From: Fay Johnston
To: John Catford
Subject: epidemiology of PM exposure
Date: Tuesday, 13 October 2015 1:11:43 PM
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image003.png

Dear Prof Catford,

My background is that I am an international expert in the public health impacts of smoke events from landscape fires and it is in this capacity that I am contacting you. I assisted the EPA as a peer reviewer of some of their protocols during the mine fire in 2014, and responded to some queries from you about this as part of the previous Inquiry.

I have reviewed available reports about smoke exposure and the health impacts in the Latrobe Valley. This included the reports on statistical associations with mortality by Barnett [1]. More recently I have read the reports of Flanders and English, Armstrong, and Gordon as posted on the Inquiry website. In the light of the evidence presented to date I wondered if some additional information about the epidemiology of airborne particles and their association with population level mortality rates would be helpful to the Board and I offer the following observations.

All comments below specifically EXCLUDE the population of Morwell and the concentrations of PM and other pollutants recorded in Morwell during the fire. This is because an elevation in mortality was not observed in Morwell.

- Comprehensive empirical air quality data during the mine fire are available only for Traralgon and Morwell. In the absence of empirical air quality data, modelling of emissions by CSIRO, commissioned by the Hazelwood Health Study, suggests that, overall, there were similar smoke impacts in Traralgon, Moe and Churchill during the fire period [2].
- PM elevations in Traralgon in 2014 during the fire period were similar to those which occurred during planned burns in 2013. See table and figures below for 2013 data from the EPA [3].
- Concentration-response relationships for airborne PM and mortality are now well-established and widely accepted. As a generalisation, a 10 $\mu g/m^3$ increase in 24 hour $PM_{2.5}$ is associated with around a one percent rise in daily all-cause mortality [4]. There is no evidence that concentration-response relationships for PM from landscape fires and mortality are substantially different from PM from background urban sources [5-10]. It is usually quite challenging to measure a mortality impact from PM in populations of less than one million people because this concentration-response coefficient is small [11].
- Caution is required when extrapolating concentration-response functions to very small populations. However I note that the statistical rise in mortality in the Latrobe Valley compared with previous years, was higher than that which would be expected from the exposure to PM likely to have been experienced by most people.
- I also note that the observed higher mortality in the Latrobe Valley does not appear to be consistent with the known temporal relationships that have been characterised for airborne PM and mortality. Acute impacts for mortality are usually greatest on same day or the following day. For other endpoints (eg hospital admissions) associations of up to a week following an event such as a wildfire episode have been reported [12, 13]. I am not aware of evidence suggesting that mortality impacts might occur months after exposure to particle concentrations of the order experienced in most places in the Latrobe Valley.
- There are numerous example of planned burn smoke impacts of similar magnitude [14]. If one accepts that the higher mortality observed in places in the Latrobe valley, excluding Morwell, during and after the months of the mine fire was directly caused by ambient airborne particles then, logically, one would also accept that smoke from planned fuel

reduction burning in Australia carries a significant mortality risk for the populations affected.

I hope this information is helpful.

Yours sincerely,

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Table. Percentiles of 24-hour PM_{10} at Traralgon (2007–14) from the EPA Air monitoring report 2014 [15]. This demonstrates that the number and peaks in air quality exceedences during 2014 was not especially unusual compared with previous years.

AAQ NEPM standard: 50 mg/m^3 (24-hour average) AAQ NEPM goal: standard exceeded on no more than five days per year. *EPA reports that three of the four reported exceedances, including the peak at 104.8, were due to planned burning in May 2013

Year	Data availability	No. of exceedances	Max	Percentiles (mg/m^3)					
	(% of days)	(days)	(mg/m^3)	99th	98th	95th	90th	75th	50th
2007	96.4	5	151.2	52.0	40.8	32.3	27.0	21.7	17.0
2008	100.0	2	64.9	42.1	39.2	33.2	27.9	22.4	17.6
2009	100.0	5	125.7	51.0	40.4	35.3	29.2	23.5	17.9
2010	100.0	3	77.6	39.5	33.4	28.1	24.4	19.4	15.6
2011	99.5	0	41.8	31.6	30.1	26.0	21.7	18.2	15.0
2012	97.8	0	35.0	29.4	27.6	24.4	21.4	18.1	14.5
2013	92.9	4*	104.8	48.7	36.0	27.6	22.9	17.8	13.4
2014	97.5	3	84.9	47.1	41.3	32.2	26.0	19.9	15.3

Figures 2 and 3. PM_{10} and $PM_{2.5}$ in Morwell and Traralgon 2012-3 from Air monitoring at Morwell East (February 2012 - May 2013). Figures reproduced from EPA reports demonstrating the impact of a bushfire (January) and planned burns (May) in Morwell (east) and Traralgon in 2013 [3]

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