serious risk to the worker's health or safety, emanating from an immediate or imminent exposure to a hazard.
>
> **87 Alternative work**
>
> If a worker ceases work under this Division, the person conducting the business or undertaking may direct the worker to carry out suitable alternative work at the same or another workplace if that work is safe and appropriate for the worker to carry out until the worker can resume normal duties. [204]

201 Unions NSW, *Hazardous air quality: The new normal?,* p 3, https://www.unionsnsw.org.au/wp-content/uploads/2020/01/Hazardous-AIR-Quality-FINAL.pdf; Submission 40, Australian Services Union, p 5.

202 Unions NSW, *Hazardous air quality: The new normal?,* p 3, https://www.unionsnsw.org.au/wp-content/uploads/2020/01/Hazardous-AIR-Quality-FINAL.pdf; Submission 40, Australian Services Union, p 5.

203 Submission 46, Asthma Australia, p 6.

204 Division 6, ss 83-87 of the *Work Health and Safety Act 2011* (NSW), quoted in Submission 48, Unions NSW, pp 3-5.

3.33 Unions NSW raised concerns that the provisions in the Act were 'not working effectively to protect workers' and in most cases were leading to:

> … disputation where the Person Conducting a Business or Undertaking determines that the workers are taking unprotected industrial action under the … Fair Work Act …
>
> The Act is clear that the worker is not stopping work. The worker is waiting to be directed to undertake safe work where they feel the work they have been directed to do is unsafe or is in an unsafe environment.[205]

3.34 When questioned as to what advice or guidance the union provided to workers who were required to work during periods of poor air quality, Mr Alistair Sage, Senior Legal Officer, Australian Workers Union, NSW Branch responded as follows:

> The advice the union would provide is that the work should only be continuing if it is safe to do so, consistent with the work health and safety legislation, and that the employer or the person with control of the business or undertaking is required to provide sufficient PPE and follow the hierarchy of controls to ensure that the workplace is as safe as possible. If effective controls cannot be put in place and the air quality is at a dangerous level, then work should cease.[206]

3.35 In his evidence, Dr Stephen Duckett, Health Program Director, Grattan Institute, remarked that 'many industrial agreements already provide for construction workers not to have to work in days when the temperature is over 40 degrees or some number, so … unions and employers should negotiate similar things about air quality'.[207]

3.36 Similar sentiments were shared by Mr Jake Field, National Safety and Training Officer, Maritime Union of Australia Division, Construction Forestry Maritime Mining and Energy Union, who stated that it would have been 'relatively easy for employers to engage with workers and find simple workarounds, but there is a real absence of guidance and enforceability by the regulator, which was exploited by employers to the detriment of workers' health'.[208]

3.37 As Ms Natasha Flores, Industrial Officer, Unions NSW, commented, it is not 'acceptable for employers to question workers when they say they are unwell because the air quality is extremely poor … People should not have to come up with a doctor's certificate to say they have asthma in extremely poor air quality'.[209]

3.38 Likewise, Ms Natalie Wasley, Delegate, Maritime Union of Australia advised that the recent exposure to bushfire smoke:

> … raised quite a lot of anxiety amongst workers, firstly, because people were forced to self-identify and say that they felt that they were more vulnerable and at risk and that isolated them within the workforce if they did not want to undertake a particular duty other people felt like they had to cover for them.[210]

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205 Submission 48, Unions NSW, p 5.

206 Evidence, Mr Sage, 10 June 2020, p 11.

207 Evidence, Dr Duckett, 12 June 2020, p 7.

208 Evidence, Mr Field, 10 June 2020, p 10.

209 Evidence, Ms Flores, 10 June 2020, p 22.

210 Evidence, Ms Natalie Wasley, Delegate, Maritime Union of Australia, 10 June 2020, p 14.

SafeWork NSW actions during the 2019-20 bushfire season

3.39 In response to concerns and claims raised by inquiry participants, SafeWork NSW outlined actions it implemented during the 2019-20 bushfire season.

3.40 In its submission, the NSW Government advised that SafeWork NSW received 38 requests between 1 August 2019 and 6 March 2020 about the health impacts from exposure to poor air quality as a result of bushfire smoke.[211]

3.41 At the hearing, Mr Peter Dunphy, Executive Director, Compliance and Dispute Resolution, SafeWork NSW, stated that in response to these 38 requests, 'follow-up action, in terms of working with those workplaces to identify what the safety issues were, to provide advice and, where necessary, to take compliance action too in regard to that' was conducted.[212]

3.42 In addition, the government spoke of the inspector guide, *Managing the effect of bushfire smoke in the workplace* prepared by SafeWork NSW, which 'provided advice to businesses and other persons conducting a business or undertaking (PCBUs) who were not directly involved in firefighting, but might have had staff affected by the smoke caused by the bushfire emergencies'.[213]

3.43 Mr Dunphy gave evidence that the regulator had been 'providing advice throughout the bushfire period to employers and to workers in terms of their obligations under the work health and safety legislation' in relation to bushfire smoke.[214] This included:

- posting information on the SafeWork NSW website
- social media posts with 'specific messaging around obligations and hazards associated with bushfires' such as 'smoke inhalation, high temperatures, the need for employers or persons conducting a business or undertaking [PCBUs] to review their emergency plans, and also looking at work health and safety during bushfire conditions', and
- the launch of the Speak Up app for requests for services or complaints or issues.[215]

Protection of people indoors

3.44 In addition to the challenges facing outdoor workers during periods of poor air quality, the committee also heard how people working indoors can find it difficult as well.

3.45 On this, the committee notes that during periods of hazardous air quality the advice can include staying indoors, with doors and windows shut or to spend time in air conditioned venues such as cinemas, libraries and shopping centres.[216]

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211 Submission 47, NSW Government p 4.

212 Evidence, Mr Peter Dunphy, Executive Director, Compliance and Dispute Resolution, SafeWork NSW, 12 June 2020, p 34.

213 Submission 47, NSW Government p 4.

214 Evidence, Mr Dunphy, 12 June 2020, p 34.

215 Evidence, Mr Dunphy, 12 June 2020, p 34.

216 Submission 47, NSW Government, p 4.

3.46 In certain contexts, this advice is difficult to follow, as highlighted by the evidence provided on behalf of teachers and child care workers. The Australian Education Union, NSW Teachers Federation, stated that 'unfortunately, while the Department of Education's advice to schools that were directly impacted by fires was effective and timely, its response to the associated air quality hazard was not'.[217]

3.47 For example, Ms Amber Flohm, Senior Vice President, NSW Teachers Federation, noted that with the recent bushfire season, the advice was that the public should stay indoors but this was challenging for teachers:

> On 12 November there were 80 fires burning across New South Wales. It was widely reported at the time via experts that due to the air quality the public should stay indoors. Teachers were, however, again on the frontline without any measures to protect their health and safety and that of all on site, including their students. Hundreds of teachers were ringing the employers WHS hotline to seek advice on how to minimise the risks on the impacts that they, their colleagues and students were suffering.
>
> Smoke was inundating classrooms, playgrounds, schools and TAFEs across New South Wales. Many teachers reported that they could barely see in front of their face. Teachers in schools on the mid North Coast forced the employer at that time to take responsibility for the health and safety of all on its site by evoking the issues resolution process from the WHS procedure.[218]

3.48 Ms Flohm highlighted the difficulties of following the health advice to stay indoors for teachers, referring to it as 'unimplementable'. She said 'when you open the door the smoke comes in and, of course, then everybody is contained in that room for up to six hours because that was the advice – not to go outside'. She also explained that moving into larger spaces is sometimes not feasible, and that some classrooms do not have air conditioning.[219]

3.49 The committee heard that the Department of Education issued advice on 19 November 2019 in the form of a factsheet to help with these matters, but issues remained. Ms Flohm stated:

> This advice did not only not resolve the matters, but actually caused greater confusion for our schools. It was absolutely unimplementable in a practical sense. It is also noted that SafeWork NSW was also unprepared to provide agencies such as the Department of Education with clear advice and guidance on hazardous air quality.[220]

3.50 The Australian Education Union, NSW Teachers Federation, noted that this advice was also late, and that by the time it was issued, 'many parts of the state had already experienced several weeks and in other cases months of very poor air quality'. It also argued that the Department's factsheet was inadequate in addressing staff wellbeing.[221]

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217 Submission 32, Australian Education Union NSW Teachers Federation, p 2.

218 Evidence, Ms Amber Flohm, Senior Vice President, NSW Teachers Federation, 10 June 2020, p 17.

219 Evidence, Ms Flohm, 10 June 2020, p 20.

220 Evidence, Ms Flohm, 10 June 2020, p 17.

221 Submission 32, Australian Education Union NSW Teachers Federation, p 2.

3.51 The Union also highlighted other issues, such as staff having to take sick leave to avoid exposure at work, lack of air conditioning in certain school buildings and pollution entering rooms when staff or students have to open or close doors to enter other areas, like bathrooms.[222]

3.52 Noting that work health and safety laws apply to all workers in schools, including volunteers, the Australian Education Union, NSW Teachers Federation stated:

> There is an urgent need for the government to work with the Department of Education to develop clear risk assessment protocols and processes which are to be implemented when there is evidence of poor air quality. This would include the Department providing the capacity for immediate local air quality testing and advice on when it would be appropriate to cease operations based on the results of such testing.[223]

3.53 In terms of whether there have been steps taken to improve the response to the issues raised by teachers in relation to the recent bushfire season, Ms Kelly Marks, Research/Industrial Officer and Climate Emergency Coordinator with the Australian Education Union, NSW Teachers Federation, stated:

> The department has established a new executive director position of the bushfire release strategy and federation officers have had a lot of meetings with that person and her team, along with lots of other stakeholders in New South Wales. Unfortunately, air quality has not been a primary focus. I have to be honest with you, the fact sheet version 3 that is in our submission still remains the advice that is on the department's website—the only advice.[224]

Protective equipment

3.54 To protect people from the harmful effects of poor air quality, and in particular PM2.5 particulate matter, two particular types of protective equipment were discussed during the inquiry – air purifiers and face masks.

Air purifiers

3.55 Air purifiers with high-efficiency particulate air (HEPA) filters were discussed as an important protective measure that could be used to mitigate the health effects of hazardous air quality.

3.56 The NSW Government noted that air purifiers with a HEPA filter can reduce PM2.5 indoors. It noted that for the air purifier to work well, the purifier must be appropriate for the size of the room and the room well sealed.[225] Dr Richard Broome, Acting Executive Director, Health Protection NSW, told the committee that the department has been looking at how purifiers can be used. He referred to work with the University of Tasmania during the Port Macquarie

222 Submission 32, Australian Education Union NSW Teachers Federation, pp 2-3.

223 Submission 32, Australian Education Union, NSW Teachers Federation, p 5.

224 Evidence, Ms Kelly Marks, Research/Industrial Officer and Climate Emergency Coordinator with the NSW Teachers Federation, 10 June 2020, pp 19-20.

225 Submission 47, NSW Government, p 4.

bushfire, which investigated whether or not it is a possibility that 'particular buildings could use these devices to create clean air spaces within themselves'.[226]

3.57 The Centre for Air pollution, energy and health Research (CAR) contended that there is evidence to support the effectiveness of indoor air purifiers with high efficiency particulate air (HEPA) filters, as long as the filter capacity is appropriate for the room size in which it is being used. It noted, however, that air purifiers are expensive and that 'there were reports of them quickly being sold out during the 2019-20 bushfire season'. [227]

3.58 Similarly, the Clean Air Society of Australia and New Zealand, stated: 'Air purifiers with HEPA monitors can be effective at reducing air pollution when confined to closed rooms (e.g. bedrooms); however the cost of commercially available filters is prohibitive to many Australians'. It called for the installation of indoor HEPA filters in childcare centres and schools.[228]

3.59 At a hearing, Ms Clare Walter, Member, Clean Air Society of Australia and New Zealand, also suggested that aged care facilities, in addition to childcare centres, invest in HEPA filters, in addition to looking at ventilation in buildings.[229]

3.60 Asthma Australia also reflected on the cost of air purifiers, including the cost of energy to run them, for people with asthma. It agreed that air purifiers can 'be highly effective in minimizing exposure to bushfire smoke', if used appropriately. Noting that the Commonwealth Department of Health provides certain rebates towards medical equipment for people with an eligible medical condition, it highlighted that the current scheme does not include asthma, meaning people with asthma do not get assistance with the purchase of air purifiers. It recommended that the NSW Government provide support to people with asthma towards the costs associated with using air purifiers with a HEPA filter to avoid asthma flare ups.[230]

Face masks

3.61 Another protective measure discussed during the inquiry were face masks, and whether they may be useful in potentially mitigating the health impacts of air pollution.

3.62 While Dr Richard Broome, Acting Executive Director, Health Protection NSW, said that there are certain circumstances in which face masks are recommended, the advice 'is to avoid exposure in the first place by staying indoors and reducing activity'. He added, 'Masks would not be the first line thing but there might be circumstances where they would be appropriate'.[231]

3.63 On the one hand, several inquiry participants supported the provision of protective equipment such as face masks, and on the other hand, concerns were expressed about the effectiveness of face masks in filtering out dangerous particulate matter.

226 Evidence, Dr Richard Broome, Acting Executive Director, Health Protection NSW, NSW Health, 12 June 2020, p 29.

227 Submission 34, Centre for Air pollution, energy and health Research (CAR), p 6.

228 Submission 43, Clean Air Society of Australia and New Zealand, pp 4-5.

229 Evidence, Ms Walter, 12 June 2020, p 23.

230 Submission 46, Asthma Australia, p 11.

231 Evidence, Dr Broome, 15 July 2020, p 7.

3.64 Asthma Australia noted that during the Spring/Summer 2019-20 period, the Australian Government distributed more than 3.5 million P2 masks to states and territories for use by people in bushfire affected communities, the Australian Defence Force, Australia Post and Australian Federal Police personnel. In addition, NSW Health distributed over one million facemasks to people in the most heavily impacted regions of the state.[232]

3.65 Doctors for the Environment Australia suggested that P2 masks be distributed in areas of air pollution hotspots. It also pointed to NSW Health's distribution of P2 masks in the air pollution hotspots of Southern NSW, Illawarra Shoalhaven and Murrumbidgee Local Health Districts as a valuable strategy that should be expanded to other areas, particularly to help those at higher risk of health effects.[233]

3.66 The use of P2 masks in an employment context was also discussed earlier. In this regard, the committee notes that the Australian Workers' Union, NSW Branch expressed support for the use of personal protective equipment during periods of hazardous air quality, including P2 masks, to protect employees, particularly outdoor workers.[234] By contrast, the Australian Education Union, Teachers Federation NSW noted that 'evidence of the efficacy of facemasks is mixed at best' and the ACTU 'does not recommend the use of masks as the fit and type of respirator requires expert advice'.[235]

3.67 In this regard, a number of stakeholders highlighted that there is limited evidence on the effectiveness of face masks in filtering out pollution. For example, the Centre for Air pollution, energy and health Research (CAR) stated:

> [T]here is limited evidence on their real-world effectiveness as they require the correct filter and fitting to work well. Unlike surgical masks, the material in P2/N95 masks do filter out PM2.5. However, the seal around the mouth and nose must be perfect for them to work well. This can be difficult to achieve, especially for those with facial hair or those who have a small face. In fact, a study from Beijing concluded that commercially available facemasks do not provide protection from pollution because of typically poor facial fit. Where a good seal is achieved, it is usually hot and uncomfortable to wear for long periods of time and breathing may become laboured.[236]

3.68 The Centre for Air pollution, energy and health Research also suggested that 'wearing a face mask may provide a false sense of security, meaning people stay outdoors for longer than what is safe'.[237]

232 Submission 46, Asthma Australia, p 11.

233 Submission 24, Doctors for the Environment Australia, pp 8-9.

234 Submission 28, The Australian Workers' Union NSW Branch, p 9.

235 Submission 32, Australian Education Union, New South Wales, Teachers Federation Branch, pp 4-5.

236 Submission 34, Centre for Air pollution, energy and health Research (CAR), p 6.

237 Submission 34, Centre for Air pollution, energy and health Research (CAR), p 6.

3.69 Likewise, the Australian Medical Association (NSW) noted that there is evidence showing that P2 and N95 masks do not filter some smoke and are most commonly used in occupational settings where exposure to airborne particles occur on a regular basis. It stated that these masks 'cannot completely eliminate exposure to smoke, as they can be difficult to fit and use appropriately, particularly for children'.[238]

3.70 When appearing before the committee, Dr Danielle McMullin, President, Australian Medical Association (NSW), expanded on the importance of masks being fitted appropriately. She stated:

> P2/N95 masks only work effectively when there is a good seal around the mouth and nose, which is particularly difficult for people of some different racial backgrounds or different face shapes, men with beards—there are other factors that can affect a mask fit. We certainly saw problems during the bushfire season where people were choosing to use a mask and not using it effectively. Also, there was the question about who should be using masks. It was difficult to find evidence-based information at that time about who should be wearing one or not.[239]

3.71 Dr McMullin emphasised that doctors regularly using masks for protection have 'fit tests'. She added, 'Presuming you do have a good quality mask, they will still be different shapes and sizes. Communicating that to the public—even the basics, that a mask needs to fit—is one factor in its effective use'.[240]

3.72 In terms of resource allocation in relation to face masks, the Australian Medical Association (NSW) also highlighted that the prioritisation of 'scarce resources can place practitioners and health agencies in an ethical dilemma'. It explained:

> Practical and medical considerations must also inform decisions about whether to recommend and distribute facemasks during periods of poor air quality to vulnerable populations, outdoor workers and the general public.[241]

3.73 Agreeing that face masks need to be fitted correctly to be effective, Asthma Australia submitted that they are a protective measure that should be used, and that there should be a strategy developed for how they will be distributed in a timely manner to people in the community who are experiencing the greatest disadvantage and are most at risk.[242]

3.74 Doctors for the Environment Australia also called for greater public education with regard to the benefits and use of face masks, specifically recommending that there be 'public education and clear guidance on the use of personal protective measures such as use of masks and indoor particle filters for sensitive individuals, delivered by direct public awareness campaigns and via health services'. It also called for increased distribution of free P2 masks via pharmacies and GP clinics.[243]

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238 Submission 31, Australian Medical Association (NSW), p 6.

239 Evidence, Dr Danielle McMullin, President, Australian Medical Association (NSW), 10 June 2020, p 28.

240 Evidence, Dr McMullin, 10 June 2020, p 28.

241 Submission 31, Australian Medical Association (NSW), p 6.

242 Submission 46, Asthma Australia, p 12.

243 Submission 24, Doctors for the Environment Australia, p 10.

Committee comment

3.75 The committee acknowledges that certain groups within the community are disproportionately affected by the health effects of poor air quality. We understand that for many vulnerable groups, including those with respiratory conditions, there is a responsibility on the NSW Government to mitigate the risks posed by poor air quality. It is clear that the needs of these groups must be taken into account in improving our overall approach to the management of air quality, especially during times of hazardous events.

3.76 In this regard, the committee agrees that it is important for policy planning in this area, including in terms of hazard reduction burns, to always factor in the potential health impacts, particularly for vulnerable groups in our community. This issue is connected to a recommendation we make in the next chapter, which is focused on enhancing cross agency collaboration in relation to the planning and management of air quality.

3.77 The committee notes the concerns raised by inquiry participants about the protections, or apparent lack thereof, for outdoor workers during periods of poor air quality, as experienced with the recent bushfires. The committee heard how challenging it was for outdoor workers to work when they were blanketed by thick smoke, where alternative arrangements, such as the rescheduling of work, or provision of appropriate personal protective equipment, or cease work orders, were either not offered or made available.

3.78 Likewise, we heard how challenging it was for teachers, childcare workers and other employees indoors, when the advice was to stay inside, yet it was simply not feasible or practical to do this for extended periods of time.

3.79 The committee understands the calls from Unions NSW and unions for work health and safety laws, regulations and protocols to be improved and strengthened in this regard to ensure the safety and wellbeing of workers, particularly when the long term health impacts of poor air quality caused by the fires are unknown. In particular, we recognise that outdoor workers have the right to cease work when air quality is at a dangerous level and their health and safety is at risk. We accept that further detailed guidance from SafeWork NSW, as the state regulator, is essential on this important, emerging issue.

3.80 However, the committee is of the view that a collaborative tripartite approach between government, unions and employers is required in order to identify, analyse, consider and resolve all the issues effecting outdoor workers raised in this inquiry. From the evidence received, the committee acknowledges that further consideration is required in terms of protection for workers and the need to find sustainable, appropriate and practical solutions to the more complex workplace health and safety issues considered by this inquiry. In saying this, all employers must continue to meet or surpass workplace health and safety laws, regulations and codes of practice of New South Wales and, if required, the Commonwealth. Given the potential significant negative impact on the health and safety of workers from exposure to poor air quality, the collaborative tripartite work recommended above should commence immediately.

3.81 Therefore, we recommend that SafeWork NSW engage directly with Unions NSW, unions, employers and other stakeholders to identify and develop policy and regulatory reforms that will improve the protection of workers from the harmful health effects of being exposed to poor air quality. In completing such work consultation will take place with medical and health experts, including thoracic specialists.

Recommendation 7

That SafeWork NSW engage with Unions NSW, unions, employers and other stakeholders to identify and develop policy and regulatory reforms that will improve the protection of workers from the harmful health effects of being exposed to poor air quality. In completing such work consultation will take place with medical and health experts, including thoracic specialists.

3.82 The committee acknowledges that protective equipment like air purifiers and face masks may help to mitigate the health impacts of air pollution. In terms of air purifiers, we note that at the federal level, rebates are provided to persons with an eligible medical condition towards the purchase of certain medical equipment. While this does not currently cover the purchase of air purifiers for people with certain health conditions, the committee believes it would be appropriate for the NSW Government to explore the potential for this scheme to be expanded with the Australian Department of Health.

3.83 Turning now to face masks, the committee notes that there is evidence that masks can be effective in filtering out air pollution, if fitted appropriately. While we were pleased to hear that masks were distributed during the recent bushfires, to communities severely impacted by the fires, we agree that more public education is needed in terms of the benefits and use of face masks more generally. Therefore, the committee believes that this should be factored in to recommendation 5, with the development more broadly of a public education 'air smart' campaign.

Chapter 4 Other issues

This final chapter considers a number of issues related to the inquiry terms of reference that emerged during discussions with inquiry participants. First, it considers the link between climate change and more threatening bushfire events such as those of the 2019-20 summer. Next it considers stakeholders' calls for action to prevent poor air quality on an ongoing basis, including via a Clean Air Strategy for the state. The chapter then explores the imperative to ensure that all relevant government agencies work together to maximise their learning from the bushfire disaster, and finally, the importance of investment in data collection and research.

Climate change

4.1 Several inquiry participants including Asthma Australia, the Grattan Institute and Unions NSW referred to the landmark 2008 Garnaut Climate Change Review to highlight that climate change was a contributing factor to the 2019-20 bushfires.[244] The Garnaut Review was commissioned by the federal, state and territory governments to examine the impacts of climate change on Australia. Participants noted that in his review report, Professor Ross Garnaut predicted that the effects of climate change on fire events would become evident by 2020:

> Recent projections of fire weather suggest that fire seasons will start earlier, end slightly later, and generally be more intense. This effect increases over time, but should be directly observable by 2020.[245]

4.2 The Centre for Air Pollution, energy and health Research (CAR) cited research on the greater risk of bushfires arising from a hotter climate to provide more detail on this prediction:

> While most studies linking bushfire risk to climate change have come from North America, the scientific consensus is that climate change will lead to an increase in fire risk around the world. In south-east Australia, it is estimated that the number of fire danger days will increase strongly by 2100 and the fire season is expected to start earlier, leading to a longer fire season. Specifically, modelling suggests that the days conducive to extreme bushfires will increase by 20 to 50 per cent in western United States and south-east Australia.[246]

4.3 In a similar vein, the Grattan Institute advised that while it is not possible to say whether the 2019-20 bushfires were 'caused' by climate change, the developing field of 'attribution studies' is seeking to measure the likelihood of extreme weather events arising from human-caused climate change. It noted one recent study, released in March 2020, which found that the 2019-20 bushfires were 80 per cent more likely to happen because of climate change,[247] and stated, 'If

244 Submission 46, Asthma Australia, p 15; Submission 38, Grattan Institute, p 8; Submission 48, Unions NSW, p 2.

245 Ross Garnaut, *The Garnaut Climate Change Review: Final Report*, Canberra, Commonwealth of Australia, (2008), p 118, quoted in Submission 38, Grattan Institute, p 8.

246 Submission 34, Centre for Air pollution, energy and health Research (CAR), p 8.

247 GJV Oldenborgh et al, 'Attribution of the Australian bushfire risk to anthropogenic climate change', (2020) p 26), cited in Submission 38, Grattan Institute, p 8.

global temperatures continue to rise to 2 [degrees Celsius] above pre-industrial levels, bushfire events in Australia like the summer 2019-20 are about eight times more likely'.[248]

4.4 Evidence that the link between climate change and more threatening bushfire events has become accepted as mainstream was reflected in the *Medical Journal of Australia* article by Arriagada et al which, as noted in chapter 1, estimated that 417 deaths nationally were attributable to bushfire smoke from the 2019-20 bushfires. That article concluded:

> Smoke is just one of many problems that will intensify with the increasing frequency and severity of major bushfires associated with climate change. Expanded and diversified approaches to bushfire mitigation and adaptation to living in an increasingly hot and fire-prone country are urgently needed.[249]

4.5 With concerns expressed regarding climate change and increasing bushfire risk, many inquiry participants underscored a health imperative to address climate change. Indeed, for many stakeholders, action to address climate change was indivisible from actions to address the health effects of bushfire and drought. The Australian Medical Association (NSW), for example, after documenting the many health effects of climate change on physical and mental health, declared, 'We must act now on climate change to curtail the increasing risk of drought and extreme bushfires and pollution events'.[250] Similarly, the Royal Australia and New Zealand College of Obstetricians and Gynaecologists (RANZCOG) asserted:

> Minimising the future impacts of exceptional events such as dust storms and bushfires hinges upon the development of strategies that allow Australia to mitigate and adapt to the effects of climate change.[251]

4.6 Similarly, both the National Asthma Council of Australia and the Menzies Institute called for 'meaningful action to address the drivers of climate change' to 'prevent sustained periods of poor air quality'.[252]

4.7 Doctors for the Environment Australia called for New South Wales to 'actively address the root cause of the bushfire emergency, which is the increasing frequency of severe fire weather due to climate change'. Specifically, it argued for 'rapid decarbonisation of the economy, and honest participation in global efforts to negotiate a solution to the climate crisis', and for New South Wales to transition 'away from our reliance on fossil fuels and [to embrace] the economic benefits of renewable energy and low carbon emitting technologies'.[253]

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248 Submission 38, Grattan Institute, p 8.

249 Nicolas Borchers Arriagada, Andrew J Palmer, David MJS Bowman, Geoffrey G Morgan, Bin B Jalaludin and Fay H Johnston, 'Unprecedented smoke-related health burden associated with the 2019–20 bushfires in eastern Australia', research letter, *Medical Journal of Australia*, 2020, 26 March 2020, p 2, attachment to correspondence from Dr Bruce Graham, Adjunct Academic in the School of Biomedical Sciences, Charles Sturt University, received 26 March 2020.

250 Submission 31, Australian Medical Association (NSW), p 8.

251 Submission 30, Royal Australian and New Zealand College of Obstetricians and Gynaecologists, p 5.

252 Submission 37, National Asthma Council Australia, p 1; Submission 35, Associate Professor Fay Johnston, Environmental Health Group, Menzies Institute for Medical Research, University of Tasmania, p 3.

253 Submission 24, Doctors for the Environment Australia, p 9.

4.8 Likewise, the NSW Council of Social Service (NCOSS) proposed that, 'Any response to the health impacts of bushfire smoke must acknowledge and address the climate-related drivers' and strongly advocated for 'renewable and clean energy solutions to reduce emissions and mitigate the wide-ranging impacts of climate change'.[254]

4.9 On the basis of the research evidence cited in paragraph 4.2 above, CAR underscored the imperative to act on climate change, as well as the consequences of inaction:

> [G]overnments must act now on climate change to curtail the increasing risk of extreme bushfires and therefore air pollution events. By maintaining the status quo, extreme bushfire events and associated health impacts will continue to accelerate.[255]

4.10 In the same vein, Asthma Australia called on the NSW Government to 'take action to mitigate climate change and the associated weather conditions causing longer bushfire seasons and sustained periods of poor and hazardous air quality'.[256]

Addressing ongoing air pollution

4.11 Beyond the issue of both bushfires, drought and climate change, numerous inquiry participants called for greater action on the part of government to improve air quality on an ongoing basis. The health effects of air pollution generally (as distinct from bushfire smoke) are documented in paragraphs 1.27 to 1.35.

4.12 Ms Claire Walter, member of the Clean Air Society of Australia and New Zealand (CASANZ) highlighted the responsibility of government to address the substantial health burden, in terms of both death and disease, arising from air pollution – which she noted is one of the highest ranked risk factors for death and disease in Australia:

> I think it is really important to recognise that bushfire pollution is not the only source of particulate pollution in Australia. Every year there are an estimated 4,880 premature deaths in Australia resulting from outdoor air pollution. Outdoor particulate matter is in the top 10 risk factors for premature death and disease in Australia, and it is the only one of these top 10 risks that is completely beyond the control of the individual. As such, effective policy that protects the public is critical. The key sources of toxic combustion that produce particulate matter in Australia are coal-fired power stations, vehicles, wood heaters and bushfires … Most public exposure to pollution comes from urban vehicle use … While bushfires represent a serious threat to Australian public health and they merit our attention today, I suggest we also consider how we reduce public exposure for all sources of combusted particulate matter in Australia.[257]

254 Submission 29, NSW Council of Social Service, p 3.

255 Submission 34, Centre for Air pollution, energy and health Research (CAR), p 8; see also Evidence, Ms Clare Walter, Member, Clean Air Society of Australia and New Zealand, 12 June 2020, p 21

256 Submission 46, Asthma Australia, p 15.

257 Evidence, Ms Walter, 12 June 2020, p 17.

4.13 According to Ms Walter, Australian policy in this area 'significantly lags' behind that of other developed nations. She noted, for example, that while much of continental Europe and the United Kingdom are banning and phasing out diesel vehicles, Australia continues to import and use them, despite their much greater production of particulate matter and nitrogen dioxide compared with regular vehicles.[258]

4.14 Like Ms Walter, Mr Maxwell Smith, Clean Air Campaigner with Environmental Justice Australia, pointed to the much greater health burden associated with ongoing air pollution compared with that for bushfires, and called for much greater action to address both the health and economic burden:

> New South Wales air pollution policy must reduce this health and economic burden from everyday ambient air pollution across the State. This means policies that seek to reduce air pollution from all major sources to as close to zero as possible. Successive NSW Health studies, including one published this year, have concluded that reducing everyday air pollution levels by even a small amount will yield a range of immediate and substantial health and economic benefits for New South Wales, which are likely to far outweigh the costs of intervention. Strong health-based air pollution standards must be implemented to protect community health all year round, with an exposure reduction framework in place for continual improvement of emission standards. We urge the Committee to make recommendations that pre-existing sources of pollution be reduced to as close to zero as possible, to mitigate the health burden of air pollution of the New South Wales community all year round.[259]

4.15 Mr Smith also highlighted that reducing air pollution on an ongoing basis will reduce the levels of air pollution already present as a backdrop to bushfire events:

> One aspect of a clean air strategy, or arguably the main purpose, is that you reduce pollution all year round. If you have a lower background level of pollution, you will ultimately have a lower concentration of pollution when events like bushfire smoke occur. As Ms Walter mentioned, there is a compounding effect that has been observed with pollution that is already in the atmosphere, especially combining with volatile organic compounds that come from gum trees, for example, creating additional ozone, which is a very dangerous pollutant for the lungs, as well as secondary sulphates and secondary nitrogen oxides combining to create additional PM2.5. You would have increased concentrations of pollution if you basically allow pollution to continue unabated. If you check pollution you would have a lot less in bushfire events.[260]

4.16 In its submission, Environmental Justice Australia argued for government action to address air quality in the interests of protecting health and preventing further harm. In doing so, it argued for strong government regulation:

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258 Evidence, Ms Walter, 12 June 2020, p 17.

259 Evidence, Mr Maxwell Smith, Clean Air Campaigner, Environmental Justice Australia, 12 June 2020, p 18.

260 Evidence, Mr Smith, 12 June 2020, p 21.

> Regulation is particularly important in controlling air pollution. Individuals cannot readily control the extent to which they are exposed to harmful air pollution. People rely on the government to implement and enforce good regulation to protect their health. Polluters will pollute to the maximum amount allowed by law (and often more when enforcement is lax as it is with air pollution).[261]

4.17 Mr Smith and his colleague Ms Bronya Lipski, Lawyer, reinforced the importance of strong regulation as a means of addressing air pollution, with Ms Lipski suggesting that regulation has to date been underutilised in New South Wales. She also highlighted the important role of extensive localised monitoring of air quality, as discussed in detail in chapter 2:

> I would say that the current regulatory framework and the legal framework for air pollution is not utilised to the extent that it could in order to ensure that point source emissions, so those emissions from facilities such as coal-fired power stations, can be reduced as much as possible. There is an existing framework, including the clean air regulations, where you can intervene to ensure that emissions standards are set to appropriately reflect the types of emissions standards to protect community health and, certainly, to include the range of monitoring points throughout the State, including in areas like the upper Hunter Valley, but also in metropolitan areas, so that we understand exactly the type of air pollution that people are exposed to at ground level from traffic pollution. I think there is a long way to go.[262]

4.18 Environmental Justice Australia made a number of recommendations that the NSW Government should:

- focus air pollution control strategies on the greatest sources of air pollution, which have the biggest impact on human health
- set strong stack emissions limits for coal fired power stations in line with international standards requiring operators to install continuous stack monitoring and best practice pollution controls
- finalise and implement a Clean Air Strategy for NSW that includes strong measures to reduce industrial pollution as close to zero as possible.
- expand the air quality monitoring network to monitor areas with particular risks to health from significant air pollution sources, such as at Lake Macquarie and Lithgow
- immediately set strong health-based air pollution standards to protect health, with an exposure reduction framework for continual improvement of the standards
- finalise the review of the Load-Based Licencing (LBL) Scheme, removing the exemption for pollution from coal mines and associated infrastructure
- commit to further research and policy development with regards to air pollution and impact on health.[263]

261 Submission 44, Environmental Justice Australia, p 10.

262 Evidence, Ms Bronya Lipski, Lawyer, Environmental Justice Australia, 12 June 2020, p 20.

263 Submission 44, Environmental Justice Australia, pp 3 and 13; see also Evidence, Mr Smith, 12 June 2020, p 20.

4.19 Others who called for greater action to address poor air quality on an ongoing basis included the Royal Australian and New Zealand College of Obstetricians and Gynaecologists, which drew on research to underscore the need for a public health approach focused on prevention. It observed that, 'The most effective way to reduce exposure to air pollution is to limit the production and release of pollutants',[264] and called on government to act to limit adverse health effects:

> Protecting the Australian public, in general, and mothers, unborn children and babies, in particular, from all forms of air pollution is clearly a moral and economic imperative … Air pollution must be adequately addressed to avoid an increased lifetime risk of poor health, lack of opportunity [for children] to meet their full potential, and lack of opportunity to actively enjoy the natural environment for future generations.[265]

4.20 Councillor Jess Miller from the City of Sydney Council drew attention to the ways that local government is constrained in its ability to protect the health of residents by inadequate monitoring and regulation of air quality at both the federal and state/territory levels. She suggested that the National Environment Protection Measure for Ambient Air Quality (explained in paragraph 1.8) 'is so weak that currently the NSW Government's Environmental Protection Authority does not meet its … obligations' within her council area, 'and when standards are exceeded, there is no consequence, penalty or recourse'. Councillor Miller went on to argue that, 'This contributes to a chronic health problem that is greatly exacerbated by acute shock such as bushfires'.[266]

4.21 Councillor Miller emphasised the benefits to be gained from state and local government working more strategically and collaboratively in this area, with the state government setting a regulatory framework that drives and informs local planning mechanisms such as local environment plans [LEPs] and the local development control plans.[267] She proposed that despite the 'policy vacuum' at the federal level, the NSW Government should act to:

- introduce a place-based monitoring protocol that sets real standards to enable state and local governments to address exposure to pollutants for people most at risk
- devise a framework that ensures the NSW Environmental Protection Agency meets its NEPM regulatory monitoring obligations
- enable punitive measures such as fines to polluters who breach existing standards
- introduce regulation that allows for diverse monitoring technology that provides data as a real time decision-making tool to government and communities
- consider funding local government to work with the community to experiment with different types of air pollution monitoring technology and locations as part of Smart Cities funding packages.[268]

264 Submission 30, Royal Australian and New Zealand College of Obstetricians and Gynaecologists, p 4.

265 Submission 30, Royal Australian and New Zealand College of Obstetricians and Gynaecologists, pp 5-6.

266 Submission 19, Ms Jess Miller, Councillor, City of Sydney Council, p 2; see also p 7.

267 Evidence, Ms Jess Miller, Councillor, City of Sydney Council, 12 June 2020, pp 18 and 21.

268 Submission 19, Ms Jess Miller, Councillor, City of Sydney Council, p 7; see also Evidence, Ms Miller, 12 June 2020, p 21.

A clean air strategy

4.22 Environmental Justice Australia and Doctors for the Environment Australia called for the finalisation and immediate implementation of the 'Clean Air for NSW Strategy' (also known as the 'Clean Air Strategy'), both arguing that this must necessarily include strong measures to reduce ongoing air pollution. Both stakeholders drew attention to the fact that the development of the strategy commenced in 2016 but is not yet complete.[269]

4.23 Doctors for the Environment referred to a number of recommendations from previous inquiries that it considered should be included in a forthcoming strategy:

- reducing air pollution from coal fired power stations via the installation of pollution reduction technologies, as mandated by other countries including the United States, China, Japan and Europe, implementing a load-based licencing scheme with fees that more accurately reflect the health burden of air pollution, and incentivising power station operators to reduce their pollution
- reducing vehicle-produced air pollution by implementing standards for passenger and light vehicles and for heavy vehicles which are mandatory in many countries, providing incentives and infrastructure to support the use of electric and hybrid vehicles, and phasing out diesel and other high polluting vehicles
- reducing pollution from wood heaters (the greatest source of PM 2.5 in winter) by phasing out their use in urban areas and via consumer education, improving appliance standards and incentives to install less polluting heaters
- reducing pollution from coal mines (the greatest source of PM2.5 overall) 'by taking into account the air pollution and health impacts of all new proposals and extensions, including full economic analysis of the health burden of pollution, and with enhanced measures to stop new developments if they contribute to worsening air pollution'.[270]

4.24 Consistent with its views documented above, Environmental Justice Australia called for the Clean Air Strategy to place the highest priority on the greatest sources of pollution:

> The priorities for pollution control strategies should reflect the relative contribution of various pollution sources, and the health impacts of those sources. Government must prioritise controlling those pollution sources which are the greatest contributor to pollution levels and have the biggest impact on human health. As is clear from the significant health costs associated with air pollution, prioritising human health will also have significant economic (and environmental) benefits.[271]

4.25 It proposed that the Clean Air Strategy for NSW should include:

- increased air quality monitoring
- research and information sharing with the public, so that the public can exercise their right to know what they are breathing and take measures to protect themselves

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269 Submission 44, Environmental Justice Australia, pp 15-16; Submission 24, Doctors for the Environment Australia, pp 7 and 10.

270 Submission 24, Doctors for the Environment Australia, pp 7-8.

271 Submission 44, Environmental Justice Australia, pp 15-16.

- increased bushfire hazard reduction and emergency planning
- pollution control for industrial and vehicle sources of pollution to reduce those sources as much as possible, including a requirement for adoption of best available technologies.[272]

4.26 Environmental Justice Australia further emphasised that the agency responsible for implementing the new strategy must be adequately resourced to deliver proper regulation and policy leadership:

> To implement and enforce an effective Clean Air Strategy, the EPA must be adequately resourced and empowered to fulfil its functions for air quality monitoring and regulation. A strong and proactive approach to air pollution prevention requires robust and well-resourced institutional arrangements capable of decisive policy intervention.[273]

4.27 The committee sought information from the Department of Planning, Industry and Environment (DPIE) regarding the progress and features of the forthcoming Clean Air for NSW Strategy.

4.28 Ms Michelle Dumazel, Executive Director, Policy Division, Environment, Energy and Science Group in DPIE advised that the Clean Air Strategy being prepared by her division is expected to be finalised in early 2021.[274]

4.29 Ms Dumazel confirmed that the strategy's development is being informed by the experience of the bushfires and drought, along with the learnings being identified via both the Commonwealth Royal Commission and the NSW Bushfire Inquiry stating, 'I think it is important that we consider any findings that come out of inquiries prior to our finalisation of the Clean Air for NSW strategy'.[275]

4.30 Ms Dumazel advised that a further consultation period will occur at the end of 2020, and 'we will be working quite closely with our colleagues [in the Environmental Protection Agency and DPIE's Science Division] in terms of the analysis and the thinking as we develop what we might put forward for consideration by Government'.[276] Asked for more detail as to the content of the Strategy, Ms Dumazel responded:

> At this point, what we are doing is looking to see what we have actually achieved since the consultation process previously on clean air, looking at the events over the summer period, of course taking into account the monitoring, the research and the changes that we have made to our monitoring system over the past couple of years and earlier this year as well in terms of communication of those messages. I think it will be important to continue to consider that. I suppose the other aspect that we are thinking about is: How does it fit in with what Government has been doing overall in relation to air quality in New South Wales? I am just thinking, for example, we now have the Net Zero Plan

272 Submission 44, Environmental Justice Australia, pp 15-16.

273 Submission 44, Environmental Justice Australia, pp 15-16.

274 Evidence, Ms Michelle Dumazel, Executive Director, Policy Division, Environment, Energy and Science Group, Department of Planning, Industry and Environment, 15 July 2020, p 10.

275 Evidence, Ms Dumazel, 15 July 2020, pp 10-11.

276 Evidence, Ms Dumazel, 15 July 2020, p 11.

> Stage 1 and there are quite a number of actions in that over the next 10-year period that look at things like electric vehicles, emissions from vehicles.
>
> It looks at renewable energy. It also looks at energy efficiency and, for example, manufacturing and agricultural processes and the emissions from that. We will be taking that into account. We will also be thinking about what is happening from a Planning perspective and how we are working with our Planning colleagues, as well as what has happened over the past year in relation particularly to bushfires and air quality. We will certainly be working with our colleagues here and within government and also looking at the research to see what needs to be included. I think what will be important will be the consultation period towards the end of the year before we finalise what the actions will be.[277]

4.31 In answers to supplementary questions, the Department of Planning, Industry and Environment confirmed that the strategy will be released in early 2021, following consultation on a draft strategy in late 2020. The development of the strategy will consider the relevant findings from the government inquiries into the 2019-20 bushfire season.[278]

4.32 The Department advised that it will be working with NSW Health, Transport for NSW and the Department of Regional NSW to develop the strategy. It expected that the strategy will include NSW Government regulatory, monitoring, research and communication actions to improve air quality and reduce the health impacts of poor air quality throughout urban and regional New South Wales.[279]

4.33 The strategy will also outline the air quality benefits anticipated from related government policies such as the *Net Zero Plan Stage 1: 2020-2030* and the *NSW Electricity Strategy,* as well as relevant transport and land use planning initiatives.[280]

Cross agency collaboration

4.34 Ms Michele Goldman, Chief Executive Officer of Asthma Australia, highlighted to the committee the imperative for a collaborative response from government, both across the relevant NSW Government agencies, and between federal and state/territory governments, in order to better respond to the inherently complex issue of addressing poor air quality from bushfires and drought:

> This is a complex issue and there is no silver bullet solution. Asthma Australia is calling for a comprehensive platform of policy reforms that is going to require a whole-of-government approach and collaboration between State and Federal governments. The good news is that we have seen how well this can work when we have been up against the crisis of COVID-19. Let us not wait for another bushfire crisis before we act.[281]

277 Evidence, Ms Dumazel, 15 July 2020, p 11.

278 Answers to supplementary questions, Department of Planning, Industry and Environment, 18 August 2020, p 1.

279 Answers to supplementary questions, Department of Planning, Industry and Environment, 18 August 2020, p 1.

280 Answers to supplementary questions, Department of Planning, Industry and Environment, 18 August 2020, p 1.

281 Evidence, Ms Michele Goldman, Chief Executive Officer, Asthma Australia, 10 June 2020, p 2.

4.35 The final report of the NSW Bushfire Inquiry recognised that there has been some collaboration across federal and state/territory agencies in terms of smoke modelling. Whilst the DPIE was credited as having 'considerable expertise' in air quality and smoke monitoring, the report acknowledged that the NSW Rural Fire Service had also been working with the Commonwealth Bureau of Meteorology and the Australasian Fire and Emergency Service Authorities Council to explore the effectiveness of a national Air Quality Forecast System (AQFx), a fire spread model to calculate smoke emissions from bushfires and includes wind-blown dust and urban sources of pollution.[282]

4.36 The committee posed to the various government agencies, what they were doing to work together in applying the learnings from the 2019-20 bushfires.

4.37 Mr Matthew Riley, Director, Climate and Atmospheric Science with the Environment, Energy and Science Group in DPIE, highlighted the Hazard Reduction Smoke Management Committee as an example of the collaborative work taking place across agencies in this area of policy. The committee is co-chaired by DPIE Environment, Energy and Science and NSW Rural Fire Service, and comprised of representatives from the EPA, NSW Health, Fire and Rescue NSW and the Bureau of Meteorology. Mr Riley advised that the committee was established several years ago in response to concerns regarding the impacts of smoke from hazard reduction burns on some busy weekends and has had two key focuses: the development of protocols for the communication of the management of smoke impacts in relation to hazard reduction burns; and better predictive services, and better modelling, so that government agencies are more aware of what the potential impacts are from smoke and planned hazard reduction burning activities.[283] Mr Riley observed:

> I think it is a really good example of how the agencies have come together and worked together to improve not just communications but to improve planning. A specific example along these lines would be the smoke modelling activities that occur during the planning of hazard reduction burns. RFS has smoke modelling capabilities, so does DPIE Environment, Energy and Science. The protocols support us in sharing information from our different perspectives and then working together to ensure that we can help minimise any smoke impacts from planned hazard reduction burning events.[284]

4.38 Mr Riley advised that over the summer, government agencies used many of that group's directions for hazard reduction burns as a model for communications in respect of wildfires. The cross-agency committee is now considering the expansion of its remit to bushfire events as well as hazard reduction burns. He gave a further example of an advisory group on climate change which provides advice to the State Emergency Management Committee regarding how climate change will affect a broad range of hazards, notably bushfires and droughts, and how that can be better incorporated into the State Emergency Management Plan. Mr Riley stated:

282 NSW Bushfire Inquiry, *Final Report* (2020), p 235.

283 Evidence, Mr Matthew Riley, Director, Climate and Atmospheric Science, Environment, Energy and Science Group, Department of Planning, Industry and Environment, 15 July 2020, p 9.

284 Evidence, Mr Riley, 15 July 2020, p 9.

> I think they are two very good examples [of how agencies have worked together]. From my perspective, I think we were working well together beforehand, and the hazard reduction burning smoke management committee certainly demonstrates that, but I think that we are continuing to build stronger working relationships off the back of this event.[285]

4.39 Dr Simon Heemstra, Manager of Planning and Predictive Services at the NSW Rural Fire Service, advised that since last summer the RFS has been working with the Hazard Reduction Smoke Management Committee to examine how the RFS can improve its ability to predict wildfire events, stating, 'We are working with that committee to look at how we can apply the learnings and the processes that we have used for hazard reduction into a wildfire predictive capability'.[286]

4.40 Dr Heemstra went on to advise that work has been progressing across jurisdictions to develop national protocols and to enable better modelling, noting that this is a rapidly evolving area of knowledge and capability:

> Part of the other challenges we have with wildfire is that the bushfire smoke goes beyond State boundaries, so modelling bushfire effects from other States into New South Wales can be challenging. Through the Australasian Fire and Emergency Service Authorities Council, we have been working on national protocols. We have also been working with the Bureau of Meteorology. They are using a smoke and dispersion modelling program called Air Quality Forecast system that we are looking to use for better national modelling. One of the challenges we have is the fact that this is still an evolving and developing space. We are doing the best practice we have at the moment, but we are also working and engaging very actively with researchers. The work that is being done through the [Office of Environment and Heritage research hub] is quite critical and the RFS is actively engaged in that work.[287]

4.41 Also with regard to cross-jurisdictional collaboration, Dr Richard Broome, Acting Executive Director, Health Protection NSW, NSW Health, advised that a key focus of NSW Health's work since the bushfires has been the development of a nationally consistent approach to air quality communication,[288] as discussed in chapter 2.

4.42 Despite the current focus on the COVID-19 pandemic, Dr Broome emphasised work in this area is still a priority, 'It is fair to say that NSW Health has had to reprioritise what it does around COVID. Within our branches, we have had to prioritise our work. What I would say is that bushfire smoke continues to be a real priority for us'.[289]

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285 Evidence, Mr Riley, 15 July 2020, p 9.

286 Evidence, Dr Simon Heemstra, Manager of Planning and Predictive Services, NSW Rural Fire Service, 15 July 2020, p 10.

287 Evidence, Dr Heemstra, 15 July 2020, p 10.

288 Evidence, Dr Richard Broome, Acting Executive Director, Health Protection NSW, NSW Health, 15 July 2020, p 6.

289 Evidence, Dr Broome, 15 July 2020, p 7.

Investment in data collection and research

4.43 A number of inquiry participants called for continued investment and focus on data collection and research on air quality. In particular, there was a strong call among stakeholders to improve the collection of data on the health effects of poor air quality, and the most effective ways to mitigate those effects.

4.44 Associate Professor Fay Johnston, for example, highlighted investment in research as a key means by which to enhance our responses to bushfire smoke:

> There are a number of ways that we can improve how we do this. The issues are actually very similar across all States in Australia. One, of course, is more research. We know what we know and we know that there are a lot of gaps, particularly on the effectiveness of interventions and on the longer-term health impacts.[290]

4.45 In her statement to the Royal Commission into National Natural Disaster Arrangements established in response to the extreme bushfire season of 2019-20, Professor Johnston elaborated on the need for a better evidence base to inform public health advice during bushfires:

> The evidence base for much of the standard health advice provided by government agencies is poor and existing evidence is often not well incorporated into practice. There is very little available evidence about the risk of persistent health impacts following severe smoke events, or comparative impacts of PM2.5 from different types of combustion. Further, advice (e.g. to stay indoors) that is appropriate for brief episodes of pollution, such as a few hours of smoke from a planned burn, is not necessarily appropriate for prolonged and severe episodes such as that experienced over the 2019-20 summer. Evidence for the appropriateness of face masks for the general population is lacking; while evidence to support indoor air filtration to protect health exists, there [are] also gaps about how and where indoor air filtration is effective and this strategy is not routinely incorporated into agency health advice.[291]

4.46 Asthma Australia explained why there is also a lack of research evidence on the health impacts of prolonged exposure to poor air quality:

> It can be difficult to identify the health impacts of sustained exposure to poor and hazardous air quality because they may be delayed or seem unrelated to the exposure. For these reasons data collected by health services, including hospitals and general practitioners, may not record exposure to bushfire smoke as a factor in the presentation of the person to the service. Likewise, exposure to smoke may not be revealed as a cause of death on a death certificate.

290 Evidence, Associate Professor Fay Johnston, Head of the Environmental Health Group, Menzies Institute for Medical Research, University of Tasmania, 12 June 2020, p 2.

291 Submission 35a, Associate Professor Fay Johnston, Head of the Environmental Health Group, Menzies Institute for Medical Research, University of Tasmania, p 11.

> There is limited research into the health impacts of prolonged exposure to poor and hazardous air quality resulting from bushfires. Historically, bushfire events have typically been brief, therefore research has focused on short term exposure. At the population level, it is difficult to determine the differences in effects of different particles.[292]

4.47 Accordingly, Asthma Australia recommended that data collection, including from NSW Health and other public health agencies, be improved to ensure that bushfire smoke is recorded as a cause of morbidity or mortality across the healthcare system, pointing out that this will help us understand the impacts of bushfire smoke on short and long term health conditions. Specifically, it suggested that, 'New South Wales work with the Australian Institute of Health and Welfare (AIHW) and other jurisdictions to develop models for improved data collection in hospitals and other health settings to adequately and promptly enable capture of data relevant to crises, such as bushfires'.[293]

4.48 The Australian Medical Association (NSW) highlighted the need for more research on the impact of poor air quality on vulnerable groups, especially Indigenous people among others:

> Research on the impact of poor air quality on Indigenous populations should be a priority. Further research should be undertaken to better understand the health impacts to vulnerable and at-risk groups, including children, people with chronic health conditions, and people from low socio-economic backgrounds.[294]

4.49 Environmental Justice Australia recommended that the NSW Government '[c]ommit to further research and policy development with regards to air pollution and impact on health', with a view to better quantifying the health impacts of air pollution and the benefits that accrue from controlling it.[295] It further proposed that research include the utilisation of detailed atmospheric modelling to estimate ground level air pollution across all populated areas of New South Wales, and the quantification of other non-health indicators such as reduced labour productivity, the co-benefits of reducing other pollutants, and reduction in secondary particulate formation.[296]

4.50 In light of these recommendations, the committee raised the issue of research with government witnesses.

4.51 Dr Broome underscored that while NSW Health does not itself conduct research into poor air quality, it supports others to undertake research, and that the developing evidence base is critically important to informing NSW Health's responses to poor air quality:

> I would say NSW Health's role in the broader government approach to air pollution is around the translation of epidemiological evidence into information that is useful to the actual agency or the policy-makers in the agencies with air quality management responsibilities. Yes, we have a small team of people who work on these sorts of issues. For example, at the moment, given this event, we are supporting research to do analysis

292 Submission 46, Asthma Australia, p 4.

293 Submission 46, Asthma Australia, pp 4-5.

294 Submission 31, Australian Medical Association (NSW), p 9.

295 Submission 44, Environmental Justice Australia, pp 3 and 13.

296 Submission 44, Environmental Justice Australia, p 20.

> essentially to work out what the effect of this bushfire actually was, based on the observed evidence that we have. So, yes, we support research by researchers.[297]

4.52 The NSW Government submission to this inquiry noted that 'Supporting research to improve understanding of the impacts of the 2019-20 bushfire event and the effectiveness of interventions to mitigate smoke exposure' had emerged as an important focus of work since the summer, with the purpose of lessening the health impact of future bushfire smoke events.[298] In respect of the emerging data from the bushfire event, it stated:

> Quantification of the impacts of poor air quality requires sophisticated analysis of data from various sources, including data on ambulance call-outs, hospital admissions, pregnancy outcomes and deaths. These data will take several months to process before they are available for analysis. NSW Health is actively supporting researchers to access and analyse data to improve our understanding of the impact of this event. NSW Health has also supported the Medical Research Future Fund's 2020 Bushfire Impact Research Grant Opportunity to fund research into the health impacts of this event.[299]

4.53 Dr Heemstra provided further information on the work of the Office of Environment research hub (discussed in paragraph 4.37) in respect of smoke modelling:

> The Office of Environment and Heritage has a research hub that is being coordinated through the University of Wollongong. It has got various streams looking at biodiversity and fire risk, but one of the streams is looking at air quality effects. It centres through Wollongong but there are various other universities engaged. The work that has been done through University of Tasmania is also being collaboratively done through this hub. That is quite important work but there is work being done through the CSIRO and Bureau of Meteorology. There is quite a lot of research in this area.[300]

4.54 In doing so, Dr Heemstra also provided the committee some insights into the challenges of modelling and predicting bushfire smoke:

> The dispersion models, I think, are improving as far as how we go on the predictive sense, on that side of things. One of the challenges we are facing is: How do we feed the inputs to those models? With hazard reduction, we know how much is planned to be burnt but particularly using the fire behaviour analysis capabilities through the Rural Fire Service, how can we get better inputs into these models more dynamically to better understand and feed those models? If you put garbage in you are going to get garbage out for your prediction for these models. There are various levels of complexity that we are trying to address, we are aware of and we are working through.[301]

297 Evidence, Dr Broome, 15 July 2020, p 6.

298 Submission 47, NSW Government, p 10.

299 Submission 47, NSW Government, p 3.

300 Evidence, Dr Heemstra, 15 July 2020, p 10.

301 Evidence, Dr Heemstra, 15 July 2020, p 10.

Committee comment

4.55 It is now some eight months since the catastrophic events of the 2019-20 summer, and less than one month before the official commencement of the 2020-21 bushfire season on 1 October.

4.56 In the committee's view it is absolutely critical for the NSW Government as a whole, as well as the individual agencies involved, to ensure that they have fully absorbed and learnt all possible lessons from last summer and be prepared for the forthcoming fire season, that is fast approaching.

4.57 The committee acknowledges that the Final Report of the NSW Bushfire Inquiry was publicly released on 25 August 2020, accompanied by the NSW Government's commitment to accept and adopt all of the inquiry's 76 recommendations.[302] Amongst these, the committee wishes to highlight recommendations 34 and 35, which relate to air quality. Recommendation 34 urged the Government to invest in operational air quality forecasting and alert systems, and public health research and policy development, including investment in a comprehensive system of forecasting and alerts for air quality incidents and pollutants of concern, and further investigation of the health impacts of bushfire smoke.[303]

4.58 Furthermore, Recommendation 35 also emphasised the need for evidence-based public health messaging about air quality during bushfire events, and recommended that the Government develop a public education campaign and support systems before the next bushfire season, including tailored messaging to targeted and vulnerable groups and an improved air quality alert system, such as an enhanced Air Rater app.[304]

4.59 The committee acknowledges that the COVID-19 pandemic has understandably been the focus of many NSW Government agencies, especially NSW Health. This inquiry report is a reminder that the 2019-20 bushfires were a major crisis for our state and nation – one that we all must learn lessons from. While there were 33 tragic deaths directly from the fires,[305] highly credible modelling tells us that around 420 people died from smoke related effects. It is self-evident that strategies to improve our monitoring, responses and messaging can actually save lives, as well as preventing a substantial burden of disease.

4.60 In the committee's view, cross agency coordination and collaboration to harness the important lessons from last summer, and moreover to implement those lessons, is critical. The evidence the committee received about coordination and collaboration in respect of communications and modelling for hazard reduction burning, and more recently, for how that can be expanded for bushfires, was encouraging, as was the evidence we received about coordination and collaboration at the national level. The committee encourages NSW Government departments and agencies with a role in this area to work cooperatively to ensure that the best learnings can be taken away from these events, to ensure that our responses are better in the future.

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302 James Carmody, 'NSW Government accepts all 76 bushfire inquiry recommendations', *ABC News,* 25 August 2020.

303 NSW Bushfire Inquiry, *Final Report* (2020), p 238.

304 NSW Bushfire Inquiry, *Final Report* (2020), p 239.

305 Lisa Richards, Nigel Brew and Lizzie Smith, *2019–20 Australian bushfires—frequently asked questions: a quick guide*, Parliament of Australia Library Research Paper, 12 March 2020, https://parlinfo.aph.gov.au/parlInfo/download/library/prspub/7234762/upload_binary/7234762.pdf

4.61 Cross-agency coordination, collaboration and communication are imperative in any event that results in a reduction of air quality. For example, if the NSW Rural Fire Service has a hazard reduction burn planned, the relevant details should be expeditiously communicated to their colleagues at NSW Health, Department of Planning, Industry and Environment and the Environment Protection Authority, who in turn should transmit and communicate relevant information about the impending event to the community and affected groups, particularly those who are vulnerable or at risk.

4.62 The committee recommends that all NSW Government departments and agencies with a role in responding to bushfire events continue to develop and implement strategies to coordinate, collaborate and communicate more effectively on the management of air quality, to ensure optimal planning for and responses during future bushfire events.

Recommendation 8

That all NSW Government departments and agencies with a role in responding to bushfire events continue to develop and implement strategies to coordinate, collaborate and communicate more effectively on the management of air quality, to ensure optimal planning for and responses during future bushfire events.

4.63 The committee is persuaded by the evidence from various stakeholders that greater action is required in respect of ongoing air pollution. Clearly, there is a substantial and troubling health burden arising from ongoing levels of poor air quality, as well as the accompanying economic impacts. Participants also made an effective case that addressing ongoing air pollution will reduce the levels of air pollution that are the backdrop to future bushfire events, thereby reducing potential levels of harm during those events.

4.64 The committee sees further value in inquiry participants' view that greater regulation is required as a key means of reducing ongoing air pollution. In the committee's view it is unfortunate that some four years after work commenced on the Clean Air for NSW Strategy, that task is still not completed. The committee recognises that the bushfire events of 2019-20 are now an important catalyst for the strategy's completion We are reassured that the Environment, Energy and Science Group in Department of Planning, Industry and Environment confirmed that the Clean Air for NSW Strategy will be finalised early 2021, and that this will provide a strong framework for the NSW Government's regulation of air pollution from industry, vehicles and wood heaters. In addition, the committee considers that the strategy must be linked to a comprehensive plan for air quality monitoring across the state (as discussed in chapter 2) and supported by adequate resourcing of the agency responsible for implementation.

Recommendation 9

That the Department of Planning, Industry and Environment ensure that it completes and releases the Clean Air for NSW Strategy by early 2021. Further, that the strategy:

- incorporate a strong framework for regulation of air pollution from industry, vehicles and wood heaters
- link to a comprehensive plan for air quality monitoring across the state
- be supported by adequate resourcing of the agency responsible for implementation.

4.65 Finally, the committee endorses the call from various inquiry participants for greater investment in and support for data collection and research on air quality in general, and in particular, the health effects of poor air quality and the most effective ways to mitigate those effects.

Recommendation 10

That the NSW Government support data collection and research on air quality in general, and in particular, the health effects of poor air quality and the most effective ways to mitigate those effects.

Appendix 1 Air Quality Monitoring Sites NSW

NSW air quality monitoring (AQMN) site[306]	Year Commissioned	PM_{10}	$PM_{2.5}$	TSP	O_3
Upper Hunter					
Bulga	2011	✓			
Camberwell	2011	✓	✓		
Maison Dieu	2011	✓			
Mount Thorley	2011	✓			
Aberdeen	2011	✓			
Jerrys Plains	2011	✓			
Merriwa	2012	✓			
Muswellbrook	2010	✓	✓		
Muswellbrook NW	2011	✓			
Singleton	2010	✓	✓		
Singleton NW	2011	✓			
Singleton South	2011	✓			
Warkworth	2011	✓			
Wybong	2011	✓			
Lower Hunter and Central Coast					
Beresfield	1993	✓	✓		✓
Carrington	2014	✓	✓		
Mayfield	2014	✓	✓		
Lake Macquarie	2020	✓	✓		✓
Newcastle	1992	✓	✓		✓
Stockton	2014	✓	✓		
Wallsend	1992	✓	✓		✓
Wyong	2012	✓	✓		✓
Illawarra					
Albion Park South	2005	✓	✓		✓
Kembla Grange	1994	✓	✓		✓
Wollongong	1993	✓	✓		✓
Roadside Monitoring					
Bradfield Highway	2018	✓	✓		✓
Regional NSW					
Albury	2000	✓	✓		
Armidale	2018	✓	✓		
Bathurst	2000	✓	✓		
Tamworth	2000	✓	✓		
Wagga Wagga North	2011	✓	✓		
Narrabri	2017	✓	✓		
Goulburn	2019	✓	✓		✓
Gunnedah	2017	✓	✓		✓

[306] Answers to questions on notice, Mr Matthew Riley, Director Climate and Atmospheric Science, Environment Energy and Science Group, Department of Planning, Industry and Environment, received 10 July 2020.

Orange	2018	✓	✓		
Port Macquarie	2019	✓	✓		✓
Coffs Harbour	2019	✓	✓		✓
Sydney					
Bargo	1996	✓	✓		✓
Bringelly	1992	✓	✓		✓
Camden	2012	✓	✓		✓
Campbelltown West	2012	✓	✓		✓
Chullora	2002	✓	✓		✓
Earlwood	1978	✓	✓		✓
Lidcombe	2019	✓	✓		✓
Liverpool	1988	✓	✓		✓
Macquarie Park	2017	✓	✓		✓
Oakdale	1996	✓	✓		✓
Penrith	2020	✓	✓		✓
Prospect	2007	✓	✓		✓
Randwick	1995	✓	✓		✓
Richmond	1992	✓	✓		✓
Rouse Hill	2019	✓	✓		✓
Rozelle	1970	✓	✓		✓
St Marys	1992	✓	✓		✓
Parramatta North	2017	✓	✓		✓
Cook and Phillip	2019	✓	✓		✓
Rural NSW					
Cowra	2007			✓	
Condobolin	2004			✓	
Dubbo	2007	✓	✓	✓	
Parkes	2007	✓	✓	✓	
Walpeup	2011	✓	✓	✓	
Werrimull	2018	✓	✓	✓	
Deniliquin	2007			✓	
Kyalite	2007	✓	✓	✓	
Rand	2010			✓	
Loddon Plains	2011			✓	
Wycheproof	2014			✓	
Gunnedah	2019	✓	✓	✓	
Moree	2008	✓	✓	✓	
Walgett	2008	✓	✓	✓	
Grafton	2019	✓	✓	✓	
Lismore	2020	✓	✓	✓	
Merimbula	2019	✓	✓	✓	
Cooma	2019	✓	✓	✓	
Griffith	2012	✓	✓	✓	
Hay	2004	✓	✓	✓	
Junee	2010			✓	
Narrandera	2012	✓	✓	✓	
Temora	2007	✓	✓	✓	

Wagga Wagga North	2014	✓	✓	✓	
West Wyalong	2007	✓	✓	✓	
Moolawatana	2008			✓	
Lameroo	2012			✓	
Euston	2005	✓	✓	✓	
Bourke	2007	✓	✓	✓	
Broken Hill	2008	✓	✓	✓	
Buronga	2003	✓	✓	✓	
Cobar	2007	✓	✓	✓	
Hillston	2007	✓	✓	✓	
Ivanhoe	2004	✓	✓	✓	
Lake Victoria	2004	✓	✓	✓	
Pooncarie	2004			✓	
Tibooburra	2004	✓	✓	✓	
White Cliffs	2008	✓	✓	✓	
Coombah	2004	✓	✓	✓	

Abbreviations	**Name of parameter**	**Pollutant units**	**Instrument type**
O_3	Ozone	parts per hundred million (pphm)	API T400 or API T204; Ecotech 9810
PM_{10}	Particles less than 10 micrometres in diameter	micrograms per cubic metre ($\mu g/m^3$)	Thermo Tapered Element Oscillating Micro-balance (TEOM) 1405A
$PM_{2.5}/PM_{10}$	Particles less than 2.5 and 10 micrometres in diameter	micrograms per cubic metre ($\mu g/m^3$)	Thermo 1405-DF TEOM (Dichotomous, Filter Dynamic Measurement System, Tapered Element Oscillating Micro-balance)
$PM_{2.5}$	Particles less than 2.5 micrometres in diameter	micrograms per cubic metre ($\mu g/m^3$)	Thermo Beta Attenuation Method (BAM)5014i; Thermo SHARP5030 BAM
$TSP/PM_{10}/PM_{2.5}$	Total Suspended Particles	Micrograms per cubic metre ($\mu g/m^3$)	TSI Multi-channel DRX DustTrak Aerosol Moniter (8533) (Rural Network sites only)
TSP	Total Suspended Particles	Micrograms per cubic metre ($\mu g/m^3$)	TSI Single-channel Dusttrak (8520) or handheld equivalent (8532) (rural network sites only)

Appendix 2 Submissions

No.	Author
1	Mr Ian Bowie
2	Name suppressed
3	Name suppressed
4	Mr Grant Mistler
5	Ms Michelle Lowry
6	Ms Therese Weiss
7	Mr Brett Elliott
8	Name suppressed
9	Name suppressed
10	Name suppressed
11	Name suppressed
12	Mr Othmane Hamidi
13	Name suppressed
14	Mr Derek Robertson
15	Mr Les Johnston
16	Ms Fernanda Rodas
17	Name suppressed
18	Name suppressed
19	Name suppressed
20	Name suppressed
21	Mrs Judy Wettenhall
22	Mrs Julie Collier
23	Ms Margaret Morgan
24	Doctors for the Environment Australia
25	Name suppressed
26	Name suppressed
27	Mr Colin Brodie
28	The Australian Workers' Union
29	NSW Council of Social Service (NCOSS)
30	Royal Australian and New Zealand College of Obstetricians and Gynaecologists (RANZCOG)
31	Australian Medical Association (NSW) Ltd
32	Australian Education Union New South Wales Teachers Federation Branch

No.	Author
33	Australian Nuclear Science and Technology Organisation - ANSTO
34	Centre for Air pollution, energy and health Research (CAR)
35	Associate Professor Fay Johnston, Environmental Health Group, Menzies Institute for Medical Research, University of Tasmania
35a	Associate Professor Fay Johnston, Environmental Health Group, Menzies Institute for Medical Research, University of Tasmania
36	Ms Anne Picot
37	National Asthma Council Australia
38	Grattan Institute
39	Name suppressed
40	Australian Services Union NSW & ACT (Services) Branch
41	Mr John O'Donnell
42	Maritime Union of Australia
43	Clean Air Society of Australia and New Zealand
44	Environmental Justice Australia
45	Public Service Association of NSW
46	Asthma Australia
47	NSW Government
48	Unions NSW
49	Ms Jess Miller, Councillor, City of Sydney Council

Appendix 3 Witnesses at hearings

Date	Name	Position and Organisation
10 June 2020 **Video conference**	Ms Michele Goldman	Chief Executive Officer, Asthma Australia
	Ms Cherylleigh Partridge	Person with lived experience, Asthma Australia
	Mr Alistair Sage	Senior Legal Officer, Australian Workers Union, NSW Branch
	Mr Garth Toner	Organiser, South East Region, Australian Workers Union, NSW Branch
	Ms Natalie Lang	Branch Secretary, Australian Services Union NSW & ACT
	Mr Jake Field	National Safety and Training Officer, Maritime Union of Australia, A Division of the Construction Forestry Maritime Mining and Energy Union
	Ms Natalie Wasley	Delegate, Maritime Union of Australia, A Division of the Construction Forestry Maritime Mining and Energy Union
	Ms Natasha Flores	Industrial Officer, Unions NSW
	Mr Shay Deguara	Manager, Public Service Association of NSW
	Ms Claire Pullen	Project Officer, Public Service Association of NSW
	Ms Amber Flohm	Senior Vice President, NSW Teachers Federation
	Ms Kelly Marks	Research/Industrial Officer and Climate Emergency Coordinator, NSW Teachers Federation
	Dr Danielle McMullen	President, Australian Medical Association (NSW)
	Dr Ben Ewald	Convenor, Special Interest Group on Air Pollution, Doctors for the Environment

Date	Name	Position and Organisation
	Dr Kristine Barnden	Member, Royal Australian and New Zealand College of Obstetricians and Gynaecologists
12 June 2020 **Video conference**	Dr Stephen Duckett	Health Program Director, Grattan Institute
	Mr Will Mackey	Associate, Grattan Institute
	Associate Professor Fay Johnston	Head of the Environmental Health Group, Menzies Institute for Medical Research
	Professor Guy Marks	Chief Investigator and Head, Centre for Air pollution, energy and health Research (CAR)
	Dr Suzanne Hollins	Head of Research, Nuclear Science and Technology and Landmark Infrastructure, Australia Nuclear Science and Technology Organisation
	Professor David Cohen	Distinguished Research Scientist, Nuclear Science and Technology and Landmark Infrastructure, Australia Nuclear Science and Technology Organisation
	Ms Clare Walter	Member, Clean Air Society of Australia and New Zealand
	Ms Bronya Lipski	Lawyer, Environmental Justice Australia
	Mr Maxwell Smith	Clean Air Campaigner, Environmental Justice Australia
	Ms Jess Miller	Councillor, City of Sydney Council
	Dr Richard Broome	Acting Executive Director, Health Protection NSW, NSW Health
	Mr Jim Kelly	Director Health and Safe Design, SafeWork NSW
	Mr Peter Dunphy	Executive Director Compliance and Dispute Resolution, SafeWork NSW

Date	Name	Position and Organisation
	Mr Anthony Clark	Director Corporate Communications, NSW Rural Fire Service
	Dr Simon Heemstra	Manager Planning and Predictive Services, NSW Rural Fire Service
	Mr Matthew Riley	Director Climate and Atmospheric Science, Environment Energy and Science Group, Department of Planning, Industry and Environment
15 July 2020 **Macquarie Room** **Parliament House, Sydney**	Dr Richard Broome	Acting Executive Director, Health Protection NSW, NSW Health
	Mr Peter Dunphy	Executive Director Compliance and Dispute Resolution, SafeWork NSW
	Dr Simon Heemstra	Manager Planning and Predictive Services, NSW Rural Fire Service
	Mr Matthew Riley	Director Climate and Atmospheric Science, Environment Energy and Science Group, Department of Planning, Industry and Environment
	Ms Michelle Dumazel	Executive Director Policy Division, Environment, Energy and Science Group, Department of Planning, Industry and Environment
	Mr David Fowler	Acting Executive Director Regulatory Operations, NSW Environment Protection Authority
	Mr Anthony Savage	Unit Head Environmental Solutions, NSW Environment Protection Authority

Appendix 4 Minutes

Minutes no. 14
Wednesday 5 February 2020
Portfolio Committee No.2 - Health
Room 1136, Parliament House, Sydney at 3.05 pm

1. Members present
Mr Donnelly, *Chair*
Ms Hurst, *Deputy Chair*
Mr Amato *(via teleconference)*
Ms Faehrmann
Mr Fang
Mr Farlow *(substituting for Mrs Maclaren-Jones)*
Mr Secord

2. ***

3. Correspondence
The Committee noted the following items of correspondence:

Received:
- ***
- ***
- ***
- 3 February 2020 – Letter from Ms Cate Faehrmann, the Hon Emma Hurst and the Hon Walt Secord proposing a self-reference for the committee to inquire into health impacts of exposure to poor levels of air quality resulting from bushfires and drought.

Sent:
- ***
- ***

4. ***

5. ***

6. ***

7. Inquiry into health impacts of exposure to poor levels of air quality resulting from bushfires and drought

7.1 Consideration of terms of reference
That Portfolio Committee No. 2 – Health inquire into and report on:

1. The health impacts of exposure to poor levels of air quality resulting from bushfires and drought including:

(a) The impact of at-risk groups including children, pregnant women, people with asthma and other respiratory-related illnesses, the elderly and other high risk groups as well as vulnerable companion animals;
(b) The impact on people who are exposed to poor outdoor air quality in the workplace;
(c) The long term impacts of exposure; and

(d) The effectiveness of various protective materials and strategies to mitigate the health impacts of exposure.

2. The effectiveness of the NSW Government to plan for and improve air quality including:

(a) the measurement, reporting and public awareness;
(b) the provision of various protective materials including face masks and air purifiers;
(c) the ability to ensure the health of at-risk groups;
(d) the suitability of work health and safety regulations, industrial provisions and related guidelines; and
(e) the capacity to response within existing resources and ongoing efficiency dividends.

3. Any related matters.

Ms Faehrmann moved that the committee adopt terms of reference as drafted.

Questions put.

The committee divided.

Ayes: Mr Donnelly, Ms Faehrmann, Ms Hurst, Mr Secord

Noes: Mr Amato, Mr Fang, Mr Farlow

Question resolved in the affirmative.

7.2 Conduct of inquiry

Resolved, on the motion of Ms Faehrmann: That the committee adopt the following timeline for the administration of the inquiry:

- Submission closing date: Friday 13 March 2020
- Hearings: 1-2 days in April at Parliament
- Report deliberative: mid June 2020
- Table report: By mid-late June 2020.

Stakeholder list

Resolved, on the motion of Ms Hurst: That the secretariat circulate to members the Chair's proposed list of stakeholders to provide them with the opportunity to amend the list or nominate additional stakeholders, and that the committee agree to the stakeholder list by email, unless a meeting of the committee is required to resolve any disagreement.

Advertising

The committed noted that the inquiry will be advertised via Twitter, Facebook, stakeholder letters and a media release distributed to all media outlets in New South Wales.

8. Adjournment

The committee adjourned at 3.52pm, until Thursday 5 March 2020 (Budget Estimates hearing).

Anthony Hanna/Stewart Smith
Committee Clerk

Minutes no. 19
Wednesday 10 June 2020
Portfolio Committee No. 2 - Health
Virtual hearing, Webex, 9.35 am

1. Members present
Mr Donnelly, *Chair*
Ms Hurst, *Deputy Chair*
Ms Faehrmann
Mr Fang
Mrs Maclaren-Jones
Mr Martin *(substituting for Mr Amato for the duration of the air quality inquiry)*
Mr Secord

2. Previous minutes
Resolved, on the motion of Mr Fang: That draft minutes no. 18 be confirmed.

3. Correspondence
The Committee noted the following items of correspondence:

Received:

- 19 February 2020 – Letter from Ms Michele Goldman, Chief Executive Officer, Asthma Australia, to the Chair, welcoming the establishment of the inquiry into the health impacts of exposure to poor levels of air quality resulting from bushfires and drought
- ***
- ***
- 5 March 2020 – Email from Dr Bruce Graham, Adjunct Academic in the School of Biomedical Sciences, Charles Sturt University, to the secretariat, suggesting the inquiry into the health impacts of exposure to poor levels of air quality resulting from bushfires and drought include consideration of high pollen counts in conjunction with thunderstorms
- 26 March 2020 – Email from Dr Bruce Graham, Adjunct Academic in the School of Biomedical Sciences, Charles Sturt University, to the secretariat, providing links to two articles from the Medical Journal of Australia on the health impacts of bushfire smoke
- 9 June 2020 – Email from the Hon Natasha Maclaren-Jones MLC, Government Whip, to the secretariat, advising that the Hon Taylor Martin MLC will substitute for the Hon Lou Amato MLC for the duration of the inquiry into the health impacts of exposure to poor levels of air quality resulting from bushfires and drought.

4. *

5. Inquiry into the health impact of exposure to poor levels of air quality resulting from bushfires and drought

5.1 Public submissions
The committee noted that the following submissions were published by the committee clerk under the authorisation of the resolution appointing the committee: submission nos. 1, 4-7, 12, 14-16, 21-24, 27-38 and 40-49.

Resolved, on the motion of Mr Fang: That the committee authorise the publication of submission no. 35a.

5.2 Partially confidential submissions
The committee noted that the following submissions were partially published by the committee clerk under the authorisation of the resolution appointing the committee: submission nos. 2, 3, 8-11, 13, 17-20, 25, 26 and 39.

Resolved, on the motion of Mr Fang: That the committee authorise the publication of submission nos. 2, 3, 8-11, 13, 17-20, 25, 26 and 39, with the exception of the author's name which is to remain confidential, as per the request of the author.

5.3 Attachments to submissions

The committee has received a number of attachments to submissions which contain information essential to the inquiry.

Resolved, on the motion of Ms Faehrmann: That the committee authorise the publication of attachments to submission nos. 10, 28, 32, 34-35, 40, 42 and 45.

5.4 Proformas A and B

The committee noted that it resolved via email to publish Proforma A facilitated by Environmental Justice Australia, and Proforma B facilitated by Asthma Australia.

5.5 Hearings

The committee noted that in light of the COVID-19 pandemic the committee resolved to postpone its hearings, originally scheduled for 22 and 23 April 2020. The committee subsequently resolved to conduct these as virtual hearings via video conference, on 10 and 12 June 2020. The committee also resolved via email the draft hearing schedules.

5.6 Extension of reporting date

The committee noted that in light of its revised timeframe for hearings, the committee resolved via email to extend the inquiry from 30 June 2020 until the last sitting day in September 2020 (24 September 2020). The Chair reported the extension to the House on 12 May 2020.

5.7 Virtual hearing proceedings

The Chair briefed members on procedures for the day.

5.8 Virtual public hearing

Witnesses were admitted via video link.

The Chair made an opening statement regarding the broadcasting of proceedings and other matters.

The following witnesses were sworn and examined:

- Ms Michele Goldman, Chief Executive Officer, Asthma Australia
- Ms Cherylleigh Partridge, Person with lived experience, Asthma Australia.

The evidence concluded and the witnesses withdrew.

Witnesses were admitted via video link.

The following witnesses were sworn and examined:

- Mr Alistair Sage, Senior Legal Officer, Australian Workers Union, NSW Branch
- Mr Garth Toner, Organiser, South East Region, Australian Workers Union, NSW Branch
- Ms Natalie Lang, Branch Secretary, Australian Services Union NSW & ACT
- Mr Jake Field, National Safety and Training Officer, Maritime Union of Australia Division, Construction Forestry Maritime Mining and Energy Union
- Ms Natalie Wasley, Delegate, Maritime Union of Australia Division, Construction Forestry Maritime Mining and Energy Union.

The evidence concluded and the witnesses withdrew.

Witnesses were admitted via video link.

The following witnesses were sworn and examined:

- Ms Natasha Flores, Industrial Officer, Unions NSW
- Mr Shay Deguara, Manager, Public Service Association of NSW
- Ms Claire Pullen, Project Officer, Public Service Association of NSW
- Ms Amber Flohm, Senior Vice President, NSW Teachers Federation

- Ms Kelly Marks, Research/Industrial Officer and Climate Emergency Coordinator, NSW Teachers Federation.

The evidence concluded and the witnesses withdrew.

Witnesses were admitted via video link.

The following witnesses were sworn and examined:
- Dr Danielle McMullen, President, Australian Medical Association (NSW)
- Dr Ben Ewald, Convenor, Special Interest Group on Air Pollution, Doctors for the Environment
- Dr Kristine Barnden, Member, Royal Australian and New Zealand College of Obstetricians and Gynaecologists.

The evidence concluded and the witnesses withdrew.

The public hearing concluded at 2.35 pm.

6. Adjournment

The committee adjourned at 2.35 pm until Friday 12 June 2020, 9.45 am, via Webex (virtual public hearing).

Merrin Thompson
Committee Clerk

Minutes no. 20
Friday 12 June 2020
Portfolio Committee No. 2 - Health
Virtual hearing, Webex, 9.46 am

1. Members present

Mr Donnelly, *Chair*
Ms Hurst, *Deputy Chair*
Ms Faehrmann
Mr Fang
Mrs Maclaren-Jones
Mr Martin
Mr Secord

2. ***

3. Inquiry into the health impact of exposure to poor levels of air quality resulting from bushfires and drought

3.1 Virtual public hearing

Witnesses were admitted via video link.

The Chair made an opening statement regarding the broadcasting of proceedings and other matters.

The following witnesses were sworn and examined:
- Dr Stephen Duckett, Health Program Director, Grattan Institute
- Mr Will Mackey, Associate, Grattan Institute
- Associate Professor Fay Johnston, Head of the Environmental Health Group, Menzies Institute for Medical Research.

The evidence concluded and the witnesses withdrew.

Witnesses were admitted via video link.

The following witnesses were sworn and examined:

- Professor Guy Marks, Chief Investigator and Head, Centre for Air pollution, energy and health Research (CAR)
- Dr Suzanne Hollins, Head of Research, Nuclear Science and Technology and Landmark Infrastructure, Australia Nuclear Science and Technology Organisation
- Professor David Cohen, Distinguished Research Scientist, Nuclear Science and Technology and Landmark Infrastructure, Australia Nuclear Science and Technology Organisation.

The evidence concluded and the witnesses withdrew.

Witnesses were admitted via video link.

The following witnesses were sworn and examined:

- Ms Clare Walter, Member, Clean Air Society of Australia and New Zealand
- Ms Bronya Lipski, Lawyer, Environmental Justice Australia
- Mr Maxwell Smith, Clean Air Campaigner, Environmental Justice Australia
- Ms Jess Miller, Councillor, City of Sydney Council.

The evidence concluded and the witnesses withdrew.

Witnesses were admitted via video link.

The following witnesses were sworn and examined:

- Dr Richard Broome, Acting Executive Director, Health Protection NSW, NSW Health
- Mr Jim Kelly, Director Health and Safe Design, SafeWork NSW
- Mr Peter Dunphy, Executive Director Compliance and Dispute Resolution, SafeWork NSW
- Mr Anthony Clark, Director Corporate Communications, NSW Rural Fire Service
- Dr Simon Heemstra, Manager Planning and Predictive Services, NSW Rural Fire Service
- Mr Matthew Riley, Director Climate and Atmospheric Science, Environment Energy and Science Group, Department of Planning, Industry and Environment.

The evidence concluded and the witnesses withdrew.

The public hearing concluded at 2.50 pm.

3.2 Inquiry activities

Resolved, on the motion of Ms Faehrmann: That the government witnesses who gave evidence as a panel at today's hearing be invited back for a further hour of evidence at the start or end of the hearing on either 14 or 15 July 2020 (for the health services in South West Sydney inquiry), with potentially only one representative from SafeWork NSW and NSW Rural Fire Service attending respectively. Further, that a representative of the NSW Environmental Protection Agency able to speak to the NSW Clean Air Strategy be invited to give evidence as part of the panel.

Resolved, on the motion of Ms Faehrmann: That answers to questions on notice for the 10 and 12 June hearings be returned by the due date of 10 July, in time for circulation to members prior to 14 July 2020.

4. Adjournment

The committee adjourned at 3.01 pm until Friday 14 July 2020, 9.00 am, Macquarie Room, Parliament of New South Wales.

Merrin Thompson
Committee Clerk

Minutes no. 21
Tuesday 14 July 2020
Portfolio Committee No. 2 - Health
Macquarie Room, Parliament House, 9.04 am

1. Members present
Mr Donnelly, *Chair*
Ms Hurst, *Deputy Chair*
Mr Amato *via teleconference*
Ms Faehrmann
Mr Fang *via teleconference*
Mrs Maclaren-Jones
Mr Secord

2. Correspondence
The committee noted the following items of correspondence:

Received

- ***
- ***

Sent

- 8 July 2020 – Email exchange between secretariat and Michaela Friedman, Department of Planning, Industry and Environment, regarding representatives to give evidence at the hearing on 15 July 2020 for the air quality inquiry.

3. ***

4. Inquiry into the health impacts of poor air quality resulting from bushfires and drought

4.1 Answers to questions on notice and supplementary questions
The committee noted that the following answers to questions on notice and supplementary questions were published by the committee clerk under the authorisation of the resolution establishing the committee:

- Australian Medical Association (NSW), received 24 June 2020
- Environmental Justice Australia, received 9 July 2020
- Asthma Australia, received 10 July 2020
- Department of Planning, Industry and Environment, received 10 July 2020.

5. ***

6. Adjournment
The committee adjourned at 4.59 pm until Wednesday 15 July 2020, 9.30 am, Macquarie Room, Parliament House.

Shu-fang Wei/Shaza Barbar
Committee Clerk

Minutes no. 22
Thursday 15 July 2020
Portfolio Committee No. 2 - Health
Macquarie Room, Parliament House, 9.31 am

1. Members present
Mr Donnelly, *Chair*
Ms Hurst, *Deputy Chair*
Mr Amato *via teleconference until 3.40 pm*
Ms Faehrmann
Mr Fang *via teleconference*
Mrs Maclaren-Jones
Mr Martin *via teleconference from 4.10 pm*
Mr Secord

2. ***

3. Inquiry into the health impact of exposure to poor levels of air quality resulting from bushfires and drought

3.1 Public hearing
Witnesses, the public and the media were admitted.

The Chair made an opening statement regarding the broadcasting of proceedings and other matters.

The following witnesses were sworn and examined:
- Ms Michelle Dumazel, Executive Director Policy Division, Environment, Energy and Science Group, Department of Planning, Industry and Environment
- Mr David Fowler, Acting Executive Director Regulatory Operations, NSW Environment Protection Authority
- Mr Anthony Savage, Unit Head Environmental Solutions, NSW Environment Protection Authority.

The following witnesses were examined on the former oath/affirmation:
- Dr Richard Broome, Acting Executive Director, Health Protection NSW, NSW Health
- Mr Peter Dunphy, Executive Director Compliance and Dispute Resolution, SafeWork NSW
- Dr Simon Heemstra, Manager Planning and Predictive Services, NSW Rural Fire Service
- Mr Matthew Riley, Director Climate and Atmospheric Science, Environment Energy and Science Group, Department of Planning, Industry and Environment.

The evidence concluded and the witnesses withdrew.

The public hearing concluded at 5.06 pm.

4. Adjournment
The committee adjourned at 5.06 pm until Thursday 10 September 2020, 10.00 am, Room 1254, Parliament House (air quality report deliberative).

Merrin Thompson/Shu-fang Wei
Committee Clerk

Draft minutes no. 24
Thursday 10 September 2020
Portfolio Committee No. 2 - Health
Room 1043, Parliament House Sydney, 10.03 am

1. Members present
Mr Donnelly, *Chair*
Ms Hurst, *Deputy Chair*
Ms Faehrmann
Mr Fang *(left at 11.13 am)*
Mrs Maclaren-Jones
Mr Martin
Mr Secord

2. Previous minutes
Resolved, on the motion of Ms Hurst: That draft minutes nos. 19, 20, 21, 22 and 23 be confirmed.

3. Correspondence
The Committee noted the following items of correspondence:

Received

- 9 June 2020 – Correspondence from the Hon Natasha Maclaren-Jones MLC, Government Whip, to the secretariat, advising that the Hon Taylor Martin MLC will substitute for the Hon Lou Amato MLC for the remainder of the air quality inquiry
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Sent:

- 20 July 2020 – Email from the Chair to Mr Tim Reardon, Secretary, Department of Premier and Cabinet, requesting government submissions submitted to the NSW Independent Bushfire Inquiry for the inquiry into the health impacts of exposure to poor levels of air quality resulting from bushfires and drought.

4. *

5. *

6. Inquiry into health impacts of exposure to poor levels of air quality resulting from bushfires and drought

6.1 Answers to questions on notice and supplementary questions
The committee noted that the following answers to questions on notice were published by the committee clerk under the authorisation of the resolution appointing the committee:

- answers to questions on notice from Ms Jess Miller, Councillor, City of Sydney Council, received 16 July 2020
- answer to question on notice from Mr Jake Field, National Health, Safety and Training Officer, Maritime Union of Australia, received 10 August 2020
- answer to question on notice from Mr Peter Dunphy, Executive Director Compliance and Dispute Resolution, SafeWork NSW, received 12 August 2020
- answer to supplementary question from Ms Michelle Dumazel, Executive Director Policy Division, Environment, Energy and Science Group, Department of Planning, Industry and Environment, received 18 August 2020

- answer to question on notice from Dr Richard Broome, A/Executive Director, Health Protection NSW, NSW Health, received 18 August 2020.

6.2 Consideration of Chair's draft report

The chair submitted his draft report, entitled 'Health impacts of exposure to poor levels of air quality resulting from bushfire and drought', which, having been previously circulated, was taken as being read.

Resolved, on the motion of Ms Faehrmann: That the following new subheading and paragraph be inserted after paragraph 1.58:

'Residents of Greater Western Sydney
Due to the geographical and physical nature of Sydney, residents of Greater Western Sydney are exposed to much higher levels of air pollution than those in other parts of Sydney.'

Resolved, on the motion of Ms Faehrmann: That the following new paragraph be inserted after paragraph 1.65:

'The committee is concerned that NSW Health did not emphasise the health impacts of exposure to any level of PM2.5 despite evidence from health professionals, including the Australian Medical Association (NSW) and Doctors for the Environment, that there is no threshold below which exposure to PM2.5 does not cause any health effects.'

Resolved, on the motion of Ms Faehrmann: That paragraph 2.104 be amended by:
(a) inserting 'permanent' before 'monitoring sensors'
(b) inserting ', including Lake Macquarie and Lithgow' after 'air pollution events'.

Resolved, on the motion of Ms Faehrmann: That the first dot point in Recommendation 1 be amended by:
(a) inserting 'permanent' before 'monitoring sensors'
(b) inserting ', including Lake Macquarie and Lithgow' after 'air pollution events'.

Resolved, on the motion of Ms Faehrmann: That paragraph 2.108 be amended by inserting ', including ensuring that PM2.5 is reported separately and hourly' after 'measurement and reporting'.

Resolved, on the motion of Ms Faehrmann: That Recommendation 3 be amended by inserting at the end ', including ensuring that PM2.5 is reported separately and hourly'.

Resolved, on the motion of Mr Martin: That paragraph 2.111 be amended by:
(a) omitting 'an independent review of' and inserting instead 'a review on'
(b) omitting 'with the outcomes of this review to be published' and inserting instead 'with the review and any findings to be published'.

Resolved, on the motion of Mr Martin: That Recommendation 4 be amended by:
(a) omitting 'an independent review' and inserting instead 'a review'
(b) omitting 'with the outcomes of this review to be published' and inserting instead 'with the review and any findings to be published'.

Resolved, on the motion of Ms Faehrmann: That the following new recommendation be inserted after Recommendation 5:

'Recommendation x
That the NSW Government provide additional resources to ensure that the air-smart public education campaign is widely advertised, particularly to vulnerable and at-risk groups.'

Resolved, on the motion of Mr Martin: That paragraph 3.27 be amended by omitting 'Some inquiry participants' and inserting instead 'Unions', subject to the secretariat checking that no broader stakeholders reflected this evidence.

Resolved, on the motion of Ms Faehrmann: That paragraph 3.79 be amended by omitting 'and endorse the position submitted by Unions NSW and the Australian Workers' Union, NSW Branch, that outdoor work should cease when air quality is at a dangerous level and a worker's health and safety is at risk' and inserting instead 'that outdoor workers have the right to cease work when air quality is at a dangerous level and their health and safety is at risk'.

Resolved, on the motion of Mr Secord: That paragraph 3.79 be amended by:
(a) omitting 'understand' and inserting instead 'understands'
(b) inserting 'Unions NSW and' before 'unions'
(c) inserting 'laws, regulations and' before 'protocols to be improved'.

Resolved, on the motion of Mr Secord: That paragraph 3.80 be amended by inserting at the end:
'Given the potential significant negative impact on the health and safety of workers from exposure to poor air quality, the collaborative tripartite work recommended above should commence immediately.'

Resolved, on the motion of Ms Hurst: That paragraph 3.81 and recommendation 6 be amended by:
(a) omitting 'NSW Government' and inserting instead 'SafeWork NSW'
(b) omitting 'unions and employers' and inserting instead 'unions, employers and other stakeholders'
(c) inserting 'and regulatory' after 'policy'
(d) inserting at the end 'In completing such work consultation will take place with medical and health experts, including thoracic specialists'.

Mr Martin moved: That paragraph 4.64 be amended by omitting 'In the committee's view it is unfortunate that some four years after work commenced on the Clean Air NSW Strategy, that task is still not completed'.

The committee divided.

Ayes: Mrs Maclaren-Jones, Mr Martin.

Noes: Ms Hurst, Ms Faehrmann, Mr Donnelly, Mr Secord.

Question resolved in the negative.

Resolved, on the motion of Mr Secord: That paragraph 4.64 be amended by omitting 'We consider it imperative that the strategy be delivered by no later than 2021 as promised, and that it' and inserting instead 'We are reassured that the Environment, Energy and Science Group in Department of Planning, Industry and Environment confirmed that the Clean Air for NSW Strategy will be finalised early 2021 and that this will'.

Mr Martin moved: That recommendation 8 be amended by:
(a) omitting 'by no later than 2021' and inserting instead 'within the next 12 months'
(b) omitting 'from industry, vehicles and wood heaters' and inserting instead 'all significant sources of' before 'air pollution'.

Question put and negatived.

Resolved, on the motion of Ms Faehrmann: That recommendation 8 be amended by omitting 'by no later than' and inserting instead 'early'.

Ms Faehrmann moved: That the following new recommendation be included at the end of the report:

'Recommendation x

That the NSW Government commit to more ambitious greenhouse gas reduction targets in line with the science to keep global warming within 1.5 degrees Celsius above industrial levels or less'.

Question put.

The committee divided.

Ayes: Ms Faehrmann, Ms Hurst

Noes: Mr Donnelly, Mrs Maclaren-Jones, Mr Martin, Mr Secord

Question resolved in the negative.

Resolved, on the motion of Mr Secord: That:

- the draft report as amended be the report of the committee and that the committee present the report to the House;
- the transcripts of evidence, submissions, tabled documents, pro formas, answers to questions on notice and supplementary questions, and correspondence relating to the inquiry be tabled in the House with the report;
- upon tabling, all unpublished attachments to submissions be kept confidential by the committee;
- upon tabling, all unpublished transcripts of evidence, submissions, pro formas, tabled documents, answers to questions on notice and supplementary questions, and correspondence relating to the inquiry, be published by the committee, except for those documents kept confidential by resolution of the committee;
- the committee secretariat correct any typographical, grammatical and formatting errors prior to tabling;
- the committee secretariat be authorised to update any committee comments where necessary to reflect changes to recommendations or new recommendations resolved by the committee;
- dissenting statements be provided to the secretariat within 24 hours after receipt of the draft minutes of the meeting;
- the secretariat table the report on 16 September 2020.
- the Chair to advise the secretariat and members if they intend to hold a press conference, and if so, the date and time.

7. Adjournment

The committee adjourned at 11.56 am.

Helen Hong/Tina Higgins
Committee Clerk

Appendix 5 Dissenting statement

Overall, I strongly support the recommendations contained in this report. This dissenting statement addresses a glaring omission in the final report, however, and that a recommendation for the NSW Government to set more ambitious greenhouse gas reduction targets.

The Terms of Reference for this Inquiry included looking into the 'effectiveness of the New South Wales Government to plan for and improve air quality'. While the recommendations in this Report will go some way to improving the way in which governments and individuals cope with days of dangerous air quality in the future, they do not address the driver of more frequent and intense mega fires and droughts. The dangerous air quality experienced by millions of people in NSW in 2019/20 from bushfire smoke and dust storms were exacerbated by hotter and drier conditions caused by climate change. I welcome the fact that the Final Report recognises this, however it is disappointing that my amendment below which I sought to include in the final report as a new Recommendation was not supported:

> *That the NSW Government commit to more ambitious greenhouse gas reduction targets in line with the science to keep global warming within 1.5 degrees Celsius above industrial levels or less.*

This is despite many submissions and witnesses stressing that climate change will lead to many more days of hazardous air quality from more extreme bushfires and droughts in NSW. Chapter 4 of the Report includes evidence to this effect from Asthma Australia, the Grattan Institute, Unions NSW, the Centre for Air Pollution, energy and health Research (CAR), the Australian Medical Association (NSW), the Royal Australia and New Zealand College of Obstetricians and Gynaecologists (RANZCOG), the National Asthma Council of Australia, the Menzies Institute, Doctors for the Environment Australia and NSW Council of Social Service (NCOSS). In particular, several submissions made reference to the prediction by Professor Ross Garnaut in the 2008 Garnaut Climate Change Review, that bushfire seasons would be observably longer and more intense by the year 2020.

The Greens believe that unless the Government also addresses the cause of extreme weather events there will be many more days of hazardous air quality which will have severe impacts on not only our health, but also on our economy and society as a whole. Further, that by not keep global heating within 1.5 degrees Celsius above pre-industrial levels, these recommendations may soon be no more effective in mitigating the health impacts of hazardous air quality than a few bandaids on a patient with terminal cancer.

Finally, the omission of a recommendation to government to take strong action on what could result in millions of people living with extremely hazardous air quality for many days of the year in the not too distant future, might be particularly glaring to those who refer to it in years to come.

Ms Cate Faehrmann MLC