



Hazelwood Mine Fire Inquiry

Joint Expert Report – 31 August 2015

Attendees:

Emeritus Professor Bruce Armstrong	Epidemiologist and Public Health Physician
Associate Professor Adrian Barnett	Principal Research Fellow Faculty of Health, School - Public Health and Social Work Queensland University of Technology
Professor Ian Gordon	Director Statistical Consulting Centre, University of Melbourne
Dr. Louisa Flander (via Skype)	Senior Research Fellow, Centre for Epidemiology & Biostatistics, Melbourne School of Population and Global Health, University of Melbourne.
Monica Kelly	HMFI Secretariat – scribe

Conclusions relating to Term of Reference 6: Whether the Hazelwood Coal Mine Fire contributed to an increase in deaths, having regard to any relevant evidence for the period 2009 to 2014;

1. Was there an increase in mortality in Latrobe Valley during the coal mine fire in 2014?

1.1 There is moderate evidence for a higher mortality from all causes and from cardiovascular disease in Latrobe Valley in Feb-Jun 2014 than in the same period during 2009-13.

Agreed by all.

1.2 There is some evidence that the increase in mortality in Feb to Mar 2014 (the period of the mine fire) was greater than the increase in mortality during Feb to Jun 2014.

Additional consensus conclusions:

- The increase in mortality persisted beyond the period of the mine fire though there is weaker evidence for this.

Agreed by all.

1.3 Barnett (2015)¹ reported a 10% higher mortality in Latrobe Valley during February and March 2014 relative to that in the same months in 2004-13. This estimate is broadly consistent with other estimates in this report (*Armstrong's*) but probably attenuated and made statistically weaker by the inclusion of two additional Latrobe Valley postcodes in the analysis.

Agreed by all.

Note: GORDON, BARNETT have not yet had a chance to review the daily death data and noting that FLANDER only reviewed data from 2009 onwards in the four main postcodes.

¹ Barnett A. *An updated analysis of death data during the Morwell mine fire* first published in 2015 (<http://eprints.qut.edu.au/81685/>)

- Based on my own analysis (*Gordon*), in which the period of potentially different risk is assumed to extend beyond the actual time of the fire, (for example, to May 2014), the excess of deaths is statistically significant at conventional levels.

Agreed by all

2. What environmental exposures might have increased mortality in Latrobe Valley during the coal mine fire in 2014?

The associated bushfires?

2.1 Mortality from all causes in February and March and February to June 2014 was closer to that in the corresponding periods of 2009 than in those of 2009-13. This observation may suggest that bushfires, which occurred in Latrobe Valley in February in both 2014 and 2009, contributed to the probable increase in mortality from all causes in 2014. This was not evident for deaths from cardiovascular disease.

ARMSTRONG, FLANDER and GORDON agreed.

BARNETT: Not agreed. Have reservation given in 2014 there two sources of fire and the difficulty distinguishing between the impact of the two. Would like to see further air quality data available across the two time periods and expert opinion on the proportion that was due to the mine fire before agreeing.

Fine particle (smoke) air pollution from the coal mine fire or the bushfires?

2.2 Across the whole period from 2009 to 2014, mortality in Latrobe Valley in both February and March and February to June was higher on days when particulate air pollution was $\geq 50 \mu\text{g}/\text{m}^3$ of PM_{10} than when it was lower.

ARMSTRONG and FLANDER agreed.

GORDON: Qualified agreement: Have not yet had an opportunity to independently analyse the data.

BARNETT: Qualified agreement: Not the best way of analysing the impact of air pollution on health. Need to look at pollution as a linear variable rather than a threshold scale.

2.3 There was no evidence that deaths from all causes or from cardiovascular disease alone during the period of the mine fire were more frequent on days with higher $\text{PM}_{2.5}$ levels than on days with lower $\text{PM}_{2.5}$ levels. This observation appears not to be consistent with the work of Flander and others (2015)², who found that mortality from all causes over the whole period 2009-14 was approximately two-fold higher in Latrobe Valley people exposed to PM_{10} at levels of $50 \mu\text{g}/\text{m}^3$ or more on the day of death than in people not so exposed. *However, on the evidence of Flander, it is very likely that particulate air pollution during the mine fire caused an increase in mortality, realised, perhaps, more after the period of the fire than during it.

ARMSTRONG & FLANDER: Agreed

GORDON: Qualified agreement: Have not yet had an opportunity to independently assess the data.

BARNETT: Qualified agreement: Concerned about the use of PM_{10} as a threshold scale rather than a linear measure.

² Flander L, Ouakrim DA, Dashti SG and Ugoni A. Age-standardised mortality and cause of death in the Latrobe Valley at the time of (and five years prior to) the Hazelwood coalmine fire in Morwell, Victoria. Centre for Epidemiology and Biostatistics, Melbourne School of Population and Global Health, University of Melbourne, 2014.

Additional note: * Removed reference to Abramson reference (from ARMSTRONG's original paper) as all agreed concern about the use of the modelling adopted in this reference, in this circumstance. This is because the model is based on long term exposure for one pollutant, not short term exposure to multiple pollutants as experienced during the Hazelwood coal mine fire.

2.4 Crude mortality data suggest that mortality from all causes in Morwell in February and March and February to June 2014 was little if at all greater than that in the corresponding periods of 2009-13. In Churchill, Moe and Traralgon, however, crude mortality in these periods was greater than in 2009-13. Since Morwell was the most exposed of these populations to emissions from the mine fire, the comparative lack of greater mortality in Morwell in 2014 than 2009-13 is inconsistent with the mine fire being the cause of greater mortality in Latrobe Valley.

ADDED: However this conclusion does not take account of evacuation of some residents from Morwell during the period of the mine fire, which might explain the lack of observed increase in mortality.

Agreed by all

2.5 Barnett (2015)³ also observed a lack of an increase in mortality in Morwell during February and March 2014 relative to that over the whole period 2004-14.

ADDED: It is acknowledged that due to the statistical uncertainty of this estimate, a large increase in mortality in Morwell cannot be ruled out.

Agreed by all

Carbon monoxide air pollution?

2.6 There was no consistent evidence that deaths from all causes or from cardiovascular disease alone during the period of the mine fire were more frequent on days with higher carbon monoxide levels than on days with lower carbon monoxide levels.

Agreed by all

GORDON: Noted reservation: Have not yet had an opportunity to independently assess the data.
BARNETT: Noted reservation: Concerned about the use of CO as a threshold scale rather than a linear measure.

Very hot days?

2.7 Across the whole period from 2009 to 2014, mortality in Latrobe Valley in February to June was greater on days when the temperature was <30°C than on days when it was higher than this. This difference was not evident in February and March of these years.

Agreed by all

GORDON: Noted reservation: Have not yet had an opportunity to independently assess the data.
BARNETT: Noted reservation: Concerned about the use of temperature as a threshold measure rather than a linear measure.

2.8 There is no evidence that higher temperatures in Latrobe Valley during the period of the mine fire were associated with a higher mortality, whereas there is strong evidence that higher mortality was associated with lower temperatures. Lower temperatures, however, do not appear to explain the

³ Barnett A. *An updated analysis of death data during the Morwell mine fire* first published in 2015 (<http://eprints.qut.edu.au/81685/>)

higher mortality in February and March 2014 than in the same months in 2009-13 as the mean daily temperatures in these two period were nearly identical.

Agreed by all

3. Was there an increase in emergency admissions to hospital (for residents) in Latrobe Valley during the coal mine fire in 2014?

3.1 Emergency hospital admissions for all conditions in the Latrobe Valley during the period of the mine fire in 2014 were more frequent than they were for the same period in 2013. Hospital admission rates for respiratory and cardiovascular diseases, considered individually, were also greater in 2014 than in 2013, though the statistical evidence for these increases was weaker.

Agreed by all

GORDON: Noted reservation: Have not yet had an opportunity to independently assess the data.

3.2 There was strong evidence that emergency hospital admissions were greater in 2014 than 2009-13 in people 25-39 years of age. The causes of this increase should be investigated.

Agreed by all

GORDON: Noted reservation: Have not yet had an opportunity to independently assess the data.

4. Why might emergency admissions have increased?

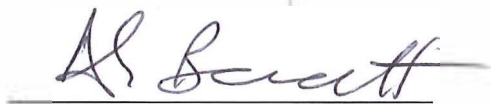
4.1 Emergency hospital admissions were greater in infants and children (0-4 years of age), albeit with statistically weak evidence in 2014 than in 2009-13, and greater in older people (65-74 years of age and, less so, 75+ years of age). These are recognised vulnerable groups for health impacts of air pollution.

Agreed by all

GORDON: Noted reservation: Have not yet had an opportunity to independently assess the data.



Emeritus Professor Bruce Armstrong



Associate Professor Adrian Barnett

Cited & agreed via email 31/8/15

Dr. Louisa Flander



Professor Ian Gordon