

**IN THE MATTER OF
The Hazelwood Coal Mine Fire Inquiry**

OUTLINE OF SUBMISSIONS

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Filed on behalf of: Dr Rosemary Lester	Ref: RWP:20150096
Prepared By:	Solicitors Code: CR 101 397
Perry Maddocks Trollope Lawyers	Tel: (03) 9663 0500
Suite 802, 9 Yarra Street	Fax: (03) 9663 0510
SOUTH YARRA VIC 3141	Email: robp@pmtl.com.au

A. Introduction

1. There is insufficient evidence before the Board to enable it to make a finding on the balance of probabilities that:
 - (a) there was or was not an increase in deaths at the relevant time; and
 - (b) even if a finding of increased deaths was made, that the Hazelwood Mine Fire was a cause of any increase having regard to any relevant evidence for the period 2009 to 2014.
2. At no stage did the statistical evidence do more than establish the proposition that there **could have been** an increase in deaths, based on various statistical models and an analysis of the particular data examined. The statistical evidence did not establish that an increase probably occurred or was more likely than not to have occurred. There is no evidence upon which The Board could make a finding of an increase in deaths on the balance of probabilities.
3. If, contrary to that submission the Board finds that the statistics do show a probable increase in deaths, there is either no or insufficient evidence to enable the Board to make a finding, on the balance of probabilities, that the increase was factually and medically caused by the mine fire and any relevant exposure to particulate matter. The following matters are also relevant:

- (a) Professor Abramson, who is the lead expert on the relationship between particulate matter exposure and death, predicted¹ that no deaths would be expected even if the fire burned for six weeks;
- (b) the process which led to the preparation of a joint expert report was flawed in many respects;
- (c) the actual numbers of deaths in Morwell decreased during the fire;
- (d) there was no evidence to establish that any person died as a result of air pollutants from the fire.²

B. Was there any increase in deaths?

- 4. The evidence on causation is that there **could** be an increase in deaths, but not a **probability** of an increase in deaths. The joint report's conclusions at 1.1 and 1.2 establish only "moderate" or "some" evidence of an increase in deaths and must be considered in the context of other evidence.³ Each expert used different data to perform their analyses and Prof Gordon admitted that he only had access to monthly data by postcode, not daily death data from 2009 to 2014, and had not seen Dr Flander's data.⁴ Dr Flander identified the difficulty of comparing Prof Gordon's results with hers and the different methods used.⁵ Assoc Prof Barnett also acknowledged that the monthly death data was relatively crude compared to other analyses that used daily data.⁶
- 5. Further, the actual numbers show that the number of deaths in Morwell during the fire (9 Feb to 25 March) and in the whole February to March period was lower than in previous years. Deaths in the February to June period were also comparable to some recent years. It is a basic principle of causation that the

¹ In the Rapid Health Risk Assessment, Exhibit RAL-2 to the statement of Dr Lester.

² The Coroners Court could not identify any deaths it had investigated that related to the fire.

³ In Prof Armstrong's report at p 6 he states that "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." At p 14 Prof Armstrong records, "Overall, I have found no evidence in the data on the relationship between PM2.5 concentration and deaths during the mine fire that PM2.5 concentration increased mortality in Morwell, where the exposure was greatest, or in Latrobe Valley."

⁴ T 497:28 – T 498:3.

⁵ T 514:13 – T 514:18.

⁶ T 563:3 – 4.

greater the exposure to the hazard, the greater the effect seen but that pattern is not apparent here.⁷

C. Was the Hazelwood Mine Fire a cause of any increase in deaths?

6. The conclusions stated in the joint expert report with respect to causation and mortality attempt to answer superficially the question whether an increase in deaths is as a result of the fire. These conclusions should be treated with caution because:

- (a) the data each expert relied on was limited in significant respects and was not the same data;
- (b) the assumptions of each expert were different;
- (c) many of the experts expressed views in their oral evidence that were inconsistent with the views recorded in the joint report;
- (d) many of the experts expressed views that they were not appropriately qualified to give and should therefore be put to one side;
- (e) one of the leading experts on the question of exposure to particulate matter and its effect on mortality (Prof Abramson) was not invited to participate in the private meeting of experts, despite having authored the Rapid Health Risk Assessment and despite his critical role in the long term health study.

7. It is submitted that the prediction in the Rapid Health Risk Assessment of no deaths if the fire burned for six weeks⁸ is a reliable predictor of the effect of the fire and likely to still be the best measure available. This is because its authors took into account the latest scientific data,⁹ including the health effects of PM2.5 and carbon monoxide,¹⁰ which its authors were eminently qualified to do. Even accepting the limits of that literature review, which Prof Abramson described as

⁷ See also Prof Abramson at T 366:12 – T 366:20, T 373:22 – T 374:20. Prof McNeil also makes that point about causation: Report of Prof McNeil (Exhibit 11) dated 28 August 2015. See discussion under “Barnett paper 2”.

⁸ See Rapid Health Risk Assessment, Exhibit RAL-2 to the statement of Dr Lester, pp 5, 9, 18 and 21.

⁹ T 354:16.

¹⁰ T 352:19.

“the best estimate we could make at the time,”¹¹ no other detailed analysis by an appropriately qualified expert has been or could be undertaken at this stage to say on the balance of probabilities that there were deaths due to the fire. This is due to factors such as a lack of information about confounding variables,¹² no data for exposures in the first few days, the inability to measure individual exposures, the unique nature of the event and the limited sample size and timeframe.¹³ Indeed in his critique of Assoc Prof Barnett and Dr Flander’s work, Prof McNeil highlights the need for future analyses to be planned with care “to avoid crude inaccurate approximations that might portray an inaccurate picture.”¹⁴ Dr Flander also acknowledged the limitations of the data.¹⁵

Absent complete information on the location of the individual deaths that we looked at, where they were, the days leading up and on the day of death, absent complete information on their exposure, ... what kinds of exposure to degraded air quality or excess temperature, absent that kind of information, a longitudinal study is a better model.

8. This fundamental problem has arisen in large part due to the flawed process that was followed regarding the private joint session and the compilation of the joint expert report. One example is the use of Prof Armstrong’s report as the template for discussions in the private session.¹⁶ In conclusion 2.3 of the joint report, it is recorded that “... 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.” According to the report, Prof Armstrong and Dr Flander agreed with that conclusion and Prof Gordon and Assoc Prof Barnett expressed qualified agreement. Prof

¹¹ T 360:6.

¹² T 345:1 – T 345:9.

¹³ Prof Abramson agreed that the best quality outcomes in epidemiological studies are associated with a sample size such as the one proposed for the adult survey and a duration of ten years. T 365:4 – T 365:6.

¹⁴ Report of Prof McNeil (Exhibit 11) dated 28 August 2015, under “Opinion”, [6].

¹⁵ T 529:20 – T 529:26. Prof Armstrong also acknowledged that an important weakness in his analysis was the estimates of exposure. He said “when you get measurement error, then associations that might otherwise be present can be obscured, so the consequences of essentially random measurement error is to lead to a lower probability that you will see an association when one is there.” (T 583:29 – T 584:18). See also his comments at with respect to measurement error T 587:12 – T 587:19. Prof Gordon made similar comments about the exposure data at T 524:12 – T 524:18. See also Assoc Prof Barnett regarding lack of data re evacuations at T 526:14 – T 526:16.

¹⁶ There is an error in conclusion 3.2 of the joint report, which is based on table 6 in Prof Armstrong’s report. The comparison year was 2013 not 2009 – 13. There is no data regarding hospital admissions prior to 2013 in table 6. The same error is apparent in conclusion 4.1 of the joint report.

Armstrong explained that this comment was directed to the effect of exposure compounding over time compared with the immediate effect.¹⁷

9. Prof Armstrong's oral evidence about causation was at other times less clear and at times inconsistent with that conclusion. On numerous occasions he gave evidence that he was unable to answer questions directed at the causal link between exposure to air pollutants and its health effects because he was not sufficiently qualified¹⁸ and he deferred to the expertise of Prof Abramson.¹⁹ On another occasion he said:²⁰

... am I certain that the increase in mortality we see in Latrobe Valley in that first part of 2014 is indicative of something different to what happened in the preceding five years? No, I'm not - but it could be.

10. He also gave evidence that "... of the various explanations that one can put forward, the most likely is that an increase, if one occurred, was due to the increase in the particulate pollution of the air during that period of time".²¹ In cross-examination he agreed with the proposition that "we should not exclude the hypothesis there was a causal relationship with the fire."²²
11. If Prof Armstrong, who has qualifications in medical science, medicine and a PhD in epidemiology does not consider himself qualified to comment on the particular health effects of exposure to air pollutants, it is difficult to see how Prof Gordon, Assoc Prof Barnett and Dr Flander may be qualified to do so. None of them have medical degrees nor any particular expertise in the health effects of exposure to air pollutants. Assoc Prof Barnett's attempts to comment on this issue²³ by citing three American studies should be disregarded as they are comments not based on any expertise off his.²⁴ Prof Gordon's comments about the effect of the spread of air pollution extending beyond Morwell²⁵ and his comments about "a lingering effect in a sort of indirect way" concerning the

¹⁷ T 516:30f.

¹⁸ See for example T 472:5 – T 472:6; T 474:12 – T 474:13.

¹⁹ See for example T 599:2.

²⁰ T 492:31 – T 493:17.

²¹ T 518:20.

²² T 590:16.

²³ At T 474f.

²⁴ For accurate and helpful evidence of the long-term health effects of PM2.5 and urban air pollution, the Board should have regard to the Rapid Health Risk Assessment and in particular at p 7f.

²⁵ T 521:20 – T 523:1.

extension of the period of risk beyond the period of the fire,²⁶ should also be disregarded as speculative and not based on his expertise.

12. Regarding inconsistency with respect to Dr Flander, despite her expressed agreement with conclusion 2.3 above, Dr Flander's oral evidence was that both she and Prof Armstrong were careful in their written work to avoid the language of causation.²⁷ She also said she "did not want to conclude that there is an effect if there is none"²⁸ that "there are not enough observations for us to choose between these different hypotheses and that means we ... can't exclude a given hypothesis".²⁹ Despite those statements, she later agreed that her position recorded in the joint report regarding conclusion 2.3 had not changed.
13. These matters above are examples of the inconsistencies in the evidence adduced and the problem of asking experts to comment (especially in the joint session) on matters that are not within their field of expertise. It is submitted that to the extent that each of the experts comments on matters beyond their field of expertise, (for example when Prof Gordon speculates about the spread of the air pollution to areas beyond Morwell and the possible effects of this) those views should be disregarded or be given very little weight.
14. Some further matters that are not adequately addressed in the evidence include the acknowledgment by Prof Armstrong based on his own figures that deaths from respiratory and cardiovascular causes were approximately the same in 2014 as they were in the period 2009 to 2013.³⁰ If there were additional deaths thought to be caused by the fire, one would expect an increase in cardiorespiratory deaths as these are most susceptible to influence by exposure to smoke. Further, if the equivocal statistical analyses were evidence of an increase in deaths, you would expect to see statistically significant increased morbidity and there is no evidence of this in hospital admission data. You would also expect to see an increase in mortality in the area that was most exposed to the pollutants, namely Morwell, which the data does not show.³¹ The expert report concluded that there is moderate/some/weak evidence for higher mortality from all causes and from cardiovascular disease in the Latrobe Valley

²⁶ T 475:28 – T 476:10.

²⁷ T 441.

²⁸ T 528:1.

²⁹ T 532:6 – T 532:15.

in Feb to June 2014 but no evidence has been presented that this increase is causally related to the fire.

15. The long-term health study being undertaken by Prof Abramson and Monash University is the obvious and prudent solution to this complex question. That study has many advantages which were absent when the Rapid Health Risk Assessment was undertaken including expert modelling from the CSIRO regarding the dispersion of smoke,³² a target sample size of about 70 per cent of the adult population of Morwell (7,500 people) and a similar proportion of the population in Sale (4,000 people),³³ the ability to adjust for individual confounders such as cigarette smoking,³⁴ and individual exposure estimates.³⁵ Prof Abramson's evidence was that in order to do a mortality analysis, the adult survey would first need to be completed to ascertain where people were during the fire, which would then be matched up with the CSIRO modelling of PM2.5 exposure and the National Death Index.³⁶ Without this type of exposure data, the Board is significantly disadvantaged.

C J BLANDEN

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³⁰ At T 600:27 – T 601:1.

³¹ Prof Armstrong also comments on this issue at p 6 of his report (Exhibit 28) under "Conclusion".

³² See T 338:30f.

³³ T 338:13.

³⁴ T 344:29 – T 345:18.

³⁵ T 347:25 – T 247:31.

³⁶ T 347:21 – T 347:31.