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2015/16 HAZELWOOD MINE FIRE INQUIRY

MELBOURNE

THURSDAY, 22 OCTOBER 2015

THE HONOURABLE BERNARD TEAGUE AO - Chairman MRS ANITA ROPER - Board Member PROFESSOR JOHN CATFORD - Board Member MR PETER ROZEN - Counsel Assisting MS RUTH SHANN - Counsel Assisting MR RICHARD ATTIWILL QC - State of Victoria MS RENEE SION - State of Victoria MR ANTHONY NEAL QC - GDF Suez MS MARITA FOLEY - GDF Suez MR CHRIS BLANDEN QC - Dr Rosemary Lester MS KATE BURGESS - Dr Rosemary Lester MS MELANIE SZYDZIK - Voices of the Valley MS MEGAN FIZTGERALD - Voices of the Valley MR ROSS RAY QC - Environment Protection Authority Victoria MR ANGEL ALEKSOV - Environment Protection Authority Victoria CHAIRMAN: Before I call for appearances, I will make some remarks which will include a good morning and welcome to all to this session of the Hazelwood Mine Fire Inquiry. I acknowledge the traditional owners of the land on which we are gathered, the Wurundjeri people of the Kulin Nation, and I pay my respects to their elders past and present.

8 It's appropriate that we, the Board, offer 9 explanation for the course of events that has led to the 10 hearing today. We are here because the Board has dealt with certain events in a way that has been calculated to 11 maximise procedural fairness. At the conclusion of the 12 13 hearing of submissions on September 9 it was announced and the announced intention of the Board that that was the end 14 15 of the hearings on terms of reference 6.

16 Subsequently, two developments caused us to have 17 to reconsider that announcement. Both involved the 18 receipt of materials that were not expected by the Board, 19 by Counsel Assisting or by anyone within our secretariat 20 when the last hearings concluded. The first materials 21 were those received from Associate Professor Barnett. The 22 second materials were those received from Dr Fay Johnston.

Despite the major dilemmas raised by the provision of those materials, the Board does not criticise either of the two. It accepts that the motive for providing the information was to assist the Board to arrive at more satisfying conclusions on term of reference 6.

In both cases the Board spent considerable time in robust discussion as to the course to be followed. One solution to the dilemma was to insist that the announced

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deadline must be observed regardless of other 1 2 considerations. The Board was primarily concerned with questions of procedural fairness. While observing the 3 deadline had its limitations, so too did the other options 4 5 and the Board had also to be concerned with issues as to inconvenience to witnesses and to parties. The Board also 6 7 had to allow for restrictions as to time and as to costs 8 imposed on it under its terms of reference.

9 The Board concluded that the compromise 10 ultimately arrived at, which involves the hearing of some further evidence and then the hearing of further final 11 submissions, is the least unsatisfactory of the options. 12 13 That compromise has involved substantial inconvenience to several academic witnesses and to parties and to their 14 15 legal representatives and to other members of the public. 16 We thank the considerable number of people who have endured that inconvenience and have done their best to 17 come together to assist the Board today. 18

19 Our final point is that the proceedings today, or 20 if necessary tomorrow, save the most exceptional 21 circumstances, mark the definitive conclusion of these 22 public hearings.

23

I will take appearances.

24 MR ROZEN: If the Board pleases, I appear with Ms Shann to 25 assist the Board.

26 MR NEAL: If the Board pleases, I appear with my learned friend 27 Ms Foley for GDF Suez Australia Energy.

28 MR ATTIWILL: I appear with Renee Sion on behalf of the State
29 of Victoria.

30 MR BLANDEN: If the Board pleases, I appear with Ms Burgess on 31 behalf of Dr Lester.

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MS SZYDZIK: I appear with Ms Fitzgerald on behalf of Voices of
 the Valley.

MR RAY: If the Board pleases, I seek leave along with my 3 learned junior Mr Aleksov to appear before this Board on 4 5 behalf of the EPA of Victoria. Your Honour, we do so in circumstances where the EPA retained Ms Johnston as a 6 7 potential expert witness in the course of an investigation 8 with the potential of criminal charges being laid as a 9 result of this fire and some of the issues that have come 10 before you. We seek to ensure that there is no prejudice to that ongoing investigation as a result of her providing 11 evidence to this Board. 12

13 CHAIRMAN: Yes, thank you, Mr Ray.

MR ROZEN: I wasn't sure if you needed to hear from us or anyone else as to that application in relation to the EPA being granted leave. So far as Counsel Assisting are concerned, we certainly would not oppose that grant of leave.

19 CHAIRMAN: We previously discussed the matter. We are prepared 20 to grant leave.

21 MR ROZEN: Before I proceed to call the witnesses, I have been 22 informed by Mr Neal on behalf of GDF Suez that there are some matters that he wishes to put before the Board. 23 24 CHAIRMAN: Mr Neal, can I enquire how long you will be? I'm 25 concerned about inconveniencing the witnesses. I'm suggesting that you either do it briefly now and, if you 26 27 want to, to do it at great length later on - - -28 MR NEAL: I don't want to do it at great length at either time, 29 and I wish to do it briefly now.

30 CHAIRMAN: That's fine.

31 MR NEAL: As a matter of courtesy and without in any way

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wanting to appear churlish given the Chairman's opening remarks, we do wish to make it plain the basis on which we appear today. We have through correspondence with the Board taken the objection that the proposed further hearing should in fact in point of principle not be occurring.

We understand the circumstances in which it has arisen. We understand an explanation has been given that there would be some risk that relevant evidence would be in the public domain which hadn't been taken account of by this Board.

12 We note the Chairman's comments that previously 13 and clearly it was said that the last hearing on this point was the final one. We note that what is being done 14 15 potentially sets a dangerous precedent in the sense that, 16 if any other person of relevant expertise chooses to put into the public domain or intimates that they will, 17 reports or other documents going to the questions to be 18 19 answered, in principle and assuming the Board hasn't 20 handed down a report one would expect the same guiding star to be applied, which is, "Well, we can't ignore 21 22 relevant evidence."

The Board has already said that at the end of this proposed hearing that will be the final, final hearing. But we see that as potentially giving rise to an inconsistent position.

27 So, to be clear, we appear today subject to that 28 protest, if it be that. It follows that we would say that 29 the further documents generated by Associate Professor 30 Barnett and other witnesses should not be admitted. 31 That's the primary position that we put.

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Under cover of that we note the Chairman's 1 2 comments about procedural fairness. Previously we have made the point that essentially procedural fairness in 3 this case depends upon a reasonable interval between 4 5 receiving intelligible material and being required to respond to it. In this case we regret to say we still 6 7 think we are in the same position as we were last time where expert evidence, the key expert evidence, the 8 9 reports of Associate Professor Barnett we find in 10 substantial part opaque, difficult to understand, difficult to deconstruct. We note in passing that that's 11 12 not a lawyer's complaint; that numerous of the experts 13 from which we will hear today complain about a lack of transparency and a lack of accessibility in those 14 15 documents. We suffer from the same problem as lawyers 16 acting for a party.

We note that since Associate Professor Barnett's latest round of material we have received in a piecemeal fashion addenda from him. Then we have received expert reports from a variety of other witnesses, and latterly Dr Fay Johnston has been introduced as a new source of expertise to the issues that need to be canvassed today.

We note that the expert conclave that was 23 24 convened on Monday, in our respectful submission, was done 25 at a time when the relevant experts hadn't had sufficient time to digest each other's opinions and reports and most 26 27 significantly, from our point of view, it seems had not 28 sufficient time or had not simply in fact had regard to 29 what we would say is most critical material, which is the 2015 births, deaths and marriage data that has become 30 available at various times, perhaps most latterly on 31

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1 8 October.

In our respectful submission, the experts' report will, we imagine, through Counsel Assisting be given considerable weight. We say the process that led to it has been an unhappily short and a somewhat abbreviated one, and that the outcome of that process which could have been valuable is indeed far less valuable for the circumstances under which it took place.

9 We say in essence that if there is to be a 10 further hearing, as clearly enough there is, that it still 11 suffers from the mischief that we don't sufficiently 12 understand the case that's put against us, even with the 13 benefit of some expert inputs. So it's against those 14 general objections that we appear today to do our best to 15 protect the interests of our client. Thank you.

16 CHAIRMAN: Thank you, Mr Neal.

MR BLANDEN: Mr Chairman, I wonder if I might make a very brief statement on behalf of Dr Lester.

19 CHAIRMAN: Yes, please do.

20 Thank you, sir. Firstly, can I adopt what our MR BLANDEN: 21 learned friend has just said in relation to the re-opening 22 of the term of reference and by way of comment, whereas we understand that the course undertaken is thought to be the 23 24 most convenient for the majority, it is unfortunately the 25 most inconvenient for Dr Lester. She was out of the 26 country when the announcement to re-open the term of 27 reference was made, she's remained out of the country 28 since and she's been almost for the entirety of that time 29 been out of contact with her legal advisers. She's been unable to follow much of what has taken place since. 30

31 Similarly, Dr McNeil, whose reports we had

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MR BLANDEN

tendered earlier, has been out of the country as well. We believe he might have returned from Europe last night, but we have been unable to ascertain positively whether he has or not. Clearly he's been unable to participate in the material-gathering exercise that's occurred to date.

6 We note at least by my arithmetic that since 7 Associate Professor Barnett provided his further advice to 8 the Inquiry shortly following the cessation of evidence on 9 the last occasion we seem to have received a total of 14 10 commentaries or reports in relation to the matters the 11 subject of the term of reference.

12 So we, on behalf of Dr Lester, say that her 13 absence from this term of reference being re-opened is 14 irresolvable in terms of the prejudice to her. So we 15 maintain our objection to the term of reference 16 re-opening.

17 I might also say by way of comment that in terms of information from the office of Counsel Assisting we 18 19 have a number of matters of information we have sought 20 most recently in the letter of 16 October 2015 sent to the principal legal adviser of the Inquiry with a reiteration 21 22 of a request for information in relation to a number of I won't repeat them now. But we remain awaiting 23 matters. 24 an answer to those matters. I thank the Inquiry for the 25 opportunity of making the statement.

26 CHAIRMAN: Yes, thank you, Mr Blanden. Yes, Mr Rozen.
27 MR ROZEN: If I could just very briefly reply to two matters
28 that have been raised. I'm very conscious also of the
29 inconvenience to witnesses. Firstly, in relation to the
30 matters raised by Mr Neal on behalf of GDF Suez, it was
31 said as I have noted it that his client does not

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understand the case put against it. I would merely respond there is no case put against it in these proceedings. It is an inquiry. It is not any form of adversarial proceeding. That, in my submission, is perhaps an unfortunate way to characterise the proceedings; certainly not an accurate one.

7 In relation to the position of Dr Lester and Dr McNeil, it is of course unfortunate and regrettable 8 that she has been out of contact and unable to provide 9 instructions. I would merely just place on the record 10 that when that was drawn to the attention of the solicitor 11 12 to the Board there was a response to solicitors for 13 Dr Lester offering to make whatever arrangements could be made to ensure that she could follow the proceedings 14 15 today, whether that be by skype or whatever other means, 16 and the same offer was made in relation to participation 17 by Dr McNeil. I understand it's not been possible for 18 that to occur for the reasons that Mr Blanden has 19 explained, but that offer was made.

I would also make the observation in relation to 20 that that, whilst obviously it would be preferable for 21 22 Dr Lester to be able to follow the proceedings if that's in fact what she wanted, the matters under consideration 23 24 today are not ones where there are issues of fact about 25 what Dr Lester did or said or occurred in relation to her. So it's not a situation where her instructions would be of 26 27 assistance in that way, that the matters under 28 consideration today don't directly raise any issues in relation to Dr Lester's conduct and the like. 29

30 With those observations and subject to anything 31 the Board may wish to deal with now, it may be appropriate

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to call the witnesses.

2 I'm very keen, Mr Rozen, for that to be undertaken. CHAIRMAN: MR ROZEN: If I could just explain to the Board and those here 3 what the arrangements will be. It will recalled there was 4 5 a panel of experts who gave evidence when we previously heard evidence in relation to this term of reference down 6 7 in the Latrobe Valley and they were Professors Armstrong and Gordon, and Associate Professor Barnett and 8 Dr Flander. Today we will have those four participating, 9 10 with Professor Armstrong participating remotely by video.

In addition, the Board will hear from Dr Philip McCloud, an expert that has been retained on behalf of GDF Suez. He has participated in the expert meeting that Mr Neal referred to and he will be here in person. Dr Fay Johnston, to whom reference has been made, will also be joining us by video from Tasmania.

23 <BRUCE CONRAD ARMSTRONG, (via videolink) recalled:

24 <ADRIAN GERARD BARNETT, recalled:

25 <LOUISA FLANDER, recalled:

26 <IAN ROBERT GORDON, recalled:

27 MR ROZEN: Dr Johnston, if I could start with you, please, and 28 could I enquire of you whether you have a copy of your CV 29 that you were kind enough to provide to the Board 30 recently?

31 DR JOHNSTON: I can get it up on my screen.

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MR ROZEN: You may know it well enough, at least the salient 1 2 details are probably familiar to you, I would trust. So we may not need you to look at it. Before I ask you, can 3 I just confirm your full name, please, Dr Johnston? 4 5 DR JOHNSTON: Yes, it's Fay Helena Johnston. MR ROZEN: You currently hold the position of Senior Research 6 Fellow and Head of the Environment and Health Research 7 Group of the Menzies Institute for Medical Research at the 8 University of Tasmania? 9 10 DR JOHNSTON: Yes. I have another position with the 11 government. 12 MR ROZEN: Could you tell us what that is, please? 13 DR JOHNSTON: I'm a specialist medical adviser, public health physician, for the Department of Health and Human 14 Services, the government of Tasmania. It's a factional 15 16 position. 17 MR ROZEN: In terms of your formal qualifications, Dr Johnston, you have listed a number of those. For the benefit of the 18 19 parties, Dr Johnston's CV is behind tab 47 of the hearing 20 book. It's been drawn to my attention that the correct pronunciation is - we seem to have lost the link. Can you 21 22 still hear me, Dr Johnston? DR JOHNSTON: Yes, I can still hear and see. 23 24 MR ROZEN: Am I right, the correct pronunciation is that the 25 "T" is to be pronounced, Johnston; is that right? 26 DR JOHNSTON: That's correct, yes. 27 MR ROZEN: In terms of your formal qualifications, Doctor, you 28 have a Bachelor of Medicine and Surgery, which was awarded 29 to you in 1987? DR JOHNSTON: Yes. 30 MR ROZEN: And in fact in your career as well as your research 31

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1 responsibilities and your other public health 2 responsibilities you have worked as a doctor for a number of years? 3 4 DR JOHNSTON: That's correct, yes. 5 MR ROZEN: In 1997 you were awarded a Master of Applied Epidemiology from the ANU? 6 7 DR JOHNSTON: Yes. MR ROZEN: And more recently you completed your PhD in 8 environmental epidemiology, which was awarded to you by 9 10 the Charles Darwin University in 2008? DR JOHNSTON: Correct. 11 12 MR ROZEN: In terms of your work you have worked in medicine, 13 public health and epidemiology since 1987? DR JOHNSTON: Yes, that is correct. 14 MR ROZEN: You commenced as an intern at the Royal Darwin 15 16 Hospital in that year and have worked in a variety of 17 positions. I won't go through them. They are set out in detail in your CV. Is that right, Doctor? 18 19 DR JOHNSTON: Yes, sorry. 20 MR ROZEN: You worked in general practice between 2001 and 2009, for a time in Darwin and then later in Hobart? 21 22 DR JOHNSTON: Yes, that's correct. MR ROZEN: And since that time you have worked as a specialist 23 24 medical adviser in public health with the Tasmanian 25 Department of Health and Human Services as well as the 26 current positions that you have just told us about? 27 DR JOHNSTON: Correct. 28 MR ROZEN: Turning briefly to your principal research areas, on 29 the first page of your CV you list your current main research areas, and a couple of those are of particular 30 interest to the Inquiry. I want to ask you briefly about 31

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2 study. This is part of the Hazelwood mine fire health
3 study that has been set up since 2014?

4 DR JOHNSTON: Correct.

5 MR ROZEN: Can you tell us briefly about what the aspect of the 6 study that you are working on involves?

7 DR JOHNSTON: Yes, the Hazelwood health study has a number of 8 streams, different aspects of long-term health and 9 The contract from the Victorian government was wellbeing. with Monash University, and I have a subcontract with 10 Monash University to lead the child health and development 11 stream, and that is looking at the health and wellbeing of 12 13 children who were exposed either because their mothers were pregnant or in the first two years of life, and we 14 15 will be following that group.

MR ROZEN: In that capacity you are a colleague of Professor Abramson from Monash University who has previously given evidence to this Inquiry about his role in relation to that study?

20 DR JOHNSTON: Yes, that's correct.

21 MR ROZEN: The other study you refer to in your CV which I want 22 to ask you about briefly is the study "Fire, Smoke and 23 People", which is some collaborative work that you are 24 engaged in that is examining health impacts of planned 25 burns and severe bushfires in the context of bushfire 26 management in Australia and Canada?

27 DR JOHNSTON: Yes, that's correct.

28 MR ROZEN: Is that work that has commenced?

29 DR JOHNSTON: Yes, it's actually the third of a series of 30 grants from the ARC that has been looking at this area. 31 So it's a field I have been actively engaged in for at

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least 10 years. The latest grant commenced a year ago. 1 2 MR ROZEN: Thank you. If I could tender the CV. The hearing book has been organised behind numbered tabs, as people 3 4 are all aware, and I would suggest that as the documents 5 are tendered they be given the exhibit numbers of the tab that they are behind, and that will ensure that the 6 7 numbering is sequential from the previous exhibits. 8 CHAIRMAN: Exhibit 47, is that what you have in mind? MR ROZEN: Yes, that would be suitable. Thank you, sir. 9 #EXHIBIT 47 - CV of Dr Johnston. 10 11 MR ROZEN: Dr Johnston, you have had some previous involvement in relation to the matters that are under investigation by 12 13 this Board, that is the Hazelwood mine fire. You in February and March of last year, that is 2014, reviewed an 14 15 EPA carbon monoxide response protocol that had been 16 developed and was being used as part of the EPA's response to the fire; is that right? 17 DR JOHNSTON: That's right. 18 19 MR ROZEN: And that work was performed by you together with an 20 English colleague, Professor Ross Anderson, of King's College, London. 21 22 DR JOHNSTON: There were two separate reports and we did them independently. I collaborated with Professor Guy Marks on 23 24 my report. 25 MR ROZEN: Just for the record, if the Board pleases, the first inquiry report at page 336 discusses Dr Johnston's 26 27 involvement. Dr Johnston, you were also a co-author along 28 with Professor Abramson and a number of other academics of 29 a rapid health risk assessment that was performed in March of 2014 for the Victorian Department of Health? 30 DR JOHNSTON: Yes, that's correct. 31

MR ROZEN: And, once again for the record, that assessment is
 part of exhibit 14 in these proceedings.

Doctor, if I can come to your involvement in the current Inquiry. You sent an email to Professor Catford, who is one of the Inquiry Board members, on 13 October. That email is behind tab 45 in the hearing book. You are familiar with the email I'm talking about, Doctor.

8 DR JOHNSTON: Yes, I am.

9 MR ROZEN: Why did you contact Professor Catford in that way?10 DR JOHNSTON: To explain that I have a role with the EPA.

I have been retained as an independent expert witness in their investigation into a potential case and as a part of that I was required to provide a detailed report about the health impacts of the smoke event on the people of the Latrobe Valley, which included an assessment of deaths.

When this Inquiry was re-opened specifically to examine the issue of deaths I had a particular interest and followed the proceedings closely, and I felt I had expertise that might help the Board. So I made contact. MR ROZEN: Had there been any contact from the Board to you

21 asking for you to have that input?

22 DR JOHNSTON: No, there had not.

23 MR ROZEN: Had you been contacted by any of the parties who are 24 involved in the Inquiry asking you to provide that input 25 to the Inquiry?

26 DR JOHNSTON: No, I have not been contacted by any of the 27 parties.

28 MR ROZEN: Thank you, Dr Johnston. If you could just bear with 29 me for the moment. I will be asking you some further 30 brief questions about the content of the email and a 31 subsequent report that you provided to the Board. But if

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I could turn to you, please, Dr McCloud, and I should 1 2 thank Dr Johnston, and thank you, Dr McCloud, for making yourself available to assist the Inquiry this morning. If 3 I could just ask you to confirm your full name, please? 4 5 DR McCLOUD: Philip Ian McCloud. MR ROZEN: You are a director of McCloud Consulting Group? 6 DR McCLOUD: That's correct, yes. 7 MR ROZEN: And McCloud Consulting Group is, as its name 8 suggests, a business that provides consultancy services, 9 10 including in the area of statistical analysis? DR McCLOUD: That's correct, yes. 11 MR ROZEN: Dr McCloud, you have or at least the solicitors for 12 13 GDF Suez have provided to the Inquiry your CV, and it is located behind tab 51 in the hearing book. There should 14 be a copy of the hearing book in the witness box. No, 15 16 it's coming up to you now. Thank you. Do you have open in front of you a copy of your CV, Doctor? 17 DR McCLOUD: Yes, I do. 18 19 MR ROZEN: If I could just start with a brief description, sir, 20 of your qualifications, which are listed at the top of the first page. You have a Bachelor of Arts with Honours in 21 22 Mathematical Statistics with First Class Honours from Flinders University? 23 24 DR McCLOUD: That's correct. 25 MR ROZEN: A Diploma of Computer Science from the University of 26 Adelaide? 27 DR McCLOUD: Yes. 28 MR ROZEN: And then a PhD which was awarded to you, am I right, in 1987? 29 DR McCLOUD: Yes, that's correct. 30 MR ROZEN: That was from Flinders University, and the PhD title 31

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1 is "Some log-linear models for the analysis of categorical 2 repeated measurements"? DR McCLOUD: That's correct, yes. 3 MR ROZEN: I won't ask you to explain to us precisely what that 4 5 is, but it obviously concerns research in the area of statistical analysis? 6 DR McCLOUD: Yes, that's correct. 7 8 MR ROZEN: Dr McCloud, in terms of your work experience, you have held your current position of Director of McCloud 9 10 Consulting Group and Principal Statistician since October 2010? 11 DR McCLOUD: Yes. 12 13 MR ROZEN: Prior to that position, you have held a range of positions in different organisations where you have had 14 responsibility for statistical analysis? 15 16 DR McCLOUD: That's correct, yes. MR ROZEN: If we can go backwards in time, before 2010, for 17 18 some 13 years, you were the head of Pharma Development 19 with Roche Products Pty Ltd. 20 DR McCLOUD: That was one role for the last three years. My 21 main role was to be the Asia-Pacific head for 22 biostatistics and data management for Roche. MR ROZEN: For the benefit of the transcript, "pharma" is 23 P-H-A-R-M-A; is that right? 24 25 DR McCLOUD: It sounds okay to me, yes. MR ROZEN: We are not talking about rural activity. Before 26 27 holding your position with Roche you held some academic 28 positions in the Monash University Statistical Consulting 29 Services? DR McCLOUD: I was employed as a lecturer at Monash University 30 and as well as that full-time job I was the Director of 31

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the Statistical Consulting Services for eight years. 1 2 MR ROZEN: Just to complete that picture, you have worked as a senior biometrician with the South Australian Department 3 of Agriculture for some 14 years before taking up the 4 5 academic positions at Monash University? DR McCLOUD: That's correct. So in total I'm one month short 6 of being an applied or biostatistician for 40 years. 7 8 MR ROZEN: Doctor, your involvement in relation to the matters under inquiry by the Board consist of being retained by 9 the law firm King & Wood Mallesons on behalf of their 10 client GDF Suez? 11 DR McCLOUD: That's correct. 12 13 MR ROZEN: When were you first contacted by King & Wood Mallesons to provide them with expert opinion and advice 14 in relation to statistical analysis? 15 16 DR McCLOUD: It was about 12 or 13 August 2015. MR ROZEN: Before the Inquiry there is a letter, and if I could 17 18 ask you to turn, please, to tab 50 in the folder that's in 19 front of you? 20 DR McCLOUD: Yes. MR ROZEN: The Board has been provided with a copy of this 21 22 letter sent by you to Ms Heffernan of King & Wood Mallesons dated 13 October. You will see in the first 23 paragraph that you refer there to a letter you'd received 24 25 from Ms Heffernan dated 6 October 2015 in which you had 26 been asked to provide comments and observations on certain 27 material? 28 DR McCLOUD: Yes. 29 MR ROZEN: I take it you can confirm that you did in fact receive this letter? 30 DR McCLOUD: Yes, I did, yes. 31

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1 MR ROZEN: But your involvement did not commence, as 2 I understand your evidence, with the receipt of this letter. You had been previously providing advice to King 3 & Wood Mallesons dating back, as you told us, some time 12 4 5 or 13 August? DR McCLOUD: That's correct, yes. 6 MR ROZEN: If you could turn a few pages forward behind that 7 same tab, in fact the fourth page behind that tab, you 8 should see a further letter from you to Ms Heffernan dated 9 14 October 2015? 10 DR McCLOUD: Yes. 11 MR ROZEN: If you could confirm, please, that that was a 12 13 follow-up letter that you wrote to Ms Heffernan in which you expressed some further opinions about the subject 14 matter you had been asked to look at? 15 16 DR McCLOUD: That's correct, yes. 17 MR ROZEN: The only other matter I want you to look at at the moment, please, Dr McCloud, you will find behind tab 58 in 18 19 the hearing book. 20 DR McCLOUD: Yes. MR ROZEN: Could you please confirm for us that that is a table 21 22 that you have prepared entitled "Number of deaths in the La Trobe Valley by year with 95% confidence interval" in 23 24 the identified postcodes and for the years 2009 through to 25 2015? 26 DR McCLOUD: Yes, that's a figure that I prepared. 27 MR ROZEN: That was prepared for whose benefit, or why did you 28 prepare that, Doctor? 29 DR McCLOUD: I had been invited to the conclave on Monday. So in preparing for that meeting this was something that 30 I took along to the conclave to discuss with the other 31 734

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experts and witnesses.

2 MR ROZEN: Thank you, Doctor. As with Dr Johnston, I will ask you some further questions in a moment about that conclave 3 and about the documents. But for the moment, if the Board 4 5 pleases, could I tender exhibits 50, 51 and 58, please. CHAIRMAN: Yes. 6 MR ROZEN: I have been reminded that I did not tender 45. 7 8 CHAIRMAN: 45? 9 MR ROZEN: Thank you, sir. If I could do that now, please. 10 CHAIRMAN: Yes. 11 #EXHIBIT 45 - Email from Dr Johnston to Professor Catford dated 13/10/2015. 12 13 #EXHIBIT 50 - Letter from Dr McCloud to Ms Heffernan of King & Wood Mallesons dated 13/10/2015. 14 #EXHIBIT 51 - CV of Dr McCloud. 15 16 #EXHIBIT 58 - Table entitled "Number of deaths in the La Trobe Valley by year with 95% confidence interval". 17 18 MR ROZEN: Dr Johnston, can I return to you, please, so that we 19 can deal with this in chronological order. You have told 20 us a moment ago that you provided an email to the Board and the circumstances about that. Subsequent to providing 21 22 that email, did you also provide to the Board and to the fellow experts that you met with earlier this week another 23 brief report dated 18 October 2015? 24 25 DR JOHNSTON: Yes, I did. MR ROZEN: Do you have a copy of both your email and the report 26 27 dated 18 October handy in front of you? 28 DR JOHNSTON: Yes, I have the report. I can open the email. 29 MR ROZEN: Thank you. If you could just do that, and if I could just for the record note that the report dated 30 18 October is behind tab 46 of the hearing book, and 31

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I should tender that whilst I have it in mind. 1 2 CHAIRMAN: Yes. #EXHIBIT 46 - Report by Dr Johnston dated 18/10/2015. 3 MR ROZEN: Doctor, have you been able to locate your email of 4 5 13 October? DR JOHNSTON: Yes, I have. 6 MR ROZEN: If I could just ask you briefly about that. After 7 8 the introduction where you draw to Professor Catford's 9 attention your background and you note that you have read various reports which have been posted to the Inquiry's 10 website, you set out in a series of dot points starting 11 halfway down the first page some observations that you 12 wish to draw to the Board's attention? 13 DR JOHNSTON: 14 Yes. MR ROZEN: Can I ask you if it is fair to summarise the 15 16 information you have provided to the Board in the following way. You note the statistical analysis of the 17 18 number of deaths in 2014 compared to the deaths in the 19 equivalent periods in the previous four years, and you 20 note that on the face of it there is an apparently unexplained increase in deaths in 2014 when compared to 21 22 those previous years? DR JOHNSTON: Yes, drawing from the reports, that was my 23 24 conclusion, yes. 25 MR ROZEN: What you then set out to do is apply your knowledge about the impact on human health of pollution and 26 particularly particulate matter 2.5 to try to draw some 27 28 conclusions about whether or not that statistical increase 29 might be explained by the Hazelwood coal mine fire? DR JOHNSTON: Yes, I did, or specifically by smoke exposure 30 from the Hazelwood coal mine fire. 31

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MR ROZEN: Yes. You draw particularly on your own research but 1 2 also the literature about the known and measured effects of smoke, and particularly smoke that contains particulate 3 4 matter on human morbidity and mortality? 5 DR JOHNSTON: Yes, I do. There is a vast literature on the health impacts of particulate matter on deaths and 6 7 hospital admissions and so forth. MR ROZEN: Yes. Can I draw your attention to what seems to be, 8 as I read it anyway, the key part of your email, and 9 10 that's the third dot point at the bottom of the first page. If I can read what you say there. You make the 11 12 following observation, "Concentration response 13 relationships for airborne PM" - that's particulate matter - "and mortality are now well established and 14

15 widely accepted." You go on, "As a generalisation, a 10 16 microgram per cubic metre increase in 24 hour PM2.5 is 17 associated with around a 1 per cent rise in daily all 18 cause mortality." That's what you have written in the 19 email?

20 DR JOHNSTON: Yes.

MR ROZEN: The reference that you give for that is reference 21 22 No. 4, and if I could ask you to turn to page 4 of that email. We see that reference No. 4 is some work by 23 Atkinson et al entitled "Epidemiological time series 24 25 studies of PM2.5 and daily mortality and hospital 26 admissions: a systematic review and meta-analysis", and 27 the citation is there provided? 28 DR JOHNSTON: Yes, that's correct.

29 MR ROZEN: That's the reference you rely on for the statement 30 in the third dot point?

31 DR JOHNSTON: Yes. It's the most recent comprehensive review,

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but it's not substantially different from earlier reviews 1 2 in its conclusion. MR ROZEN: I understand that you were emailed either late 3 yesterday or early today with a copy of what we understand 4 5 to be that article by Atkinson and others. Can I confirm that you received that email? 6 DR JOHNSTON: No, I have not received an email. 7 MR ROZEN: You don't happen to have at hand a copy of the 8 Atkinson study by any chance? 9 10 DR JOHNSTON: I would have to look. I'm not at my work computer. I'm having to do this from home, and I may not 11 12 have it with me on my home laptop. 13 MR ROZEN: I'm instructed, Doctor, that it has just been emailed to you. Are you in a position to open an email, 14 or is that difficult as well, given your current location? 15 16 DR JOHNSTON: No, I'm opening it now. MR ROZEN: Thank you. For the benefit of the Board and the 17 18 parties, the document I'm referring to is behind tab 61 in 19 the hearing book, and the Inquiry is indebted to the legal team for Voices of the Valley for providing us with that 20 21 late yesterday. 22 Doctor, have you been able to open the email and look at the attachment? 23 24 DR JOHNSTON: Yes. 25 MR ROZEN: You will see that on the first page of the article there is a series of what are described as key messages? 26 27 DR JOHNSTON: Yes. 28 MR ROZEN: And the first of those is, "What is the key 29 question?" And it goes on, "Is there convincing and consistent evidence worldwide that short-term exposure to 30 outdoor fine particulate matter (particles with a median 31

.DTI:MB/TB 22/10/15 738 BY MR ROZEN Hazelwood JOHNSTON/McCLOUD/ARMSTRONG/BARNETT/FLANDER/GORDON aerodynamic diameter of less than 2.5 micrometres) air
 pollution is associated with increased risk of death and
 emergency admission to hospital?" Do you see that?
 DR JOHNSTON: Yes.

5 MR ROZEN: What I want to ask you about is the expression
6 "short-term exposure". That doesn't appear to be defined
7 anywhere in this article that I can see, but perhaps you
8 are able to assist the Board on what - does that have a
9 defined meaning in your field?

DR JOHNSTON: Yes, it relates daily changes in particulate matter and daily changes in the outcome of interest, and it can include lags of up to several days. Usually "short-term" refers to daily associations and "long-term" usually refers to the yearly associations, yearly averages.

MR ROZEN: I understand. So is it the period of exposure that is described as short-term or long-term, or something else?

19 DR JOHNSTON: It's the period of exposure.

20 MR ROZEN: The reason I'm asking you this is because, as you 21 are aware and as we all are, the Hazelwood mine fire burnt 22 for 45 days and, even though the exposure levels varied during that time, I think it is fair to say that there was 23 24 some exposure to the community in Morwell and other towns 25 during that period of 45 days. My question is: does this 26 article, which is dealing, as it says, with short-term 27 exposure, place you and the Board in a position to be able 28 to extrapolate directly from its results to the experience of the Hazelwood fire? 29

30 DR JOHNSTON: Not necessarily. There's relatively few studies 31 that look at longer periods of exposure, and by that

.DTI:MB/TB 22/10/15 739 BY MR ROZEN Hazelwood JOHNSTON/McCLOUD/ARMSTRONG/BARNETT/FLANDER/GORDON I mean of the order of weeks. However, the literature on the health impacts of fire smoke from landscape fires is very small by comparison, but it does examine periods of weeks, four weeks or even months in the case of some of the South-East Asian big fires.

6 MR ROZEN: Just so that I can understand that, Doctor. Is the 7 position that the Atkinson meta-analysis, that is the 8 studies that comprise that analysis, are principally 9 concerned with short-term exposure in an urban setting; 10 that is to pollution, for example, from cars and other 11 sources?

12 DR JOHNSTON: Yes, it primarily considers background sources of 13 particulate matters, industry and transport being major 14 contributors.

MR ROZEN: Given that, is it fair to say that one at least needs to be cautious about extrapolating from the findings in that data to the situation that the Board is concerned with, that is 45 days exposure from a coal mine fire?
DR JOHNSTON: Yes, I agree one does need to be cautious in extrapolating.

MR ROZEN: You mentioned a moment ago that there are other studies that you refer to in both of your articles concerning landscape fires. Are you able to summarise briefly your understanding of the knowledge and research that emerges from those studies?

26 DR JOHNSTON: Yes, I can. As I said, the evidence base is far 27 smaller and one of the key questions has been when you 28 look at particulate matter as a marker for the entire 29 toxic mix, that is smoke from combustion, do you see a 30 difference in the deaths when it is in that context as 31 compared with in the context of urban air pollution.

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There is no evidence to suggest it's any 1 2 different. Some studies can't find an association with mortality. But most studies seem to find associations of 3 the same size, the same order of magnitude. 4 That 5 includes - there's two studies in particular that were peat and forest fires that were guite prolonged of 6 7 relevance lasting, one, four weeks and, another, I think two weeks, the Moscow peat fires, and those in particular 8 had very similar results to that found in this review by 9 10 Atkinson et al.

MR ROZEN: When the Inquiry heard last month from Professor 11 12 Abramson, he was giving evidence about the rapid health 13 risk assessment, which you, along with him and others, 14 prepared for the Department of Health early in 2014. His 15 evidence, as I understood it, was that in the research 16 that was done for the preparation of that assessment and a 17 subsequent document that was prepared by the same group you were unable to identify a study that looked at 18 19 scenarios such - or that was certainly not identical to 20 the Hazelwood coal mine fire. In fact, you were unable to identify any mine fire that had impacted on human health? 21 22 DR JOHNSTON: Correct.

MR ROZEN: In those circumstances, he told us, and I understand you are also telling us, that what one then can do to try and assist and analyse the situation is to draw on these other studies which look at, firstly, short-term exposure in an urban setting, that's the Atkinson report?
DR JOHNSTON: Yes.

29 MR ROZEN: And also longer term exposure from forest and 30 I think you also mentioned peat fires, and they are the 31 other references that are referred to in your email and

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the subsequent report?

2 DR JOHNSTON: Yes, that's correct.

MR ROZEN: Are you able to assist the Board with understanding 3 whether it can be assumed that the contents of the smoke 4 5 from a slow-burning coal mine fire like the one that occurred at Hazelwood will be for present purposes the 6 7 same as the smoke that one is exposed to, for example, 8 from a planned burn or a bushfire in Australia? 9 DR JOHNSTON: Yes, I can in very general terms. The toxicology of smoke from the combustion of hydrocarbons is 10 complicated. But where there's incomplete combustion as 11 12 there is in all those cases - bushfires, planned burns, 13 peat fires, coal fires - a very similar spectrum of compounds is liberated, including particulate matter 14 15 scatters, particularly carbon dioxide, and a whole suite 16 of chemicals that are products of incomplete combustion, 17 such as oxides of nitrogen and sulphur and aldehydes and many chemicals that are known to be irritant and harmful 18 19 to health.

20 What is different is the relative contributions 21 of these things, and that depends on how far you are from 22 the fire, how much oxygen was available, how much 23 atmospheric chemical transformation has occurred. But in 24 general the ingredients are similar.

25 MR ROZEN: Doctor, can I please turn to the second document 26 that you have prepared for us, that is the report of the 27 18 October, which is behind tab - it is exhibit 46 in the 28 proceedings. Do you have that, Doctor?

29 DR JOHNSTON: Yes.

30 MR ROZEN: If I can just read from the first paragraph of that. 31 You write, "Below I present a basic assessment of

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population exposure to PM2.5 from mine fire smoke 1 2 (table 1) and apply a range of concentration response functions based on the available evidence (table 2). 3 Based on this assessment I conclude that a mortality 4 5 increase of 3.6 per cent would be a plausible upper bound consistent with current available evidence and that PM 6 exposure from smoke is unlikely to explain a mortality 7 increase as large as 30 per cent. Other explanations for 8 such a large statistical correlation should also be 9 considered." That's what you wrote in your report, 10 Doctor? 11

12 DR JOHNSTON: Yes, that's correct.

MR ROZEN: Have you had the opportunity to consider what other explanations there may be for that large statistical correlation?

DR JOHNSTON: Yes, I have thought about it in some depth. I don't dispute that there is a statistical correlation, but when you get a result that is an order of magnitude higher than what you might expect knowing the evidence it's important to think about that issue very deeply.

22 DR JOHNSTON: And there's a number of issues that could be of 23 relevance. Would you like me to list some of them? 24 MR ROZEN: I would, please.

25 DR JOHNSTON: I think the main one is the fact that this is 26 such - the air pollution studies consider a very small 27 population. Usually you need to study a population of a 28 million or more or a smoky day that affects a million 29 people you would generally expect to see one additional 30 death. There is a lot of variation around that. So when 31 you are looking at a very small population you can get

.DTI:MB/TB 22/10/15 743 BY MR ROZEN Hazelwood JOHNSTON/McCLOUD/ARMSTRONG/BARNETT/FLANDER/GORDON anomalous results. You can fail to see a result that's there. But you can also get surprising results because just one death can have a huge change in the proportion of people who have died when deaths are not a frequent event.

5 An example of that that I see in my public health practice - it's not my direct responsibility with 6 the government, but a reasonably common thing public 7 health authorities have to deal with is a statistical 8 9 cluster of cancers in a small community where the 10 probability and statistics tell you that it's higher than you would expect, and that requires a lot of investigation 11 12 in every case. As part of that investigation you consider 13 what the exposures are of concern. It might be you consider what the likely effect of that exposure is, you 14 15 consider the time course of exposure and outcomes, and in 16 many - probably most of these cases you are unable to explain why there is a statistical correlation. So the 17 fact that it's a small community with a small effect size 18 19 means that there is more uncertainty about interpreting 20 the result, particularly as we know it's so far from what 21 we might expect.

22 But, having said that, when you take known dose-response concentrations and then apply them to a very 23 24 small community or an individual, you need to do that with 25 caution as well because the impact on the community comes down to underlying vulnerability, the people who were 26 27 there, what their risks were. We know, for example, that 28 in the Latrobe Valley many health indicators are poorer 29 compared with the wider Australian population. You would expect this community to be more vulnerable than an 30 average population. So it might be higher than what we 31

.DTI:MB/TB 22/10/15 744 BY MR ROZEN Hazelwood JOHNSTON/McCLOUD/ARMSTRONG/BARNETT/FLANDER/GORDON 1 expect from the literature, but I wouldn't expect it to be 2 an order of magnitude higher.

The other issue that hasn't been discussed but in 3 4 my previous work in writing reports there is a small body 5 of literature about cardiovascular mortality following 6 natural disasters. There is a limited body of evidence - and this isn't my direct area of expertise, but 7 there are some studies that show higher deaths from 8 cardiovascular disease following a natural disaster like 9 10 an earthquake, for example. After the World Trade Centre there was a study showing more life-threatening cardiac 11 12 arrhythmia. Taking data from defibrillators that people 13 have implanted - that's a medical device that responds to an abnormal heartbeat - showed a rise in that. It didn't 14 assess deaths. 15

We also know without any doubt that the amount of stress and disruption and concern for health, particularly in the town of Morwell, was substantial. So, as well as being exposed to smoke, there was the aspect of community stress, there's the aspect of a small population. So all those factors need to be considered.

22 MR ROZEN: Thank you, Doctor, in relation to your first observation about the small sample size, and that's a 23 24 matter that the Board has had drawn to its attention by a number of witnesses, is the point there that, if I could 25 26 adopt the words that Dr McCloud uses in the joint report, 27 the Board needs to recognise that given - that one of the 28 issues with a small sample size is that even quite 29 significant changes may just be the result of natural random variation? 30

31 DR JOHNSTON: Yes, I would agree with that.

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MR ROZEN: Thank you. Doctor, the last thing I want to ask you 1 2 about is the meeting that you were kind enough to participate in earlier this week on 19 October 2015, can 3 4 I confirm that you met with your five colleagues who are 5 here today giving evidence? DR JOHNSTON: 6 Yes. MR ROZEN: At the conclusion of your meeting you were provided 7 8 with a document which had been prepared by a member of the 9 Inquiry's staff which set out a recording of the - the 10 various conclusions reached by the participants in the meeting in response to the six questions that you were 11 asked to consider; is that right? 12

13 DR JOHNSTON: Yes, that's right.

MR ROZEN: The joint report, for the benefit of the parties and the Board, is behind tab 57. Do you have a copy of that joint report in front of you, Doctor, by any chance? DR JOHNSTON: No, but I can get it very quickly.

MR ROZEN: All right. The copy I have in front of me and that others here have has a space for your signature but your signature is not attached. No doubt - you were able to look at it and email back to the Inquiry that you were happy with the contents of the document; is that right? DR JOHNSTON: Yes, that's correct.

MR ROZEN: Can I just confirm the answers that you gave to two of the questions that the joint meeting was asked to consider. If you turn to the second page of the joint report you will see question No. 5 at the bottom of the page. Do you have that, Doctor?

29 DR JOHNSTON: I can actually see it on the screen being 30 projected.

31 MR ROZEN: Thank you. The question that you were asked was,

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"Having regard to the reports of Associate Professor 1 2 Barnett dated September, 25 September and 9 October 2015 and commentary on them undertaken by Professor Armstrong, 3 4 Professor Gordon, Dr Flander and Dr McCloud: (a) was there 5 an increase in mortality in the Latrobe Valley during the coal mine fire in 2014?" The answer recorded next to your 6 7 name is: "Qualified agreement. I think it is very likely there was an increase in deaths, but not of the magnitude 8 of those estimated by Associate Professor Barnett." That 9 10 accurately describes the answer you gave? DR JOHNSTON: Yes, I did qualify the "very likely" to "likely". 11 But that's a minor difference. 12

MR ROZEN: Just to correct that, it should be written: "I think it is likely there was an increase in deaths, but not of the magnitude of those estimated by Associate Professor Barnett"?

17 DR JOHNSTON: Yes.

MR ROZEN: Then the second question that was asked there is, "If yes" - to (a) - "did the coal mine fire contribute to the increase in mortality?" The answer recorded next to your name is, "Yes, it is likely." That remains your evidence, as I understand it?

23 DR JOHNSTON: Yes, it does.

24 MR ROZEN: If I'm able to summarise the contribution that you 25 are making to this Inquiry, it is that the Inquiry ought 26 have regard to the, you say, extensive literature about 27 the general effect of PM2.5 on human health in the various 28 settings that we have described in determining the 29 question that it has been asked to consider?

30 DR JOHNSTON: Yes.

31 MR ROZEN: Thank you, Doctor. If I could turn then to you,

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1 Dr McCloud. Apparently I haven't tendered the Atkinson study behind tab 61. So I will do that now, if I may, 2 3 sir. 4 CHAIRMAN: 61. Do you also want 57 to go in? 5 MR ROZEN: I probably should ask each of the witnesses about 57 before it is tendered. 6 CHAIRMAN: Okay. 7 #EXHIBIT 61 - Atkinson study. 8 MR ROZEN: Dr McCloud, if I could turn to you, please, and ask 9 you about the report that we mentioned earlier, that is 10 behind tab 50. Do you have that in front of you? 11 DR McCLOUD: Yes. 12 13 MR ROZEN: As I understand what's occurred here is that, as you set out in the first paragraph, you were provided with a 14 series of emails between 6 October and 13 October by King 15 16 & Wood Mallesons solicitors and asked to comment on the material that was attached to those emails? 17 DR McCLOUD: That's correct, yes. 18 19 MR ROZEN: Without necessarily going to them, we have copies of 20 each of those emails, which have been kindly provided to the Inquiry. For the record, I note they are part of 40, 21 22 behind tab QQ. In your report or in your letter dated 13 October 23 24 2015 you note in the second paragraph, no doubt drawing on that extensive experience you have, that "in sundry fields 25 of application such" - should that be "such as medical 26 27 science", Doctor? 28 DR McCLOUD: Yes. MR ROZEN: "Such as medical science, clinical trials, public 29 health and time series of death statistics, the task of 30 understanding causality is clouded because of random 31

variation. It is well understood that unexpected peaks or troughs in time series of data are often the result of random variation." Can you expand on that observation, please, Doctor?

5 DR McCLOUD: Perhaps if I can give an example there from my relatively short career compared to the wealth of sort of 6 7 human history, if you like, there was an institution who came to talk to me at one point where their monthly 8 success rate through a particular process was around 9 10 40 per cent. Then in one particular month this dropped to 20 per cent, and the month after went back to the normal 11 12 level. They checked everything - the quality of their 13 water, the quality of their processes. So this was just a spike of random variation for one month for whatever 14 reason. We see this consistently in the physical 15 16 sciences, in medical science when we are studying various 17 phenomena.

MR ROZEN: If I can just skip over paragraph 3, which I will 18 19 come back to, and go to the first of the points that you 20 make. You make six points or observations about the material that you had been provided to review. Can I just 21 22 clarify with you that, in addition to what's been referred to as the recent material from Associate Professor Barnett 23 24 that has been provided to the Inquiry, you have also had the opportunity to consider all of the other reports, that 25 26 is the reports of the various colleagues that are sitting 27 in the witness box with you today; is that right? 28 DR McCLOUD: Yes, I have.

29 MR ROZEN: So the observations you make here, even though in 30 the specific sense they are directed to those recent 31 reports of Associate Professor Barnett, they are

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observations that you would make generally about all of 1 2 the material that is before the Board? DR McCLOUD: I think I would probably rather consider that on a 3 4 case-by-case basis. 5 MR ROZEN: All right. The first point you make, and it is a matter that you return to, is that, in the absence of 6 death certificates that report on specific cause of death, 7 a significant piece of the puzzle, as it were, is missing 8 from the current Inquiry? 9 10 DR McCLOUD: I don't mean that as a criticism, but yes. MR ROZEN: It is merely an observation that an examination of 11 death certificates and presumably if autopsies were 12 13 conducted then the details of those autopsies might shed further light on the questions? 14 DR McCLOUD: Or going on from the death certificates then talk 15 16 to the hospital staff about the condition of the patient 17 on that day, perhaps talk to family about the relationship between the time of exposure to mine fire pollution and 18 19 when symptoms first started to appear. 20 MR ROZEN: If I could go over to the page, the end of that 21 point, you make the observation, and I quote, "It is this

detailed medical assessment of the deaths during the period of the mine fire that is lacking from the current analysis. In my opinion, the numbers alone are not adequate to justify a conclusion that the pollution from the mine fire caused the increase in deaths compared to previous years."

If I can just pause there in the reading, that observation about or that question that you posited there about whether the mine fire caused the increase in deaths compared to previous years, was that a question that you 1 were asked specifically to answer by King & Wood Mallesons 2 solicitors?

DR McCLOUD: No, I don't recall that. Could I perhaps refer to 3 the graph that was behind I think it is tab 55, is it? 4 5 MR ROZEN: I think it is behind 58, if I have the right one. DR McCLOUD: So if you have that graph in front of you, here we 6 7 have the number of deaths recorded during the mine fire period for each of the years 2009 through to 2015. What 8 you notice in 2014 there, that the number of deaths is 83, 9 10 does not stand out as a particular outlier.

We are also able here to calculate the mean of 11 these seven figures and get a figure of 69.4, and then we 12 13 can assess the level of variation around these figures, just the natural background variation, by calculating the 14 15 standard deviation, which in this case is the square root 16 of 69.4. So it is about 8.5. If we then multiply that by 17 two to give ourselves a rough 95 per cent confidence interval, then for every one of these figures the sort of 18 19 natural background random variation is about plus or minus 17 deaths. So when we look at the 83 that occurred in 20 2014 this is only 13 above the mean of, let's say, 70, and 21 22 so this is just within the background natural random 23 variation of this process.

24 MR ROZEN: Thank you, Doctor. I'm not sure that the question 25 that I asked you was expressed as clearly as it could be. What I was focusing on is the use of the word "caused" in 26 27 the sentence that I read out to you in your report; that 28 is, you were making observations about whether or not the 29 mine fire caused the increase in deaths, and my question is: was that something you were asked specifically to 30 address by the solicitors? 31

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DR McCLOUD: No. That was something from my own thinking and
 reading of the material.

MR ROZEN: You also use the same expression on the first page, 3 4 perhaps if I could take you back to it, in the third 5 paragraph, do you see the paragraph "in a number of the expert reports", and if I can draw your attention to the 6 7 sixth line into that paragraph, a sentence that starts, "However, such an increase in the number of deaths during 8 9 the period of the mine fire in 2014 compared to previous 10 years does not prove that the pollution from the mine fire was the cause of the increase." Do you see that? 11 12 DR McCLOUD: Yes, I do, yes.

MR ROZEN: I think you are aware of the question before the Board, aren't you, Doctor, that is did the mine fire contribute to an increase in deaths in 2014 compared to previous years?

17 DR McCLOUD: Yes, I'm aware of the question.

MR ROZEN: I just want to ask you about the use of the definite article in that sentence, if I could, that you are saying the pollution from the fire was not "the" cause of the increase. Are you ruling out that it may have been a cause of the increase?

DR McCLOUD: No, not entirely. But given the natural variation 23 24 that we have here, when you look at, say, 2015 we have an 25 increase there from a mean of 70 to 77. So it's an increase of seven deaths, but of course none of those 26 27 because of the mine fire because there wasn't a mine fire 28 that year. So when we look at the increase from 70 to 83 29 in 2014 there may be a portion of that which is associated with the mine fire but a good portion of that may well be 30 explained by just the natural random variation within this 31

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1 process. 2 MR ROZEN: I understand. In fact, you deal with the 2015 figures at point 5 of your report, if I understand it, the 3 bottom of page 4? 4 5 DR McCLOUD: Yes. MR ROZEN: If I understand the point you are making, the 6 evidence the Board has previously heard is that - and if 7 we look at your graph which very helpfully depicts 8 this - 2014 and 2009 appear to be standout years that 9 10 require some explanation? DR McCLOUD: Yes. 11 MR ROZEN: What you are drawing to our attention is on the same 12 13 analysis 2015 seems to fit broadly into the same category? DR McCLOUD: Yes, that's correct. 14 MR ROZEN: You also in your report make reference to the 15 16 dose-response relationship question; that's at point 2? DR McCLOUD: Yes. 17 MR ROZEN: As I understand the point you are making there, and 18 19 this is something that the Board has obviously heard 20 evidence about previously, the science about dose-response 21 relationship is that one expects the effect to be greatest 22 where the effect - where the dose is the greatest, if I can use that terminology? 23 DR McCLOUD: That's correct. 24 25 MR ROZEN: An aspect of the material that perhaps has confounded you to some extent is the evidence about the 26 27 impact on Morwell compared to other towns further away 28 from the fire? DR McCLOUD: That's correct. 29 MR ROZEN: At point 3 you make reference to the final rapid 30 health assessment report, and you would have heard me 31 .DTI:MB/TB 22/10/15 753 BY MR ROZEN

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Hazelwood

asking Dr Johnston briefly about that. You would accept, 1 2 would you not, Doctor, that that report, which was necessarily a predictive report, whilst it may be of some 3 assistance to the Board in answering the question before 4 5 it, it's really an analysis of the evidence about what happened that is of greater significance, is it not, than 6 7 a prediction made in advance or at the time of the fire? 8 DR McCLOUD: I would agree with that, but perhaps to qualify 9 that by saying that also the report of Fay Johnston and Professor Abramson is not confounded with the random 10 variation within the system. Given that it's studying 11 12 many other reports that were looking at particulate 13 matter, it's therefore of relevance because it really takes the random variation out of the equation. 14 MR ROZEN: Thank you. Can I ask you to examine point 4 in your 15 16 report, please, towards the bottom of page 3. I'm not sure I understand the point that you are making there. 17 As I understand it, it concerns the data input into the 18 19 analysis. Perhaps if you look at the last sentence above 20 the heading point 5 on page 4 you say, "In my opinion the better control group for estimating the increased number 21 22 of deaths in 2014 compared to earlier years is that restricted to the period of the mine fire rather than 23 using all days of the year." Can you expand on that 24 25 observation for us, please, Doctor? 26 DR McCLOUD: Sure. So the figure that we saw before behind tab 27 58, there I have restricted it to the period of the mine 28

fire. So this acts as a homogeneous period of days and therefore serves as a good control group in assessing the changes in deaths from year to year. In the more recent analyses all days of the year have been added, and because

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one does that you then have to come up with a mathematical 1 model which will satisfactorily model all the extra 2 variation that's been introduced because of all the winter 3 months, all the spring months, all the days in autumn, and 4 5 that's a difficult and challenging thing to do. If that model doesn't do a very good job of doing that, then it 6 7 can lead to systematic biases in the analysis. So there is always this tradeoff between having homogeneous control 8 groups or heterogeneous control groups, and it's not 9 10 always easy to decide which one is best.

MR ROZEN: Thank you, Doctor. Now could I turn to your participation in the meeting earlier this week, and once again on behalf of the Board express our gratitude for you making yourself available to participate in the meeting. Have you had a chance to look at the report which you signed as an accurate reflection of the discussions? DR McCLOUD: Yes.

MR ROZEN: It's behind tab 57. I just want to ask you about a 18 19 couple of the questions and answers that you gave. If you 20 could focus your attention, please, on the question at the 21 foot of page 2, the question of whether there was an 22 increase in mortality during the fire having regard to the various reports and also obviously the discussions that 23 24 you had. The answer that's recorded next to your name is, 25 "Although there was an observed increase in mortality during the time of the coal mine fire, this is within the 26 27 bounds of natural random variation."

28 DR McCLOUD: Yes, that's correct.

29 MR ROZEN: That's the answer you give based on the statistical 30 knowledge and experience that you have that was described 31 earlier?

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MR ROZEN: Yes. In relation to the second question there, 3 question (b), "If yes to 1, did the coal mine fire 4 5 contribute to the increase in mortality?", the answer that's recorded next to you is as follows: "I do not 6 believe we can answer yes to this question based on any 7 statistical analysis because of the inherent random 8 variation. Only a detailed examination of death 9 certificates could ascertain the number of deaths caused 10 by coal mine fire pollution." Do you accept, Doctor, that 11 12 another way to answering the question is through the 13 application of epidemiological analysis? 14 DR McCLOUD: Such as was conducted by Dr Johnston and Professor Abramson? 15 16 MR ROZEN: Well, and Professor Armstrong. 17 DR McCLOUD: Yes, and Professor Armstrong, sorry. MR ROZEN: I understand that - you are obviously not an 18 19 epidemiologist, that's beyond your area of expertise? DR McCLOUD: Yes. 20 21 MR ROZEN: The answer you give there is, as a pure matter of 22 statistical analysis, you don't accept that the answer is 23 yes? 24 DR McCLOUD: I just believe it's very difficult to accurately 25 estimate the number who have died from coal mine fire 26 pollution. 27 MR ROZEN: Yes. I just want to understand what it is you are 28 saying. The answer recorded next to Professor Armstrong 29 is, "It is likely the coal mine fire contributed to the increase in mortality, but it does not explain the 30 apparent magnitude of the increase." Are you saying 31

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Professor Armstrong is wrong?

2 DR McCLOUD: No, that's Professor Armstrong's opinion, so ... MR ROZEN: And on questions of epidemiology - - -3 DR McCLOUD: Could I say - and I don't want to put words in 4 5 Professor Armstrong's mouth, so perhaps we should listen, but the two points are not dissimilar. Professor 6 Armstrong is saying, "It's likely the coal mine fire 7 8 contributed to the increase in mortality, but it does not explain the apparent magnitude of the increase." So 9 that's alluding to the fact that it is difficult to 10 estimate the exact magnitude of the number of deaths 11 12 caused by coal mine fire pollution. 13 MR ROZEN: Which, fortunately, is not a task the Board has to 14 engage in. But, if I understood the evidence you gave earlier, it was that you don't rule out that the coal mine 15 16 fire may be a cause or a contributing factor to the increase? 17 DR McCLOUD: I don't rule it out, no. 18 19 MR ROZEN: Thank you, Dr McCloud. If I could turn - and I can 20 indicate to the Board that I will be far briefer with the 21 four experts that have already previously given evidence, 22 and I will start with the first of those, and that's Associate Professor Barnett. Associate Professor Barnett, 23 24 if we can just clarify the record. Subsequent to the last 25 occasion on which you gave evidence in relation to term of reference 6 you provided a further report entitled 26 27 "Analysis of daily death data during the Morwell mine 28 fire" to the Inquiry. ASSOCIATE PROFESSOR BARNETT: Yes. 29 30

30 MR ROZEN: For everyone's benefit, that's behind tab 42 of the 31 folder. I wonder if Dr McCloud could pass you the folder.

1 If you could just confirm for us that the document behind 2 tab 42 is that report that was provided to the Inquiry on 11 September? 3 ASSOCIATE PROFESSOR BARNETT: Yes, that's the one. 4 5 MR ROZEN: There's a bit of confusion here, and it is probably my confusion, about the date that was provided. Are you 6 7 able to - - -8 ASSOCIATE PROFESSOR BARNETT: I sent it I believe on 15 September. 9 10 MR ROZEN: I stand corrected. It is exhibit 40B in the materials, I'm sorry, Associate Professor Barnett. So on 11 12 15 September that was provided to the Board. Can 13 I summarise what occurred after that. The report that you 14 provided to us, that is the one behind tab 42, was, to 15 your knowledge, provided to Professor Armstrong for 16 comment? ASSOCIATE PROFESSOR BARNETT: Yes. 17 MR ROZEN: And Professor Armstrong's comments were conveyed to 18 19 you, and you then, in response to the comments made by 20 Professor Armstrong, copies of which have been provided to all of the parties, provided the Board with a further 21 22 version of that report, if I can call it that? ASSOCIATE PROFESSOR BARNETT: Yes. 23 MR ROZEN: We find that behind tab 43? 24 25 ASSOCIATE PROFESSOR BARNETT: Yes. MR ROZEN: Can I just confirm, Associate Professor Barnett, 26 27 that you weren't specifically asked by the Inquiry to 28 perform this further work after the previous hearing 29 concluded? ASSOCIATE PROFESSOR BARNETT: No. 30 MR ROZEN: Having said that, the data that you examined was 31 .DTI:MB/TB 22/10/15

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provided to you by the Inquiry, was it not? 1 2 ASSOCIATE PROFESSOR BARNETT: Yes, on 31 August. MR ROZEN: Yes. The position was you hadn't had the 3 opportunity to conduct that analysis before giving 4 5 evidence on the last occasion? ASSOCIATE PROFESSOR BARNETT: That's right. 6 MR ROZEN: After the report that was - the report dated 7 8 25 September, which I have just taken you to, you were then provided with two additional questions which had been 9 asked of you through the Inquiry by Professor Armstrong? 10 ASSOCIATE PROFESSOR BARNETT: Yes. 11 12 MR ROZEN: And you responded to those in a document dated 13 9 October 2015, which we find behind tab 44? ASSOCIATE PROFESSOR BARNETT: That's correct. 14 15 MR ROZEN: Then just to complete that picture, Associate 16 Professor Barnett, you were sent a further email in which 17 you were asked four additional questions which had been 18 conveyed to the Board by King & Wood Mallesons, the solicitors for GDF Suez? 19 ASSOCIATE PROFESSOR BARNETT: Yes. 20 MR ROZEN: If you could look behind tab 60, please, is that a 21 22 copy of your response dated 7 October 2015 to those four questions? 23 ASSOCIATE PROFESSOR BARNETT: Yes. 24 25 MR ROZEN: Can I tender 42, 43, 44 and 60, please, sir? 26 CHAIRMAN: Yes. 27 #EXHIBIT 42 - Report entitled "Analysis of daily death data 28 during the Morwell mine fire". 29 #EXHIBIT 43 - Report of Associate Professor Barnett. #EXHIBIT 44 - Document dated 09/10/2015. 30 #EXHIBIT 60 - Response by Associate Professor Barnett dated 31 .DTI:MB/TB 22/10/15 759 BY MR ROZEN

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2 MR ROZEN: Associate Professor Barnett, if I could go back to
3 the document dated 25 September that is behind tab 43.
4 ASSOCIATE PROFESSOR BARNETT: Yes.

5 MR ROZEN: Under the heading "Summary" you wrote as follows, and I quote, "This latest analyses gives a 99 per cent 6 7 probability of an increase in deaths during the 45 days of the fire, with an estimated 23 additional deaths. This is 8 larger than the 79 per cent to 89 per cent probability and 9 10 10 to 14 additional deaths from my two previous analysis. This increase in probability and deaths occurred because 11 this analysis used daily data whereas the previous 12 13 analyses used monthly data." If I could just stop there for a moment. Can you just explain to us, please, the 14 differences between the daily and monthly data that you 15 16 refer to there?

17 ASSOCIATE PROFESSOR BARNETT: So monthly data is quite a crude estimate of exposure and there will be some measurement 18 19 error in there. When we move from monthly data to daily data we have a much clearer picture and will reduce 20 measurement error. We know from statistical theory that 21 22 whenever we reduce measurement error if we have a true association between two variables any reduction in 23 24 measurement error will strengthen that association, and that's exactly what happened in this case. 25

26 MR ROZEN: Associate Professor Barnett, you, along with your 27 colleagues in the witness box there, participated in a 28 meeting on 19 October of this year, that is on Tuesday of 29 this week; is that right?

30 ASSOCIATE PROFESSOR BARNETT: That's right. On Monday.

31 MR ROZEN: I'm sorry, Monday. You have had an opportunity to

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look at the report behind tab 57? 1 2 ASSOCIATE PROFESSOR BARNETT: Yes. MR ROZEN: You have conveyed to the Inquiry your agreement with 3 the contents of the document? 4 5 ASSOCIATE PROFESSOR BARNETT: Yes. MR ROZEN: I won't ask you about your answers to the questions 6 because it was your work that was the subject of the 7 8 questions and of course - perhaps not of course, but it records that you, not surprisingly, agree with the 9 analysis that you have conducted? 10 ASSOCIATE PROFESSOR BARNETT: That's right. 11 MR ROZEN: Thanks, Associate Professor. Dr Flander, if I could 12 13 turn to you, please, and note of course that you have previously given evidence to us in this Inquiry, and on 14 15 behalf of the Board I thank you for your continued 16 participation. You were sent a copy of the further work 17 carried out by Associate Professor Barnett that's just 18 been referred to for your comment? 19 DR FLANDER: Yes, I was asked to comment on the September 20 reports. MR ROZEN: Could I ask you, please, to turn to tab 49, I think 21 22 it is - sorry, 48? DR FLANDER: Yes. 23 MR ROZEN: That's a copy of an email dated 13 October 2015 that 24 25 you sent to Ms Stansen, a solicitor to the Inquiry, in response to her request of you to consider the 26 27 25 September 2015 Barnett report? 28 DR FLANDER: Yes. 29 MR ROZEN: The six points you have made there, are they in response to six questions or that is just how you have set 30 out your response? 31

.DTI:MB/TB 22/10/15 761 BY MR ROZEN Hazelwood JOHNSTON/McCLOUD/ARMSTRONG/BARNETT/FLANDER/GORDON 1 DR FLANDER: It is a list of my responses. It is not an answer 2 to questions.

3 MR ROZEN: If we can just go through those briefly. You note 4 at 1 that, "The methods used in the analysis appear to be 5 correct; and 2, the results presented in the analysis 6 appear to be correct, subject to the following 7 reservations about the way the results are presented."

8 Can I summarise what then follows. It's concerns 9 you raise about the various uncertainties associated with 10 the analysis not being as explicitly explained and set out 11 in the document as you think is appropriate?

12 DR FLANDER: Yes, specifically two areas of lack of specificity 13 or uncertainty. One is about the lack of a discussion or 14 specification around the uncertainty around the estimates, 15 to which has been alluded by other experts. That means in 16 cases of small numbers a point estimate will have a large upper and lower bound around it. So that's one of the 17 The other is my own uncertainty reading the 18 issues. 19 document because I don't see an explanation for the 20 discussions around the significance of the temperature results or lack of significance, and also the decision to 21 22 use the calendar year as the reference set rather than the days of the fire as the reference set. So those are two 23 24 kinds of uncertainties.

25 MR ROZEN: If I can tender the email behind tab 48.

26 CHAIRMAN: Yes.

27 #EXHIBIT 48 - Email from Dr Flander to Ms Stansen dated 28 13/10/2015.

29 MR ROZEN: Dr Flander, you also participated in the meeting on 30 Monday of this week. If I can ask you to look, please, at 31 the joint report that emerged from that meeting, and in

.DTI:MB/TB 22/10/15 762 BY MR ROZEN Hazelwood JOHNSTON/McCLOUD/ARMSTRONG/BARNETT/FLANDER/GORDON particular I want to ask you about question No. 4. It is
 behind tab 57, I'm sorry, Doctor.

3 DR FLANDER: Yes, I see it.

MR ROZEN: You will see that question 4 was as follows: "For those who have previously given evidence to the Inquiry, has the additional analysis undertaken by Associate Professor Barnett and any commentary done on that analysis altered your previous opinions? If so, how?" The answer recorded next to your name is, "Not changed my previous opinion"?

11 DR FLANDER: That's correct.

12 MR ROZEN: And that remains your position?

DR FLANDER: Yes. So, specifically, evidence I gave to the Inquiry in September and then with reference to additional analysis, which would be the reports of September of this year; following that, I don't have any other basis to evaluate his work.

18 MR ROZEN: I understand.

19 DR FLANDER: Okay, great. So then in that case I have not 20 changed my previous opinion.

21 MR ROZEN: I would seek to factor into that the discussion that 22 you participated in the meeting earlier this week.

23 DR FLANDER: Yes. That includes the discussion that we had on
24 Monday, yes.

25 MR ROZEN: Thank you. Thanks, Dr Flander. If I could turn to 26 you, Professor Gordon, please, and ask you to look behind 27 tab 49 of the folder?

28 PROFESSOR GORDON: Yes.

29 MR ROZEN: Professor, you were also asked to provide your 30 observations about the work that Associate Professor 31 Barnett did subsequent to the previous hearing? 1 PROFESSOR GORDON: Yes.

2 MR ROZEN: You responded in a document entitled "Commentary on 3 Associate Professor Barnett's recent reports, Hazelwood 4 mine fire, 14 October 2015"?

5 PROFESSOR GORDON: Yes.

6 MR ROZEN: If I can draw your attention, please, to the second 7 page of that document, paragraph 4?

8 PROFESSOR GORDON: Yes.

9 MR ROZEN: You write as follows, and I quote, "Given the timing 10 of the request (yesterday) and of the provision of documents, I have not been in a position to spend much 11 12 time on this commentary and it is therefore necessarily 13 brief. In particular, there are more analyses that I would have preferred to have done in order to inform my 14 15 opinion. However, I have done some analyses, described below." 16

You go on and raise a number of concerns, which we are obviously all able to read and I won't take you through them specifically, but if I could draw your attention to the final paragraph, 23?

21 PROFESSOR GORDON: Yes.

MR ROZEN: You return to this theme of in the limited time available to you, having done the best you are able to to analyse the further material. You conclude by saying, given that and the reservations that you have indicated, your position about the results is therefore not currently changed from the evidence that you have previously given ? PROFESSOR GORDON: Yes.

29 MR ROZEN: Do I read that correctly?

30 PROFESSOR GORDON: Yes.

31 MR ROZEN: Subsequent to this, you were able to participate in

.DTI:MB/TB 22/10/15 764 BY MR ROZEN Hazelwood JOHNSTON/McCLOUD/ARMSTRONG/BARNETT/FLANDER/GORDON 1 the meeting on Monday of this week?

2 PROFESSOR GORDON: Yes.

3 MR ROZEN: As I read the answers you give to the questions that 4 were raised for the meeting, they reflect what you write

5 in paragraph 23 of this document?

6 PROFESSOR GORDON: Essentially, yes.

7 MR ROZEN: Specifically in relation to the fourth question 8 about whether the previous evidence you have provided to 9 the Board has altered, the answer that is recorded next to 10 your name is, "I reach the same conclusion now as when 11 giving evidence to the Inquiry. I have increased 12 confidence in that position as a result of this additional 13 work." That's right, isn't it?

14 PROFESSOR GORDON: Yes.

15 MR ROZEN: Why do you have increased confidence?

16 PROFESSOR GORDON: For two reasons: one, because the analysis that Associate Professor Barnett has done is now based on 17 daily data, and I agree with him that there would be a 18 19 general expectation that that analysis would be more 20 refined than the monthly analysis that was previously done based on aggregates and so on, allowing more targeted 21 22 control of confounders and so on, if you are looking at short-term exposures, and so I'm swayed a little bit by 23 24 that analysis, notwithstanding the desire on my part to 25 understand it better and, if we had more time, to discuss it with Associate Professor Barnett. 26

27 But just as a general proposition I accept that 28 the daily data is likely to be more refined, and therefore 29 I'm influenced by that finding. That's one thing. The 30 second thing, and this really arises out of the conclave, 31 is what we heard from Dr Johnston about the specific

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indications of PM2.5 and its impact on deaths. 1 2 MR ROZEN: Thank you, Professor. Professor Armstrong, you have been sitting patiently waiting for me to ask you a 3 question. Can you still hear me? 4 5 EMERITUS PROFESSOR ARMSTRONG: Yes, I can. MR ROZEN: Thank you, Professor. You have heard the evidence 6 that Associate Professor Barnett gave about his responding 7 to questions and comments that you made about his recent 8 work? 9 EMERITUS PROFESSOR ARMSTRONG: Yes. 10 MR ROZEN: Can you confirm for us that he accurately describes, 11 12 so far as you are aware, what occurred, that is that you 13 were provided with the further work that he had done and you provided comments to the Board, which were in turn 14 15 provided to Associate Professor Barnett? 16 EMERITUS PROFESSOR ARMSTRONG: Yes, I can confirm that. MR ROZEN: For the record, the email communications - and 17 18 I don't need you to look at these, Professor Armstrong, 19 but they are at 40E and 40F of the hearing book, and they 20 will all be tendered as part of a bundle, exhibit 40. Professor Armstrong, can you confirm for us that you also 21 22 participated in the joint meeting on Monday of this week, albeit remotely from Sydney? 23 EMERITUS PROFESSOR ARMSTRONG: Yes, I can confirm that. 24 25 MR ROZEN: In response to the question in the joint report about whether the opinion that you have previously 26 27 conveyed to the Board had changed as a result of these 28 further developments, it records you as saying, "I reach 29 the same conclusion now as when giving evidence to the Inquiry. I have increased confidence in that position as 30 a result of this additional work." That remains the 31

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position, Professor?

2 EMERITUS PROFESSOR ARMSTRONG: Yes, it does.

MR ROZEN: Can you tell us why you have increased confidence in 3 that position as a result of the additional work? 4 5 EMERITUS PROFESSOR ARMSTRONG: Essentially the same reasons as Professor Gordon gave. I believe that there are really 6 7 two very important aspects about the work that Associate Professor Barnett did; that is, the use of the daily data 8 9 and, secondly, the fact that it was precisely circumscribed to the period of the mine fire, whereas all 10 of the preceding analyses had been based on the months 11 that encompassed bits of the mine fire. 12

13 So I think it more precisely targets the exposure and, as Professor Gordon rightly said, it allows, using 14 15 the daily data, more precise control of any confounding 16 that might be present, and I think that the analysis clearly demonstrates a confounding with temperature, not 17 one that many expected, but the one that is actually more 18 19 observable, and that is that there are more deaths on 20 cooler days or colder days, and this does seem to be the reason why the estimate of relative risk increased beyond 21 22 what it had previously been.

Thank you, Professor. They are the questions that 23 MR ROZEN: 24 I have for the experts, if the Board pleases. I think 25 perhaps the most appropriate thing would be for me to firstly tender the joint report as exhibit 57.

27 CHAIRMAN: Yes.

26

28 #EXHIBIT 57 - Joint experts report.

29 MR ROZEN: And for completeness I should tender all of the documents, the remainder of the brief, if I can put it 30 that way, as exhibits under the various numbered tabs. 31

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1 CHAIRMAN: Yes.

2 MR ROZEN: If the Board pleases.

3 CHAIRMAN: Yes, Mr Neal.

4 <CROSS-EXAMINED BY MR NEAL:

5 MR NEAL: Before I start specific questions for those 6 witnesses, could we note for the record that the Atkinson 7 report that my learned friend took Dr Johnston to was apparently conveyed to my instructors some time yesterday 8 afternoon in a general conveyance of documents without any 9 specific reference to it, and as I rise to my feet 10 I haven't read that document and - - -11 CHAIRMAN: Is this the one under tab 61? 12 13 MR NEAL: Yes. So, again, our capacity to put to witnesses issues arising out of that is non-existent. Dr McCloud, 14 15 could I start with you, please. In terms of the latest 16 analyses by Associate Professor Barnett, I want to ask you a number of questions about the data that's been used in 17 18 that, in those documents generally, and in comparison to 19 previous data inputs to his analyses. 20 I think it is common ground, if I can preface my 21 question to you this way, that there's a hypothesis being 22 examined that PM2.5 or 10 emissions may have caused mortality as a result of the fire. 23 24 DR McCLOUD: Yes, I say that's correct. 25 MR NEAL: At the moment to this point what has been used as a population to test that hypothesis has been postcodes? 26 27 DR McCLOUD: That's correct, yes.

28 MR NEAL: Variously four and then six and now back to four?29 DR McCLOUD: Correct, yes.

30 MR ROZEN: Given that what we are endeavouring to do is to test 31 the effect of particulate matter on a population, are

.DTI:MB/TB 22/10/15 768 BY MR NEAL Hazelwood JOHNSTON/McCLOUD/ARMSTRONG/BARNETT/FLANDER/GORDON 1

postcodes the best way of doing that?

2 DR McCLOUD: I think you would want to be able to identify 3 those people who are actually exposed to the pollution 4 from the mine fire, which may not include everybody within 5 a postcode.

I want to take you to two documents that have been 6 MR NEAL: 7 produced by King & Wood Mallesons that bear upon that point. I will just endeavour to find the now exhibit 8 number for those. They are exhibits 55 and 56, for the 9 10 Board. I just want to ensure that the Board gets physical copies of those or has physical copies of those. If I can 11 explain. We are dealing with two similar-looking 12 13 documents. Do you have copies of those in front of you? DR McCLOUD: Yes, I do. 14

MR NEAL: One of them is headed "Hazelwood Mine Fire Inquiry 15 16 CSIRO mine fire air pollution modelling overlaid with postcode areas. Postcode boundaries determined in 17 18 reference to municipal suburb boundaries." The second 19 document in my sequence is similarly headed except that it 20 is in reference to "Australian statistical geography standard". Everyone will note, I think quickly, that what 21 22 we are looking at here is effectively a difference in perhaps the approach of various authorities to what 23 24 constitutes a postcode boundary. But, in any event, you 25 can see quickly that for postcode 3825, the northern-most of the postcodes, on the first and the second document 26 27 they are quite different in extent?

28 DR McCLOUD: They are, yes.

29 MR NEAL: I don't want to take you in any detail to that.
30 That's a function of each of those bodies considering what
31 is constituted by a suburb and what is constituted by a

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postcode. But the point I wanted to draw your attention 1 to is this, that, whatever be the geographic distribution, 2 the first or the second, importantly for our purposes it's 3 4 overlain by a previous document that's been before the 5 Inquiry, which is a CSIRO modelling, and I think it might have been Professor Abramson said the best one we have, 6 which indicates or endeavours to model the distribution of 7 emissions over the course - over territory, if I can put 8 it to you that way, and also makes distinctions in terms 9 10 of gradations of exposure, going from no colour, zero, to a red colouring at 1, and consistently with that one sees 11 the darkest colour around Morwell and one tends to see a 12 13 gradation away from Morwell to the east and to the west. 14 The point of that document is just to draw attention to this: do you accept that, whichever of the 15

16 maps is used, it would appear that for postcode 3825, to 17 start with, a very substantial part is said by this model 18 not to be affected by the fire?

19 DR McCLOUD: That's clear, yes.

20 MR NEAL: And to a significant extent postcode I think 3840 has 21 not an entire coverage either?

22 DR McCLOUD: Sorry, is 3840 the Morwell postcode? Because of 23 course that was most heavily impacted.

24 MR NEAL: I will have to double-check that for you. 3840 is
25 Morwell, and 3825 is Moe.

26 DR McCLOUD: Yes.

27 MR NEAL: Do you also note that, according to the CSIRO 28 modelling, areas to the west of Morwell are in fact not 29 within the postcodes captured by the current study? 30 DR McCLOUD: You have to excuse me. West is to the right or to 31 the left?

.DTI:MB/TB 22/10/15 770 BY MR NEAL Hazelwood JOHNSTON/McCLOUD/ARMSTRONG/BARNETT/FLANDER/GORDON 1 MR NEAL: To the left.

2 DR McCLOUD: Sorry, could you repeat the question? MR NEAL: Yes. That's a capture of postcode boundaries. If 3 you look to the left of Moe in the direction of Trafalgar, 4 5 for example, what one sees is areas affected, perhaps significantly affected, which are not captured within 6 postcode boundaries? In other words, you don't see any 7 line or map around the area of Trafalgar which is a 8 postcode? 9 10 DR McCLOUD: True. So what you are saying there is that the area of Trafalgar is not included in the analysis even 11 12 though it was impacted by the fire? 13 MR NEAL: Yes. DR McCLOUD: Yes. 14 MR NEAL: Could I simply suggest to you that statistically it 15 16 would be a far preferable technique to use the CSIRO 17 modelling of the area affected as the population capture for the study? 18 19 DR McCLOUD: That would be desirable, yes. 20 MR NEAL: The fact that it's done the way it is and appears to 21 include areas that do not lie within that emission map, 22 what do you say the effect of that is? DR McCLOUD: Of course it means that the deaths that have 23 occurred in the areas which have not been impacted by the 24 25 coal mine fire are not occurring because of any pollution from the coal mine, and they would simply add to the 26 27 random noise within the sort of statistical analysis. 28 MR NEAL: Yes. Could I ask you a separate question and seek to 29 clarify. The current Barnett reports use the period 2009 to 2014, all days - not what's been referred to by 30 shorthand as fire days, but all days. In terms of 31

.DTI:MB/TB 22/10/15 771 BY MR NEAL Hazelwood JOHNSTON/McCLOUD/ARMSTRONG/BARNETT/FLANDER/GORDON statistical modelling, do you have a view about the - well, would you compare for me a modelling that depends on all days as opposed to a modelling that depends on what we are calling fire days, and I will define that by 9 February to 25 March?

6 This gets to the point that I had discussed before DR McCLOUD: where often in designing studies there's a tradeoff 7 between sort of homogeneity and heterogeneity in the way 8 we decide to sample. If we do restrict the sampling days, 9 10 then it's obviously more focused to the mine fire period, and so this means that the deaths we are observing have 11 all occurred in the summer time, whereas when you go to 12 13 all days then it is necessary to develop a statistical model that adequately explains the systematic variation 14 15 that's been introduced into the model because of taking 16 all the days of the year, and it's very difficult to tell 17 whether the models adequately do that. We do have some diagnostic techniques to try to explain that, but it is 18 19 very hard to say.

20 MR NEAL: If the capture is of days, and there's a large number 21 of days, in the thousands, is it fair to put it to you 22 this way, that presents a greater challenge for the 23 statistical modelling because you are dealing with, as you 24 say, heterogeneous days as opposed to homogeneous days? 25 DR McCLOUD: That's correct, yes.

26 MR NEAL: As you sit there now, are you persuaded that the 27 challenges that that presents were in fact adequately 28 coped with by the modelling that Associate Professor 29 Barnett used?

30 DR McCLOUD: It is difficult to say, but what I would say here 31 is in the statistical model that's being used apart from

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the parameters of the intercept of the model and the 1 2 postcode parameters that were all significant, of the 19 other parameters only three were statistically 3 significant, which doesn't give me a lot of confidence 4 5 that the models - you could actually leave the 16 non-significant parameters, you can leave them out of the 6 7 model and you do almost as well. So it doesn't give me a lot of confidence that the model is a particularly strong 8 model, let's say. 9

MR NEAL: In terms of that fire period question that we are studying here, could I raise this further proposition with you: if what we are focused on is the effect of emissions, the period of the fire, which we understand to be the ignition point to the fire-out point, is not the same as mapping PM2.5 or 2.10 correlations?

DR McCLOUD: What I have seen of the emissions and the periods of strong emissions was during the month of February, and that through the month of March the levels of PM2.5 were relatively low, not much above background emissions.
MR NEAL: I want you to have a look at a document which is actually an extract of the last report of the Board, page 277. Are you familiar with that document, Doctor?

23 DR McCLOUD: I have seen the graph before, yes.

MR NEAL: Does the Board have that document in front of them, 24 25 other than on the screen? Could I just postulate this for 26 you: if we are looking at particular peaks of particulate 27 matter, if one did a capture - one way of looking at it, a 28 capture - between - approximately 13 February to around about 3 March, that might be a capture of a period where 29 significant exceedances of PM, particulate matter, 2.5 30 31 occurred?

.DTI:MB/TB 22/10/15 773 BY MR NEAL Hazelwood JOHNSTON/McCLOUD/ARMSTRONG/BARNETT/FLANDER/GORDON 1 DR McCLOUD: That's correct, yes.

MR NEAL: In terms of the data for this analysis, may it be a
legitimate approach to have studied that period and use it
plus equivalent periods from previous years as the basis
for your modelling?
DR McCLOUD: I think that's correct, yes.
MR NEAL: In the latest of the reports, the last two what
I will call the formal reports, from Associate Professor

9 Barnett, as we understand it, it's suggested that there 10 has been a spike of deaths above what one would have 11 expected?

12 DR McCLOUD: That's correct, yes.

MR NEAL: As I understand it, Associate Professor Barnett's position is that he has created a model in which seasonal and other variations are coped with and he is able by that model to produce an outcome which shows an extraordinary increase?

18 DR McCLOUD: That's that increase of 23 deaths, yes, estimated.
19 MR NEAL: I'm sorry, I used the term "extraordinary" - that is,
20 not present otherwise. There was something extraordinary
21 happening in that period, forget about the number of

22 deaths that might have been attributed to it?

23 DR McCLOUD: Yes, I would say that's correct.

24 MR NEAL: I would like you to look at the document exhibit 53.
25 DR McCLOUD: Yes.

26 MR NEAL: Do you have a copy of that in front of you?

27 DR McCLOUD: I do, yes.

28 MR NEAL: Does the Board have that in front of it? Yes. Are
29 you again familiar with this document?

30 DR McCLOUD: Yes, I am.

31 MR NEAL: To explain to others, this is a document produced by

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King & Wood Mallesons, and it's a transposition of data 1 2 from the material provided by the Board for the period 2009 to 2014 in relation to what I have been calling the 3 4 fire period? 5 DR McCLOUD: Correct, yes. MR NEAL: Significantly in this document we have the addition 6 of the year 2015? 7 8 DR McCLOUD: Correct. MR NEAL: Looking at the simple figures - I want to go to your 9 10 graphical representation, which is similar to this, I think, in a moment, but we see, for example, if you go 11 down the left-hand side, a four postcode total shown, 12 13 that's the heading, and on the right-hand side for 2014 you see the figure 83? 14 DR McCLOUD: Correct. 15 16 MR NEAL: And for 2015 you see the figure 77? DR McCLOUD: Correct. 17 MR NEAL: Similarly, if you add to that graph two other 18 19 postcodes which were originally part of Associate 20 Professor Barnett's study, you have equivalent figures 83 and 81? 21 22 DR McCLOUD: Yes, that's correct, yes. MR NEAL: If you add in two other postcodes which we understand 23 24 were part of the request from the Board to Births, Deaths and Marriages, you have the equivalent figures 2014 and 25 '15, 86 and 81? 26 27 DR McCLOUD: Correct. MR NEAL: Just staying with that for the moment, what do you 28 29 say statistically is the significance of the 2014 total figure for the four postcodes? 30 DR McCLOUD: I think the 2014 and 2015 figures demonstrate that 31

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there's nothing unusual about the number of deaths that we 1 2 are seeing in 2014, that the 2015 figures are almost coincident, and therefore the suggestion is that there's 3 nothing striking about 2014. 4 5 MR NEAL: In relation to 2015, I think the working premise is we are not talking about a fire, a mine fire period? 6 DR McCLOUD: Correct. 7 MR NEAL: Does that allow you to say something further about 8 the hypothesis that 2014 has mine fire related increase of 9 10 deaths? DR McCLOUD: It just adds to the discussion we have had earlier 11 that the increase that we have seen in 2014 is within the 12 13 bounds of the natural variation of this process, and the 2015 figures really support that, given that they are very 14 similar to the 2014 figures. 15 16 MR NEAL: You have produced your own what I call graphical 17 representation which is very similar to this raw data, have you not? 18 19 DR McCLOUD: Yes, that's correct. 20 MR NEAL: Could you have that document in front of you as well, 21 please? 22 DR McCLOUD: Yes. MR NEAL: Mr Rozen took you to this document, but if I could 23 24 just briefly ask you to explain what it captures. Firstly, is it correct that it's only capturing what I'm 25 26 calling the mine fire period? 27 DR McCLOUD: That's correct, yes. 28 MR NEAL: And, clearly enough, it is dealing with the years 29 2009 to 2015 for the mine fire periods only? DR McCLOUD: Correct. 30 MR NEAL: So, year on year, we are getting 9 February to 31

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25 March comparisons? 1 2 DR McCLOUD: That's correct. MR NEAL: Clearly enough, on the other axis the number of 3 deaths is absolute numbers of deaths? 4 5 DR McCLOUD: Yes. MR NEAL: In the middle of the document you have a horizontal 6 bold line and at the right-hand side we see "mean equals 7 8 69.4"? 9 DR McCLOUD: So that is equal to the mean of the seven numbers? 10 MR NEAL: Yes, for those seven year periods. DR McCLOUD: Yes, that's correct. 11 MR NEAL: Going across to the left-hand side and working left 12 13 to right, we have a series of vertical lines and each of those vertical lines has like a bullet point on it? 14 15 DR McCLOUD: Correct. So the bullet point is equal to the 16 number of deaths for that year during the mine fire 17 period, and the vertical line is roughly plus or minus 17, 18 around each of the bullet points and I think, as 19 I'd explained before, this is a 95 per cent confidence 20 interval for the number of deaths during the mine fire period for each of those years. 21 22 MR NEAL: I think you explained before a formula by which you are able to construct the upper and lower part of the 23 vertical line? 24 25 DR McCLOUD: Yes, that's correct. Would you like me to do it 26 again or? 27 MR NEAL: Perhaps quickly. 28 DR McCLOUD: So here if we assume that the number of deaths follow the Poisson distribution, which is also consistent 29 with Associate Professor Barnett's analysis, here the mean 30 is 69.4, and for the Poisson distribution that is also 31

1 equal to the variance. So we can measure the natural 2 variation by taking the standard deviation, which is the square root of the variance, which is around 8.5, and then 3 multiply that by two to give us a rough 95 per cent 4 5 confidence interval, which is two times 8.5, so plus or minus 17 deaths per year. 6 MR NEAL: I take it that that's standard statistical 7 8 theorising, what you have just done? 9 DR McCLOUD: Yes. MR NEAL: If we apply that to 2014 and we look at the vertical 10 line there, the solid bullet point, as I'm calling it, 11 12 represents the number of deaths actually recorded? 13 DR McCLOUD: Eighty-three in that year, yes. MR NEAL: And above and below that, I think you described 14 before, would be a figure of 17? 15 16 DR McCLOUD: Yes. MR NEAL: Which is the measurement of the standard deviation; 17 is that correct? 18 19 DR McCLOUD: Or 95 per cent confidence interval. 20 MR NEAL: Okay. Looking at that graph can I draw your 21 attention to the years 2014 and '15? 22 DR McCLOUD: Yes. MR NEAL: And note that if we are looking at the vertical lines 23 24 there is a very substantial amount of overlap between 25 those two? DR McCLOUD: That's correct. 26 27 MR NEAL: What is the significance of that? 28 DR McCLOUD: It is really indicating that the two points are 29 very similar and that, given the natural variation of this process, there's no evidence for a difference between the 30 figures that we see in 2014 and 2015. 31

MR NEAL: If I can summarise that, on this graphical representation and the raw data table that we were referring to, do you say that they are both consistent with your natural variation theory in explaining actual death figures?

6 DR McCLOUD: I do, yes.

7 MR NEAL: In conventional statistical practice, if you were 8 explaining something by natural variation, as you have, 9 and a contradictor of that said, "It's not that; that's 10 not a good explanation," what would one normally do in 11 order to advance the debate?

DR McCLOUD: Often we find that to say to people that random variation perhaps explains the difference, it's not a very satisfactory explanation. We do like to believe there's a reason for it. But random variation is a part of every physical, medical study that we might do. But we do have ways of measuring that.

18 So here with this particular process, as I have 19 described, we take the square root of the mean to get a 20 standard deviation, and then multiply that by 2 to get a feel for the natural variation of this process, which we 21 22 have said is plus or minus 17 deaths, and we need to factor that into all of our thinking about looking at this 23 process, "Did something exceptional happen in 2014?" So 24 25 it is a difficult thing to often have people accept that random variation is a big contributor to what we are 26 27 looking at.

28 MR NEAL: In my hypothetical contradictor of your theory would 29 the production and examination of actual medical data for 30 that same deaths statistic advance the debate? 31 DR McCLOUD: Yes, absolutely.

.DTI:MB/TB 22/10/15 779 BY MR NEAL Hazelwood JOHNSTON/McCLOUD/ARMSTRONG/BARNETT/FLANDER/GORDON 1 MR NEAL: Because?

2 It's the only way to remove random variation from DR McCLOUD: the equation. So as we look at these figures there's 3 always random variation around the number of deaths that 4 5 we are seeing each year, and the only way to eliminate that is to go to actual death certificates. If some are 6 7 identified by a medical reviewer that mine fire pollution may have contributed to the death, then there could be a 8 9 discussion with the medical people who treated the person 10 on the day of their death or in the days leading up to their death, further discussion with family members about 11 12 whether the person was indeed exposed to mine fire 13 pollution, when did symptoms set in after that exposure, amongst other factors. 14

MR NEAL: Included in that analysis I'm assuming would be a cause of death which was plausibly related to the fire which in the context of our discussions in this Inquiry seem to be respiratory and cardiac deaths.

19 DR McCLOUD: Yes, that's correct.

20 MR NEAL: In the context of the questions that this Inquiry has 21 to respond to, can I ask you this. In the circumstances 22 that we are just describing where you would say 2014, the 23 fire period, does not display anything exceptional and so 24 I'm taking it you are saying the premise for saying what 25 caused that just doesn't exist because it's not 26 exceptional - - -

27 DR McCLOUD: I guess you to need to be careful about that. It 28 could be that random variation meant that it was a bit 29 lower than 83 and another cause took it up and raised the 30 number of deaths. So you do need to be careful there, 31 I think. But, while we are dealing with a situation where

.DTI:MB/TB 22/10/15 780 BY MR NEAL Hazelwood JOHNSTON/McCLOUD/ARMSTRONG/BARNETT/FLANDER/GORDON 1 2014 is not looking like an outlier, it's not a 2 statistical outlier based on the chart we have here, then 3 you need to factor into your thinking the consideration of 4 the amount of contribution that random variation could 5 make to this total figure. So 2014 as a figure is not an 6 outlier, if you like, statistically.

MR NEAL: Given that there may be this tension between the idea 7 that Associate Professor Barnett's modelling demonstrates 8 an increase related to the fire of some magnitude and the 9 10 body of opinion that you are expressing, which is it's consistent with random variation, what would you say as a 11 12 conventional statistical approach to the idea of 13 proceeding on Associate Professor Barnett's analyses and not taking account of the 2015 data? 14

15 DR McCLOUD: I think if the 2015 data were available then it 16 should be considered.

MR NEAL: Can I put it to you that if you accept, as you seem to, that the 2015 data contradicts or contests the model theory, can I put it to you that it is simply untenable not to take account of the 2015 data?

21 DR McCLOUD: Again, as I said, if the data was available then 22 it should be considered, yes, and should be included in 23 the analysis.

MR NEAL: If you met that situation that I have just posited to you in practice where perhaps you propose a modelled estimate, but empirical data is available, and you presented your modelled estimate to your client and said, "This is what we think," what would be the reaction you would expect?

30 DR McCLOUD: I think they might ask you to redo it again and 31 add the additional data. 1 MR NEAL: Could I ask you to go to your report, please.

2 DR McCLOUD: Sorry, the number, please?

MR NEAL: 50. In your various reports you raise a number of 3 4 reservations about process or modelling process, including the modelling of - I'm sorry, you make the point in point 5 2 that one expects in this context of dose-response 6 relationship, and previously the Inquiry has been 7 endeavouring to understand why it was that in Morwell on 8 previous Associate Professor Barnett analyses there was a 9 10 deficit rather than an increase.

11 DR McCLOUD: Correct.

12 MR NEAL: In the current document there's an increase, so we 13 don't need to worry about explaining why there was a deficit anymore, an increase of close to six. In terms of 14 the model that was used, do you understand how I think the 15 16 December 2014 report from Associate Professor Barnett had a deficit for Morwell and the current document shows 17 almost six extra deaths? How does that come about? 18 19 DR McCLOUD: I think it's probably a question that we need to 20 delve further into, but one explanation may be that in the previous analyses it had focused on the mine fire period, 21 22 and so the control group had been the mine fire period from 2009 to 2013, where in the current analysis the 23 24 control period now includes all the mine fire periods from the earlier years. So those 45 days of the mine fire 25 26 period are a minority of the rest of the days. So what's 27 possible here is that the estimate that's coming from 28 using all of the days - so not focusing on the coal mine period - is now lower for all postcodes, whereas before 29 that wasn't true for Morwell. 30

31 MR NEAL: Can I put that back to you in this way. If you

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expand the comparison for the Morwell area from the mine 1 2 fire period to every day from 2009 to 2014, my words, you tend to dilute the particular qualities of the mine fire 3 period in 2014? 4 5 DR McCLOUD: That's going to be true because they are just absorbed into this very large control group now with over 6 7 2,000 days, yes. 8 MR NEAL: So it's correct, and I think you and Professor 9 Armstrong draw attention to the fact, that in the current 10 modelling we don't have a differentiation anymore between postcodes as we previously did; we rather have a common 11 relative risk, that is the model depends upon attributing 12 13 the same risk of death to each postcode? DR McCLOUD: That's correct. That's the way the modelling has 14 15 been done, yes. 16 MR NEAL: Do you understand why that was done? 17 DR McCLOUD: Associate Professor Barnett explained in the 18 earlier analysis there wasn't a lot of difference between 19 the postcodes, and so on this occasion they were kept 20 together. There wasn't a lot of difference as a function of 21 MR NEAL: 22 taking your data being all the days? DR McCLOUD: That's true in this case as well, yes. 23 24 MR NEAL: Could I just draw your attention to a couple of 25 points from your 14 October report. In the interests of time can I try and summarise some of it. I take you to be 26 27 saying that, although Associate Professor Barnett suggests 28 that his simple modelling of figures is not to be 29 preferred to his more sophisticated modelling, you are saying, "Well, that really depends on the quality of your 30

31 more sophisticated modelling."

.DTI:MB/TB 22/10/15 783 BY MR NEAL Hazelwood JOHNSTON/McCLOUD/ARMSTRONG/BARNETT/FLANDER/GORDON 1 DR McCLOUD: It does, yes.

2 MR NEAL: You have already made the point that you think a 3 number of the parameters in the model have no function; 4 you could take them out and have almost no effect on the 5 model.

6 DR McCLOUD: It would be something to investigate and look at. 7 But, again, if you have a parameter in the model that's 8 not statistically significant, then often good practice is 9 to remove it and that may help to actually sharpen up the 10 confidence interval or credible interval for the 11 parameter.

MR NEAL: Point 6 of your document of 14 October, the last line there, "The credible interval is relatively wide. So considerable uncertainty remains about the point estimate or the risk ratio." Can you reduce that to some layman's terms for us, please?

DR McCLOUD: For the credible interval for the number of 17 observed deaths over and above the expected under the 18 19 model the middle range was 23 deaths, so this is the 20 figure that we have often referred to, and the credible 21 interval goes from two to 46; so all the way from almost 22 zero to 46 deaths during the mine fire period, and this is just a wide interval which means there's still 23 considerable doubt about the estimate. 24

25 MR NEAL: Can I just move you on to the experts' conference 26 that you participated in and ask you this. Firstly, were 27 all your fellow conferees familiar with the contents of 28 your two reports?

29 DR McCLOUD: I would have to say I'm not sure.

30 MR NEAL: Was it apparent to you in your discussions that all 31 your fellow conferees were familiar with the 2015 births,

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deaths and marriage data?

2 DR McCLOUD: There was a discussion around various ways of obtaining the data. So not all sources were the same. 3 But, yes, I think they were familiar with it, yes. 4 5 MR NEAL: Was there in your view substantial discussion of the statistical significance of the 2015 data addition 6 compared with the position that had been before Associate 7 Professor Barnett which didn't include that? 8 9 DR McCLOUD: We did have some discussion, but it wasn't 10 substantial. But there was some discussion, yes. MR NEAL: Did you say there was some but it was not 11 substantial? 12 13 DR McCLOUD: It didn't go on for a long time, no. MR NEAL: In terms of the answers that you gave, I'm just going 14 15 to ask you to clarify one or two things for me. In 16 question 1 the question was, "Do you agree with Associate Professor Barnett's conclusions that: there is a 17 99 per cent probability of an increase in deaths during 18 19 the 45 days of the fire?" Your answer was, "Agree there was an increase in the observed number of deaths". Can 20 I just stop you there. What are you referring to when you 21 22 say "observed number of deaths"? DR McCLOUD: Again, if we just go back to the figure, the 23 observed number of deaths was 83. You can calculate the 24 25 mean in a number of ways. We have done it simply in the diagram where the mean is 70. So there is an increase of 26 27 13 deaths above the mean. 28 MR NEAL: So your answer to this question is in fact drawing on 29 the empirical data; it's not confining itself to Associate Professor Barnett's report? 30

31 DR McCLOUD: That's correct, yes.

.DTI:MB/TB 22/10/15 785 BY MR NEAL Hazelwood JOHNSTON/McCLOUD/ARMSTRONG/BARNETT/FLANDER/GORDON MR NEAL: In answer to question 1b your answer - the question is, "Do you agree with Associate Professor Barnett's conclusions that" - there was effectively an estimated 23 additional deaths. Your answer, "Not agreed. Work of Abramson and Johnston relevant. Zero - two deaths in line with these models would be more reasonable." Can you explain how you come to those figures?

8 DR McCLOUD: In the Johnston work that's been shown here today 9 the worst case scenario gave an increase of 3.6 per cent. If we have a mean number of deaths of 70 for the fire mine 10 period, then that's roughly three to four deaths. But, as 11 12 I said, that's a worst case scenario. It's an upper 13 bound. From the meta-analysis that was published by Atkinson the best estimate was a 1.04 per cent increase in 14 the mean number of deaths, which for a mean of 70 would 15 16 give you not even one whole death, I guess. So 1 per cent 17 of 70, about 0.7. So I think it's reasonable to say sort of zero to two deaths, and based on the meta-analyses not 18 19 more than that.

20 MR NEAL: Taking you to question 2, which is, "Do you agree with the methodology used by Associate Professor Barnett 21 22 to reach those conclusions", you say "Agreed." Can you explain to me what you are agreeing to there? 23 24 DR McCLOUD: It is really just agreeing that the sort of 25 Bayesian approach adopted by Associate Professor Barnett is reasonable. The assumption of a Poisson distribution 26 27 is reasonable. So these sort of high level statistical 28 aspects of the methodology were reasonable. 29 MR NEAL: It's not to say you generally agree with the analysis? 30

31 DR McCLOUD: So then you get down to the detail of the model

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- and again, as I said, we don't have many parameters that are significant from a statistical perspective. So there are concerns around that.
- 4 MR NEAL: Thank you. Those are the questions I have for
 5 Dr McCloud for the moment.

6 Professor Armstrong, can we see you again, 7 please? Apparently you may not have your camera on, I'm 8 told, Professor.

9 EMERITUS PROFESSOR ARMSTRONG: I have my camera on. I have my 10 microphone on. The only thing I'm unable to do at this 11 point is turn them off. The camera is working because 12 it's showing an image on my screen here. Why it is 13 getting through to you, I don't understand.

MR NEAL: Unfortunately you are just a document to us, but I'm sure you are much more than that.

16 EMERITUS PROFESSOR ARMSTRONG: Just a collection of them.

17 CHAIRMAN: Can we just proceed on the basis that we can hear

Professor Armstrong quite well. We will see how we copewith other potential problems.

20 MR NEAL: Professor, I have been referring in my questions to 21 Dr McCloud to a number of exhibits, some of which are the 22 CSIRO modelling, some graphs of raw data et cetera. Do

23 you have those at hand?

EMERITUS PROFESSOR ARMSTRONG: I don't have them at hand, but I saw them on the screen when they were being referred to earlier.

27 MR NEAL: If they are back on the screen whilst we are talking, 28 that's sufficient for you?

29 EMERITUS PROFESSOR ARMSTRONG: Yes, it is.

30 MR NEAL: Can I ask you this. At Monday's experts' conference 31 had you personally given time to a study of the 2015 data

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we have been referring to?

2 EMERITUS PROFESSOR ARMSTRONG: No.

3 MR NEAL: Had you had the opportunity to digest Dr McCloud's

4 two reports?

5 EMERITUS PROFESSOR ARMSTRONG: Yes.

6 MR NEAL: In terms of 2015 data can you say when you first 7 received that data?

8 EMERITUS PROFESSOR ARMSTRONG: I think the first time I became 9 aware of the numbers, total number of deaths during the 10 period et cetera, was in fact - it may be today. I don't 11 remember it coming up on Monday. But, if it came up on 12 Monday, it didn't make an impression on me. But obviously 13 quite an issue has been made of it today. So I'm now very 14 well aware of it.

MR NEAL: I want to come back to that point. If I may, can 15 16 I just repeat a couple of the propositions that I was putting to Dr McCloud. Given that you have been listening 17 18 to that evidence and the pressure of time, I will try and 19 do that a bit more cryptically. In terms of the modelling 20 and the data that was used for the modelling you heard me put to Dr McCloud that a population capture which 21 22 coincided with the CSIRO mapping may have been a better way to have modelled this situation. 23

EMERITUS PROFESSOR ARMSTRONG: In an ideal world that is 24 25 exactly right. If that had been feasible or even if it is feasible now it would be a preferable way of doing it 26 27 because then, not only can you allocate people likely to 28 have been significantly exposed or not likely to have been 29 significantly exposed, you can get some quantification on individual exposure based on the individual location of 30 people during the time. The CSIRO model, obviously that's 31

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just a model too. So it has its uncertainties. But it's 1 2 almost certainly a better representation of population exposure than simply an aggregation of postcodes. 3 MR NEAL: In terms of the period, the data period that's been 4 5 used, in previous reports of yourself and others there have been a variety of techniques used, one of which was 6 7 months February to March and sometimes February to June, and currently what we are doing is using daily figures. 8 9 I wanted to be clear with you, because I wasn't when you answered Mr Rozen. We are at one, are we not, Professor, 10 that the current Barnett model depends on an all days 11 analysis 2009 to 2014? 12 EMERITUS PROFESSOR ARMSTRONG: That is as I understand it; 13 14 correct. MR NEAL: Again can I put to you what I put to Dr McCloud, 15 16 which is that, given the difficulties of modelling heterogeneous periods, a preferable approach may have been 17 in this case to have used what we will call the fire 18

19 period for 2014 and model it against the equivalent

20 periods 2009 to 2013 and now 2015?

EMERITUS PROFESSOR ARMSTRONG: Let me say I don't agree with 21 22 the proposition that one should now add 2015. But I think if I had been doing that modelling - and it's not 23 something I personally do, but if I had been asking a 24 25 biostatistician to do it for me I would have suggested that the same periods of time, the same 45 days in the 26 27 preceding years had been used for comparison, recognising 28 of course that that could limit the statistical power of 29 the analysis. The extension to all days of the year would add statistical power, but adds the possibility of 30 confounding by other factors. It's under those 31

.DTI:MB/TB 22/10/15 789 BY MR NEAL Hazelwood JOHNSTON/McCLOUD/ARMSTRONG/BARNETT/FLANDER/GORDON circumstances that it would be quite proper to bring into consideration the other variables that Associate Professor Barnett used. I don't agree with Dr McCloud's proposition that because they didn't do anything that they should have been left out.

MR NEAL: Is if fair to summarise the views there that a 6 broader capture of days may add, as you put it, power to 7 the analysis but it also introduces challenges to the 8 modelling because of what Dr McCloud explained, the 9 10 comparison of heterogeneous periods effectively? 11 EMERITUS PROFESSOR ARMSTRONG: Yes, and as I say that challenge was dealt with by adding those additional variables which 12 13 were both available and proper, but you could still posit that there was some other variable that wasn't there that 14 might have been confounded. 15

16 MR NEAL: Professor, you are just fading out a bit on your 17 audio for us.

18 EMERITUS PROFESSOR ARMSTRONG: I'm sorry; I will lift the

19 little microphone up closer to my mouth in the hope that 20 that will help. Is that better?

21 MR NEAL: Thank you. Given that the underlying hypothesis we 22 are looking at here is the question of whether particulate matter emissions from the fire could be causally related 23 to deaths in the area studied, would you agree that a 24 25 model which looked at exceedances of the PM2.5 or PM10 26 measures would perhaps be better modelling again? 27 EMERITUS PROFESSOR ARMSTRONG: In that context you are 28 referring to something like the CSIRO work. If that's the 29 case, the answer is yes.

30 MR NEAL: I'm referring to the page from the last report - - -31 EMERITUS PROFESSOR ARMSTRONG: Okay, sorry. Let me say in

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1 principle yes. But we do have uncertainties in that early 2 period, particularly because some of the early days were not properly captured. It's a relatively short period, 3 4 which means that the numbers available for the modelling 5 start to become very small. So we might improve focus on the exposure, but we could lose quite a lot in statistical 6 7 power because of the reduction in numbers. I think it's the kind of thing that you might do in addition, but 8 9 I don't think I would do it exclusively and then try and 10 interpret all the information as it came together. In terms of drawing analogies between this mine fire 11 MR NEAL: 12 and other studies of particulate matter emissions, the 13 matter I think that Mr Rozen was taking Dr Johnston to, would it be fair to say that if you were studying what 14 15 I have called a somewhat contracted period, the notable 16 peaks of PM2.5 or 10, if you were limiting yourself to 17 those then you could say that what you were doing was in fact a study of a relatively short-term nature, that is a 18 19 short period? EMERITUS PROFESSOR ARMSTRONG: It would be a short-term study, 20 21 yes. 22 MR NEAL: By that I mean validly analogous with those which Dr Johnston's been relying on. 23 EMERITUS PROFESSOR ARMSTRONG: I don't think that that's what 24 25 Dr Johnston meant when she referred to short periods. What she was referring to, as I understand it, was how 26 27 long you expected to see when the deaths might occur in 28 relation to the exposure. We do have exposure during 29 later periods, so you still have the same possibility; it's just that the exposure is less. So I don't think 30

31 that by contracting the period in which the observations

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 is the same as what Dr Johnston was saying. But perhaps
 she should answer that herself.

4 MR NEAL: If I could take you to the evidence that Dr McCloud 5 was giving based on the table and his own graph. You 6 recall that conversation?

7 EMERITUS PROFESSOR ARMSTRONG: Yes, I do.

MR NEAL: Obviously what he says graphically that his document 8 9 entitles him to say is that the figures for 2014 are 10 consistent with random variation and, if you like, the idea that you are trying to explain an unexpected increase 11 12 goes away because it's not there to be seen. Firstly, let 13 me ask you this, accepting that that's his position: can I put it to you that that's a plausible explanation of the 14 15 figures?

EMERITUS PROFESSOR ARMSTRONG: It has always been a plausible 16 17 explanation of the figures that chance, that is random variation, explains the observation. The way this has 18 19 been approached to date was to say, "There was a year in 20 which there was a mine fire or a period during which there 21 was a mine fire. Let us compare what happened during that 22 end period with similar periods preceding that," going back in a reasonable period of time, and five years was 23 24 the most common one chosen. One formulates a hypothesis 25 which one tests that mortality was greater during the 2014 than it was in the period 2009 to 2013. It is very common 26 27 in statistics that one does it that way and one calculates 28 a parameter, in this case relative risk, the 95 per cent 29 confidence interval and computes a P-value and uses that information to decide how likely it is that the excess 30 observed in 2014 was unusual relative to what was observed 31

.DTI:MB/TB 22/10/15 792 BY MR NEAL Hazelwood JOHNSTON/McCLOUD/ARMSTRONG/BARNETT/FLANDER/GORDON 1 in 2009 to 2013.

31

2 As soon as you chop that up of course you will see more variation, although in practice, as you can 3 readily see from Dr McCloud's chart, 2010, 2011, 2012, 4 5 2013 were consistently appreciably lower. The fact that the 95 per cent confidence interval will overlap is not at 6 all surprising because the smaller the number of 7 observations that you put in there the wider the 8 confidence interval. So I don't think there's any 9 10 inconsistency between what Dr McCloud has presented and what we have been saying all along. There's a big 11 difference in the interpretation, and the interpretation 12 13 that I put on this and I still subscribe to is that it is reasonably likely that there was an excess in 2014, but we 14 15 can't be sure of it.

16 MR NEAL: Can I put this to you: where there is a contesting 17 body of opinion, being your preferred view and that of Dr McCloud, is it not a valid approach to then say, "Well, 18 19 let's look at the actual medical data for the period 20 because that may advance one or other of the theories"? EMERITUS PROFESSOR ARMSTRONG: That would be true if you had a 21 22 very precise relationship between a particular exposure and a particular cause of death. Then it becomes very 23 24 easy. In this situation what we have is an exposure which 25 affects a range of conditions, mainly respiratory and cardiac, which are very common in the absence of that 26 27 exposure. So they are occurring all the time. It would 28 be extremely hard to draw any sensible conclusions from an examination of the causes of death other than those that 29 have already been drawn and are covered in my report. 30

What we do observe is that the biggest increase

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in deaths within some specific categories - respiratory, 1 2 cardiovascular - was in cardiovascular causes of death. That fits very comfortably with what is observed in the 3 studies of PM2.5 exposure, the ones meta-analysed in 4 5 Atkinson et al et cetera. So that's about as close as you can get to it. That's already been done. Going down and 6 7 looking at individual death certificates will not be the slightest bit more informative. 8

9 MR NEAL: Does that depend on the information that you have to 10 hand?

EMERITUS PROFESSOR ARMSTRONG: No, it doesn't. It depends on the lack of specificity with respect to cause that cardiovascular disease has.

MR NEAL: You heard Dr McCloud I think say that the sort of examination that might be appropriate is to get specific case study analysis of the deaths in the relevant

17 contested period, if you like.

18 EMERITUS PROFESSOR ARMSTRONG: Exactly the same problem that 19 I have just described; that you won't find anything there 20 that allows you to specifically say, "This one was linked 21 to the exposure. This one wasn't", and so on.

22 MR NEAL: But it may advance our sense of the probability of

23 one or other scenario.

24 EMERITUS PROFESSOR ARMSTRONG: Not in my opinion.

MR NEAL: Looking at the 2015 data that I think you are saying you are only perhaps superficially familiar with, can I put it to you just as a matter of general principle that where we are studying a period of 2009 to 2014 without even knowing what the data is that the period of 2015 gives a useful statistical perspective to the analysis.
EMERITUS PROFESSOR ARMSTRONG: Let me say when you are looking

.DTI:MB/TB 22/10/15 794 BY MR NEAL Hazelwood JOHNSTON/McCLOUD/ARMSTRONG/BARNETT/FLANDER/GORDON 1 at this from a purely descriptive point of view then 2 I would agree absolutely that each additional year will 3 add information. Where, though, you have a specific 4 hypothesis, as in this particular case, it is not going to 5 be so informative. To my mind, the fact that 2015 is also 6 elevated does not affect the way I look at 2014 in 7 comparison with the preceding five years.

8 Having said that, having looked at it, it does 9 raise a question, "Well, is it possible that there are some delayed affects of the mine fire, and we are still 10 seeing them in 2015?" There has been some recent 11 literature around that in a rather different context, in 12 13 an air pollution context, suggesting that there can be for intense periods of exposure effects that last for a 14 15 significant period of time later.

16 So I don't think in this case really that 2015 advances any argument. It's an interesting observation. 17 It will be interesting to see what happens in the future. 18 19 But, to my mind, it doesn't add anything and hasn't 20 changed my opinion in terms of the probability that there was an increase in deaths in the period of 2014. 21 22 MR NEAL: Accepting what you have just said involves the idea that there might be a lingering effect, it's clear, is it 23 not, that that's directly contradicted by what Dr Johnston 24 25 has to say?

26 EMERITUS PROFESSOR ARMSTRONG: Well, I think you should ask 27 Dr Johnston that question. I'm referring to another 28 experience that has been seen as contrary to conventional 29 wisdom, but you can demonstrate not only short-term 30 effects of particle exposure, you can demonstrate 31 long-term effects.

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MR NEAL: Can I put it to you this way perhaps, Professor 1 2 Armstrong. Where the Board has to proceed to make a very serious finding in relation to deaths and attributing it 3 to a specific cause, the 2015 data and what Dr McCloud has 4 5 told us about how it should be understood, which is natural variation, really requires that theory of natural 6 7 variation to be disproved before it's safe to rely on the 8 current non-2015 modelling.

9 EMERITUS PROFESSOR ARMSTRONG: I think I have expressed my view 10 on this matter as clearly as I can. I think your comment 11 is more for the Board than for me as a scientist for them 12 to take into consideration.

MR NEAL: In relation to the experts' conclave that you attended, is it fair, as I read it, that there was a fairly general level of dissatisfaction with the transparency and the accessibility of Professor Barnett's

17 reports?

EMERITUS PROFESSOR ARMSTRONG: I think I would prefer not to speak for others, but certainly I found, yes, the lack of clarity and, to my mind, incompleteness of description of exactly what was done to be somewhat frustrating to my full understanding of the work.

23 MR NEAL: Do you understand why that occurred?

EMERITUS PROFESSOR ARMSTRONG: I don't. Anything that I were to suggest would be speculation. I don't wish to speculate.

- 27 MR NEAL: It is not a lack of expertise on the part of 28 Associate Professor Barnett?
- 29 EMERITUS PROFESSOR ARMSTRONG: No, I certainly don't believe 30 it's due to a lack of expertise.

31 MR NEAL: Thank you, Professor.

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CHAIRMAN: How much longer do you expect to be? I'm only 1 2 asking that. There's the advantage that we have two skype links that have managed to be sustained. We have time 3 limits coming up as to one witness. We have, I think, 4 5 some people perhaps in need of a comfort break. But I'm trying to balance all these things up and work out what 6 7 the best course is. My mental state was I will wait until 8 you finish your cross-examination, then call for a comfort 9 break, then leave it to the other cross-examiners. But 10 I'm in your hands to some extent.

MR NEAL: I can only answer it this way, sir. I would think to accelerate, but I note that there are four witnesses yet to go.

14 CHAIRMAN: There are four witnesses, but you are asking the 15 questions. You will have a better idea as to whether you 16 are likely to take half an hour, in which case I would ask 17 you to keep going, or significantly longer, in which case 18 other people may have to make some other arrangement if we 19 take a break now.

20 MR NEAL: I doubt I would confine myself to half an hour.
21 CHAIRMAN: It is perhaps totally inappropriate to ask witnesses
22 to give me an indication whether they would prefer to keep
23 going or take a comfort break. What do you think?
24 ASSOCIATE PROFESSOR BARNETT: I'm not bothered. Happy to keep

25 going.

26 CHAIRMAN: Keep going. Okay. Anyone who feels minded to take 27 a comfort break can do so at any time.

28 MR NEAL: Dr Flander, I want to come to you next, if I may.
29 Can I perhaps take up that last point about transparency
30 and accessibility, which is one that you gave voice to
31 I think in responding to Associate Professor Barnett.

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Again, in the interests of time, I will try and, as 1 2 lawyers say, verbal you and see whether you agree with me or not. Is it fair to say that there was an unhappy level 3 of opaqueness about the reports from your point of view? 4 5 DR FLANDER: I would not use the words "happy" or "unhappy". I have had the privilege of reading several of Associate 6 7 Professor Barnett's reports over the course of the year and I learned a lot. One of the things I learned is that, 8 albeit his statistical expertise is well in advance of 9 10 mine, there was a lot of similarity in our approaches

11 including the assumption of a Poisson distribution, that's 12 the shape of the distribution of the mortality data.

But my initial reservations, which are in my public record submissions to this Board and also the most recent report, are that it is hard for me to follow the reasoning, that the assumptions are not well described, but most importantly that the issue around explaining the uncertainty around the estimates is what is missing for full transparency.

I speak as an epidemiologist with an interest and some publications in the area of expert judgment under uncertainty and the importance of producing open documents that are fully described and with a good description about the sources of uncertainty.

25 MR NEAL: In particular do you address that remark to the 26 figure of 99 per cent that was used in Associate Professor 27 Barnett's report?

28 DR FLANDER: Yes, I think I said as much in my emails 29 submission.

30 MR NEAL: Could I ask you about some of the data questions that 31 I was asking some of the other witnesses. You look like

.DTI:MB/TB 22/10/15 798 BY MR NEAL Hazelwood JOHNSTON/McCLOUD/ARMSTRONG/BARNETT/FLANDER/GORDON you are keen to answer in the way that you - - DR FLANDER: No, I can answer to the best of my ability.
MR NEAL: Surely. Putting it briefly, the idea that I think
some other witnesses have now agreed to that a modelling
based on the CSIRO mapping, if you like, may have been a
preferable way to capture the population more likely
affected by this event.

8 DR FLANDER: Yes, I think that's true. Certainly the data that 9 we used in our report of June included postcodes that we 10 see now on a map were not likely to have been affected. 11 Therefore any estimate of mortality in those areas would 12 contribute to the looseness of our prediction;

MR NEAL: I suppose a corollary of that is, if you accept what I was putting to other witnesses, there are areas definitely, particularly to the west, which are most

17 obviously affected and not included.

18 DR FLANDER: Absolutely.

uncertainties.

13

19 MR NEAL: In terms of the question of the period of days, we 20 seem to have a variation of opinion between all days 2009 21 to 2014 and "fire days" 2009 to 2014. We will leave aside 22 2015 just for the moment. I think the views that have been expressed are that homogeneity might be an advantage, 23 24 that is comparing like with like. The other side of that 25 coin is if you use heterogeneous periods then, my words, 26 you are imposing more challenges on your modelling. You 27 are nodding.

28 DR FLANDER: Your question is?

29 MR NEAL: Do you agree that's a fair summation of perhaps the 30 two approaches?

31 DR FLANDER: Yes.

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MR NEAL: In this case do you have a preference in terms of 1 2 which period you say would better have been modelled? DR FLANDER: My preference is to stand on the work that we did 3 4 do, which was looking at the days of exposure. The report 5 says February and March, which is what we had. It wasn't monthly data. It was daily deaths and associated with 6 7 exposures to temperature and a conservative estimate of air quality. It makes sense to me in epidemiologic terms 8 to compare the period of exposure with the same period in 9 10 previous years.

MR NEAL: When we are talking about the period of exposure we have two possibilities, I think.

13 DR FLANDER: Yes.

MR NEAL: Which is fire ignition, fire safe and some mapping of unusual or dangerous emission levels. Do you have a preference about that?

DR FLANDER: I haven't really thought about it until now so I would like not to answer. I can tell you that, given the availability of the data that we used, you would want a measure that was capturing exposure throughout all the affected areas. The measure we had was PM10 because it was captured for the whole area. I don't really know. I don't have a strong opinion about that right now.

24 MR NEAL: By now I take it you are also familiar with the ideas 25 that I was putting to Dr McCloud in relation to the simple 26 graph that he produced.

27 DR FLANDER: Yes.

28 MR NEAL: And the raw data of material showing actual numbers 29 of deaths produced by my instructing solicitors' office. 30 His analysis of that was obviously that it's plausibly to 31 be explained by natural variation. What do you say about

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1

2 DR FLANDER: At the risk of repeating myself, may I say that all along I have been loath to ascribe or, more 3 4 accurately, attribute different causes of death to the 5 mortality observed because the number of observed cases is so small. I think that it's very likely that there is 6 7 some background variation in the mortality observed. I think it's also likely, although hard to say how likely, 8 that there were other causes of mortality. 9

In the data that we looked at, even with a conservative estimate of PM10 applied throughout the dataset for the entire period, air quality has an effect on mortality in the Latrobe Valley. That would have to be true. That would have to be true for that period as well. But I am reluctant to give a number at this time because the number of cases is so small.

MR NEAL: Do I understand you particularly via your expressions of opinion in the expert conclave to say, my words again, that if there is some increase you are agnostic about its cause?

21 DR FLANDER: Yes.

22 MR NEAL: In terms of the data that was added in Dr McCloud's 23 graph, which includes 2015, as the raw data table also 24 does, what do you say about the value of that just in 25 general terms first, allowing 2015 gets brought into the 26 perspective?

27 DR FLANDER: Well, I looked at it on Monday and my first 28 reaction was how similar the distribution of points and 29 intervals around the points across a central line, how 30 closely that rhythm approximates the figures that we 31 produced looking at the death data, of course not

.DTI:MB/TB 22/10/15 801 BY MR NEAL Hazelwood JOHNSTON/McCLOUD/ARMSTRONG/BARNETT/FLANDER/GORDON

including 2015. We see the same pattern of similarity 1 2 between 2009-2014 and reduced mortality for the intervening years and overlapping confidence intervals. 3 So it doesn't really surprise me. I didn't look at 2015 4 5 data and I only saw this figure on Monday. I think it's interesting and there could be a lot of reasons for that 6 7 mortality. I would be very reluctant to say what the 8 reason is for that mortality.

MR NEAL: Can I put it to you this way: it certainly lends some 9 10 plausibility to the natural variation theory? DR FLANDER: It includes it. I don't know that the pattern 11 that we observed looking at 2009 through 2014 was solely 12 13 as a result of natural variation, and I didn't conclude that. So I'm looking at this very similar distribution of 14 events and I have similar reservations about, I'm sorry, 15 16 attributing the different fractions of causes to these 17 results.

18 MR NEAL: Let me put this perhaps hypothetically to you. If it 19 is plausible to say that there was natural variation in 20 2014 - - -

21 DR FLANDER: Some portion, yes.

22 MR NEAL: As opposed to a theory that there were as much as 23 23 extra deaths involved by modelling, not taking account of 24 2015 figures, that it would be appropriate to actually 25 draw in the 2015 figures to assist with checking of the 26 model.

27 DR FLANDER: I think that the model can be checked and 28 evaluated, deconstructed and specified to examine the 29 estimate of 23 deaths on the basis of the work that 30 Associate Professor Barnett has done. I don't know 31 that considering 2015 mortality informs that question.

.DTI:MB/TB 22/10/15 802 BY MR NEAL Hazelwood JOHNSTON/McCLOUD/ARMSTRONG/BARNETT/FLANDER/GORDON MR NEAL: Can I put this to you: if there is an apparent tension between a posited significant increase and an explanation, just random variation, would it not be appropriate to investigate the actual medical data around the deaths to try and find some discriminator between the two options?

7 DR FLANDER: Well, with respect to informing the Board and to 8 the best of my understanding of this problem, I looked at 9 the death data. I had death certificate data. What we had was the cause of death as recorded in medical language 10 which we then converted into categories of death, and 11 that's in our report. It was not overwhelmingly 12 13 informative. It was informative, but it didn't point us in any significant direction. 14

We do see an increase in cardiovascular causes of 15 16 death. But, as Professor Armstrong points out, that in and of itself is not an association that proves a cause. 17 In particular we don't see that excess of cardiovascular 18 19 diagnoses or causes of death in association with deaths 20 during the period of February and March. But we are talking about a handful of cases. It's a very small 21 22 number of cases to be talking about.

23 Would we be better informed if we had hospital 24 records, if we had medical records of the general 25 practitioners of each of these people who died on those 26 individual days? Maybe and maybe not.

27 MR NEAL: Depending on the quality of the record.
28 DR FLANDER: Absolutely. It's not just the quality of the
29 records; it's also the fact that these are loose
30 categories - not loose categories, but these are
31 diagnostic categories that capture a lot of causes. The

.DTI:MB/TB 22/10/15 803 BY MR NEAL Hazelwood JOHNSTON/McCLOUD/ARMSTRONG/BARNETT/FLANDER/GORDON organ systems involved respond in particular ways to a variety of insults. I'm trying to give you the benefit of my reasoning and not just "yeses" and "nos". I'm sorry I can't be more specific.

5 MR NEAL: That's all right. Thank you, Dr Flander. Professor 6 Gordon, you have heard me put to some of the other 7 witnesses the way the data has been drawn into this 8 analysis may have been improved by certain different 9 approaches. One is the geographic approach. Do you agree 10 with that?

PROFESSOR GORDON: I agree in principle. It may have been practically difficult to do that because of the difficulties with geo-coding locations of people on the basis of the CSIRO map that you showed us. I don't know to what extent that is possible.

16 Again, some of the other issues one would need to investigate a little bit, but I don't necessarily have the 17 18 same concern as was articulated about the large area of 19 3825 that's evidently not exposed. You would have to look 20 at how many people were actually there. The main population centre, as I understand it, in that postcode is 21 22 Moe itself. That is in the exposed area. I'm not sure how important the - - -23

24 MR NEAL: In principle it seems to be correct that you may be 25 drawing in deaths that aren't related to a fire affected 26 area.

27 PROFESSOR GORDON: Yes, but how many there are and whether that 28 would have a meaningful impact, I'm not sure.

29 MR NEAL: Clearly. In terms of the fire period as the control 30 period, is it fair to say that the corresponding period 31 year on year would present a less challenging modelling

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test than using all days over the period? 1 2 PROFESSOR GORDON: I agree with the points that other experts have made about that. There's a kind of a trade-off 3 there. Potentially there might be relevant information in 4 5 the other periods of the year if you can model them satisfactorily. But by confining it to the fire period 6 you are getting a more homogenous period of the year for 7 8 the purposes of comparison. So there is a trade-off 9 there. MR NEAL: In terms of the modelling that was done - and again 10 I'm trying to give very much an overview of your formal 11 report - you have, I think, a level of discomfort about 12 13 not being able to burrow into the material in a way that you think is appropriate; is that fair to say? 14 PROFESSOR GORDON: Yes, because I had a day and it's 15 16 complicated. 17 MR NEAL: If you wanted to validly test the things that you 18 were interested in would you take days, weeks, months or 19 what to do it? 20 PROFESSOR GORDON: Weeks and the expected cooperation of 21 Associate Professor Barnett to talk about it with him. 22 I don't mean weeks full time. MR NEAL: No, I understand. As you were in the experts' 23 conference, were you familiar with the 2015 data? 24 25 PROFESSOR GORDON: Only insofar as I had seen it in

26 Dr McCloud's report. He mentioned the figure of 77 in his 27 letter that he wrote.

28 MR NEAL: So the actual data he was relying on you hadn't had

29 available to you?

30 PROFESSOR GORDON: No.

31 MR NEAL: Would you agree with the in principle idea that the

.DTI:MB/TB 22/10/15 805 BY MR NEAL Hazelwood JOHNSTON/McCLOUD/ARMSTRONG/BARNETT/FLANDER/GORDON proximate year of 2015 would be a valuable addition to our perspective on what's happening in 2014?
PROFESSOR GORDON: I would agree it's relevant to consider, yes.

5 MR NEAL: Do I take it ideally then you would like to have been able to absorb that into your thinking when you were 6 7 having the discussion at the experts' conference? 8 PROFESSOR GORDON: Yes. We had, as Dr McCloud indicated, a 9 discussion about it for a period of time, not necessarily 10 a substantial period of time. There wasn't a substantial period of time to discuss anything. But we did talk about 11 it. 12

13 In that connection, I would like to say that it would be helpful - just to be pedantic - to clarify the 14 data themselves. I don't believe that the figures at 15 16 tab 53 give exactly a mean of 69.4 - I'm not sure what the explanation is; I'm sure that Dr McCloud and I could sort 17 18 it out quite quickly - nor do I believe the figures at 19 tab 53 are those represented in the figure exactly. But 20 the difference is very small. I don't know what the 21 explanation is.

22 MR NEAL: Would you just excuse me a moment. Thank you,
23 Professor Gordon, I don't want to ask you any further
24 questions.

Associate Professor Barnett, I only have a couple of questions I want to raise with you. In your latest modelling I'm somewhat confused when you talk about the period of 45 days as being the fire period, but then you use a figure of 46 in other parts of your document. My understanding is we had a consensus that there was a "fire period" from 9 February to 25 March, being 45 days. The

.DTI:MB/TB 22/10/15 806 BY MR NEAL Hazelwood JOHNSTON/McCLOUD/ARMSTRONG/BARNETT/FLANDER/GORDON introduction I think to your report says 45 days, but the
 modelling involves a number of 46.

ASSOCIATE PROFESSOR BARNETT: Yes, that was a simple mistake 3 that was pointed out to me in the conclave and 4 5 I re-analysed the data during the conclave and it made almost no difference to the relative risk of the fire. 6 MR NEAL: Just on that point, can I ask you to look at a 7 document which is 54 in our book. Can I be quick with 8 you. It is the document that looks like that, Associate 9 10 Professor.

ASSOCIATE PROFESSOR BARNETT: The Births, Deaths and Marriages data? No. I beg your pardon, I am now. I have it in front of me, starting from 9 February 2014.

MR NEAL: It is a simple chart. I just wanted you to note that the extra day that was included, 26 March, has five deaths associated with it, which is the highest of any single day in the period study.

18 ASSOCIATE PROFESSOR BARNETT: As I said, I excluded that and it 19 made no difference to the relative risk of the fire.

20 MR NEAL: Statistically those five deaths made no difference?21 ASSOCIATE PROFESSOR BARNETT: It made no difference, no.

22 MR NEAL: Can you explain to me how that 46 figure - - -

23 ASSOCIATE PROFESSOR BARNETT: Five deaths may be reasonably

24 large, but when you compare it to 88 it is small if you 25 are looking at the total number of deaths.

26 MR NEAL: Could you turn your mike? Could you repeat that 27 answer?

ASSOCIATE PROFESSOR BARNETT: Five deaths, yes, I agree that is quite a high figure. When you compare that to 88 is the total, or 83, it becomes less of a difference.

31 MR NEAL: In your current document you use a common relative

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1 risk for all the postcode areas. I think Professor 2 Armstrong pointed out to you that approach is one which tends to, I think he said, obscure differentials that you 3 had earlier identified. 4 ASSOCIATE PROFESSOR BARNETT: Potentially, yes. 5 MR NEAL: Is that a function, as I think Dr McCloud was saying 6 to us, that when you include a vastly larger number of 7 days, in my terms, you tend to dilute the effect of a 8 particular period of days? 9 10 ASSOCIATE PROFESSOR BARNETT: So you have gone from postcodes to days there. So I'm a bit confused. What I was talking 11 12 about was a common relative risk across postcodes, 13 regardless of the length of days. 14 MR NEAL: Your ability to get to the common figure, as 15 I understood perhaps what Dr McCloud was explaining, was a 16 function of including all the postcodes for all the 17 period. ASSOCIATE PROFESSOR BARNETT: I'm not sure what the question 18 19 actually is. There is a difference here between using all 20 days and using a common effect across postcodes. That common effect across postcodes doesn't necessarily depend 21 22 on how many days we use. That's a separate assumption to 23 how many days go into the analysis. MR NEAL: I had understood Dr McCloud to be saying that as you 24 25 expand that data of days you tend to minimise the individual effects of particular days and then I'm 26 27 relating that to a particular postcode, being Morwell. So 28 you would submerge Morwell's difference arguably by 29 expanding the number of days greatly. ASSOCIATE PROFESSOR BARNETT: I wouldn't say there's any 30 31 general rule to that happening. I would say as we

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increase the number of days we would get a better estimate 1 at the baseline mortality rate in these places. 2 So arguably it would be more accurate. I wouldn't 3 necessarily say that it would always go towards smearing 4 5 things towards a common relative risk. I should also add I did test whether the relative risk was different using a 6 7 statistical test across the four postcodes, and it wasn't. 8 There is a good argument for using a common relative risk. 9 That said, in your December 2014 report you most MR NEAL: clearly exposed a significant differential between Morwell 10 and three other postcodes, and we had a substantial amount 11

ASSOCIATE PROFESSOR BARNETT: Yes, again in the earlier analysis there wasn't actually any statistical evidence that they were different. So, again, I'm sure I did say in that analysis that we should prefer the common relative risk, as there is no evidence that the relative risks were actually different.

of conversation about why the deficit.

12

MR NEAL: When you proposed to do the new analysis that you did, did you have some expectation about what its outcome would be in terms of direction?

22 ASSOCIATE PROFESSOR BARNETT: Most definitely. I expected that 23 the relative risk would increase.

24 MR NEAL: You expected to produce a larger number of deaths out 25 of your resumed analysis?

ASSOCIATE PROFESSOR BARNETT: Yes. There is a well-known measurement error theory that if you reduce measurement error, as we have done here, and if there is a true association between exposure and disease - it's a mathematical thing - the relative risk will increase; it has to go up.

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MR NEAL: Thank you, Associate Professor. We don't have any 1 2 other questions, thank you. CHAIRMAN: Thank you. I plan to take a break now. But, 3 because I'm concerned about witness time, can you give me 4 5 an idea without committing yourself to it, Mr Blanden? MR BLANDEN: Not long, I don't think, sir. Probably 15 minutes 6 or thereabouts. 7 8 CHAIRMAN: What about you, Ms Szydzik? 9 MS SZYDZIK: About the same. CHAIRMAN: That creates a bit of a dilemma. I also have to 10 allow for the transcribers. So we will make it 11 10 minutes. So we will resume at 20 to 1. 12 13 (Short adjournment.) CHAIRMAN: Yes, Mr Blanden. 14 <CROSS-EXAMINED BY MR BLANDEN:</pre> 15 16 MR BLANDEN: Thank you, Mr Chairman. Dr McCloud, could I start by asking you a question in relation to a matter that was 17 18 raised with you by Counsel Assisting. You were asked a 19 question in relation to the rapid health response 20 assessment. I think your comment in relation to that 21 study was that it was a predictive study, but it had the 22 advantage of being, as I understood what you said, not confounded by random variation. You weren't asked to 23 24 explain that. I wonder if you might explain that to us, 25 please. DR McCLOUD: So in the current study, as we have discussed at 26 27 some length, we have a fair amount of random variation for 28 this data that's sampled from a Poisson distribution with a mean of 70. The difficulty, as we have discussed, is 29 separating how many deaths we may attribute to the mine 30 31 fire and other causes, and this is not an easy exercise.

.DTI:MB/TB 22/10/15 810 BY MR BLANDEN Hazelwood JOHNSTON/McCLOUD/ARMSTRONG/BARNETT/FLANDER/GORDON 1 So what I meant by that is, by going back and 2 considering the several studies that Dr Johnston and 3 colleagues have considered, the meta-analysis that they 4 have done there would indicate that the best estimate for 5 the increase in death rate would be 1.04 per cent, and 6 this was based on the analysis of the increase in 7 concentration of the PM2.5.

8 So this estimate of 1.4 per cent, which had sort 9 of a worst case of 2.08 based on a regional analysis, this 10 of course is not influenced by the random variation that 11 we have within the current study. So we are able to 12 derive an estimate that's not affected by the random 13 variation in this study.

MR BLANDEN: To that extent, are you effectively relieved from having to take account of other reasons why there might be random variation affecting the current study? DR McCLOUD: Perhaps could you ask that question again or in a

slightly different way just to assist me?

18

MR BLANDEN: Yes. The fact that it doesn't carry with it the random variation that we see in the current study because it's a predictive one, not based on the actual figures, how do you then marry the two up? You have the predictive study absent the random variation. You have the actual figures which have that. What sort of comparison do we make of the two?

26 DR McCLOUD: It gets tricky, I think. So it's complicated. 27 Dr Johnston has alluded to the fact that this is a fairly 28 small sample size that we are considering in this region 29 of about 60,000 people, and that a lot of these studies 30 have been based on centres or cities of perhaps a million 31 people.

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If we apply the 1 per cent or the 2.08 per cent 1 2 to the number of deaths that we have been observing, so around 70, then we are looking at an estimate of about one 3 to two additional deaths associated with the mine fire 4 5 pollution. But again that's just an estimate. So it assists the process, it gives us a ballpark figure, but 6 7 because of the small numbers we still can't be absolutely 8 sure.

9 Thank you. I will come back to you in a few MR BLANDEN: 10 minutes, if I could, but I wanted to ask Dr Johnston some questions, if she's still with us and I think she is. 11 12 Dr Johnston, you were a co-author of that predictive study 13 that I have just referred to. I wonder if you could comment on the same question I have just asked Dr McCloud; 14 that is, what do we make of its value as a predictive 15 16 study absent the issues that go with the current statistics? 17

DR JOHNSTON: That study used modelling of known concentration 18 19 response variables and applied them to the setting that we 20 have. So it's useful to give a ballpark figure. That 21 study looked at average increases in PM2.5 over a one-year 22 period. It used the long-term studies where the yearly average exposure is related to yearly average changes in 23 24 deaths. So it was slightly different from the evidence 25 I presented earlier which applied the short-term studies 26 where a daily average of exposure is related with daily 27 changes in deaths. But they came to similar sorts of 28 conclusions in terms of order of magnitude of impact. 29 MR BLANDEN: Are you assisted in any way in terms of removing what you would expect in terms of random variation from 30 the actual figures by the predictive nature of the first 31

.DTI:MB/TB 22/10/15 812 BY MR BLANDEN Hazelwood JOHNSTON/McCLOUD/ARMSTRONG/BARNETT/FLANDER/GORDON

study? Do they feed into each other to any extent? 1 2 DR JOHNSTON: The idea of a meta-analysis is that you do get a good idea of the concentration response by itself, whereas 3 in any one individual study you have all the other effects 4 5 that would be influencing that population. So it is helpful in that regard, but it is not telling you any 6 7 truth. It's just giving you a ballpark figure. MR BLANDEN: Your background, as I understand it, is in 8 research into the effects of effectively smoke events on 9 10 population cohorts; is that correct? DR JOHNSTON: Yes, that's correct. 11 MR BLANDEN: As I read your research, is it fair to say that 12 13 the greatest effect that you would expect to find, that is as an adverse impact of a smoke event, is likely to be 14 primarily a respiratory adverse impact? 15 16 DR JOHNSTON: No. I used studies of mortality from all causes, 17 not restricted to respiratory causes. In our population, respiratory causes of death are actually only about 18 19 10 per cent of all deaths; whereas cardiovascular causes 20 are nearer 30 per cent of all deaths. With smoke exposure and particulate exposure, even though respiratory is a 21 22 very sensitive organ, the respiratory system, because so many more of us have got underlying heart disease in 23 absolute numbers the rise in deaths is much higher for 24 25 heart disease than for lung disease. MR BLANDEN: In terms of the studies which you have authored or 26 27 co-authored in the past, has it been the case that the 28 data that you have looked at has concentrated effectively

29 on either respiratory or cardiovascular presentations as a 30 result of a smoke event?

31 DR JOHNSTON: The studies I have personally done have looked at

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all cause mortality, and in one study I did we also looked 1 2 at cardiovascular and respiratory causes as a subanalysis. MR BLANDEN: Did that subanalysis lead you to conclude that 3 perhaps, although not certainly, the respiratory cause of 4 5 death might have been more evident than a cardiovascular cause of death as a result of smoke impacts or smoke 6 7 events? 8 DR JOHNSTON: That was a subanalysis which meant our

9 statistical power was lower, and neither got a result of 10 statistical significance. The more convincing result was 11 with the cardiovascular deaths, because there are more of 12 them and (indistinct) statistical power.

MR BLANDEN: In general terms they are the two areas? If you are to see an increase in mortality as a result of what I will call a smoke event, you would be more likely to see them in terms of either respiratory or cardiovascular causes?

18 DR JOHNSTON: Yes, they are the main two organ systems that you 19 would expect to see. Yes.

20 MR BLANDEN: As I understand your research, again in terms of 21 the effect of a smoke event, you would expect to see the 22 impact of that smoke event taking place on the population 23 within a day or at most a couple of days of the event 24 itself occurring?

25 DR JOHNSTON: As far as smoke studies go, yes, that's what my 26 studies have shown. I'm aware of other studies that show 27 health impacts not for mortality but for respiratory 28 hospital admissions, for example. Some studies show there 29 is still an increase in the following week after the 30 event. I'm not aware of any studies that show that for 31 mortality.

.DTI:MB/TB 22/10/15 814 BY MR BLANDEN Hazelwood JOHNSTON/McCLOUD/ARMSTRONG/BARNETT/FLANDER/GORDON MR BLANDEN: In terms of those presentations, I think as you have just said, ordinarily you would expect a presentation within a day or two at a hospital if there was such an event, possibly extending to a week, but in your experience and certainly in terms of the reports that you have read not extending past that?

7 DR JOHNSTON: Yes, that's correct.

8 MR BLANDEN: The report that you co-authored, the predictive 9 report, said this and I just want to put to you a 10 conclusion from the health risk analysis that was the 11 document you co-authored with, amongst others, I think 12 Professor Abramson and a number of other authors.

13 The conclusion of that report - it's on page 18 of the report for the Inquiry's benefit - is as follows, 14 and I will quote, "It can be seen that for this combined 15 16 exposure scenario no additional deaths would be expected 17 even if the exposure continues for six weeks. However, after three months this level of exposure would be 18 19 expected to result in some additional deaths from 20 IHD/COPD, lung cancer and ALRI."

21 The exposure scenario to which that statement 22 refers was a risk of PM2.5 exposure for alternate durations of three weeks, six weeks, six months, nine 23 24 months and a year, all of which were modelled in relation 25 I think specifically to Morwell South. How does that 26 conclusion from that report sit with the conclusions you 27 have expressed arising from the joint meeting of experts 28 the other day and the report that's emanated from that? 29 DR JOHNSTON: The rapid health risk assessment, as I said before, used the yearly average exposure and the yearly 30 average change in deaths that you might expect to see. At 31

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that point there was a lot of uncertainty about what the 1 2 duration of exposure might be, and whether it might go on for one month or six months was all totally unknown. Now 3 4 that we know what has happened and how long the exposure 5 was, using the year-long concentration response coefficient it might give us a maximum bound, but I don't 6 think it's as helpful as using the short-term response 7 coefficient. So that was the best estimate that could be 8 made at the time. But it's not as useful as the more 9 recent work. 10

MR BLANDEN: When you say "not as useful", you mean with the 11 benefit of the studies which in fact have been done 12 13 subsequently it's not as useful as it was prior to actually getting the data for what in fact occurred? 14 DR JOHNSTON: Correct, and it was restricted to Morwell, but 15 16 not Traralgon or Moe or other parts of Latrobe. 17 MR BLANDEN: Do I understand from what you say it was, given the information that you then had, effectively the best 18 19 that could be done in that sort of predictive way that the 20 report was expressed?

21 DR JOHNSTON: Yes. It was using the information available at 22 the time.

23 MR BLANDEN: In terms of the first report that you forwarded to 24 Professor Catford on 13 October, do you have a copy of 25 that in front of you? This is your initial emailed 26 report.

27 DR JOHNSTON: Yes, I have just opened it.

28 MR BLANDEN: You will see that in the third paragraph, which is 29 the preamble to your dot points, you say this, and I will 30 just read it out, "All comments below specifically exclude 31 the population of Morwell and the concentrations of

.DTI:MB/TB 22/10/15 816 BY MR BLANDEN Hazelwood JOHNSTON/McCLOUD/ARMSTRONG/BARNETT/FLANDER/GORDON particulate matter and other pollutants recorded in Morwell during the fire. This is because an elevation in mortality was not observed in Morwell." I take it that that's really the starting point for the points that you make which follow on; is that correct?

DR JOHNSTON: Yes, that's correct. The time I wrote this email
I wasn't aware of the third analysis by Associate
Professor Barnett.

9 MR BLANDEN: Just so we are clear, that latter analysis by 10 Associate Professor Barnett is the only one that actually 11 does show an elevation in mortality in Morwell as a result 12 of the fire?

13 DR JOHNSTON: Yes.

MR BLANDEN: At that time, as I understand your conclusion, you 14 were of the view that there was an observed higher 15 16 mortality but it didn't seem to be consistent with - and I'm quoting from your second last dot point - "the known 17 18 temporal relationships that have been characterised for 19 airborne particulate matter and mortality." Could you 20 just explain to us what you meant by that phrase? 21 DR JOHNSTON: That was my final comment. My main comment was 22 that it was not consistent with the concentration response associations known. The temporal associations was because 23

in the earlier Inquiry there was talk of whether the fire 24 25 might have influenced death rates up to six months later, and that is something not consistent. So when I say "not 26 27 consistent with temporal impacts", that's what I'm 28 referring to. I'm not aware of any evidence of a smoke episode or smoke for two or three or four or six weeks 29 influencing mortality several months later or a year 30 later. That didn't fit the evidence. 31

.DTI:MB/TB 22/10/15 817 BY MR BLANDEN Hazelwood JOHNSTON/McCLOUD/ARMSTRONG/BARNETT/FLANDER/GORDON MR BLANDEN: I take it from what you have just said that you share some of the concerns of Dr McCloud in terms being capable on the basis of the known statistics of making positive conclusions about things that aren't at least relatively heavily qualified?

DR JOHNSTON: I wouldn't put it like that. The statistical 6 7 analysis was very sound and it came to a conclusion that was statistically convincing. My point is that studies 8 give us unexpected results, and in my view this study has 9 10 given unexpected results knowing what we know about smoke events. So, in the light of there's a mismatch between 11 12 what we know and what we saw, we need to think very hard, 13 think what other analyses we should do, think about what the causes might be. In small populations unusual 14 15 statistical correlations happen a bit more often than in 16 great big populations of millions of people. So that's 17 clearly one of the things we have to think about.

18 MR BLANDEN: Is the background to that view your knowledge of 19 the various studies which shows the likely sort of impact 20 of particulate matter exposure not creating an event of 21 the magnitude that the statistical study here would seem 22 to indicate?

23 DR JOHNSTON: Yes, the magnitude, the size of the effects of 24 the third report by Associate Professor Barnett is far 25 higher than you would expect from known relationships 26 between mortality and particulate matter or fire smoke as 27 a mixture.

28 MR BLANDEN: In terms of, finally, the reason for you emailing 29 Professor Catford, I'm not sure whether anybody has 30 actually asked you this question, but there is some 31 curiosity about why it was that you effectively

.DTI:MB/TB 22/10/15 818 BY MR BLANDEN Hazelwood JOHNSTON/McCLOUD/ARMSTRONG/BARNETT/FLANDER/GORDON voluntarily sent the professor a report in the nature of
 your 13 October email.

DR JOHNSTON: Yes, for two reasons, one that I articulated at 3 the beginning of this hearing in that I have another role 4 5 in providing independent expert advice on this. So I was following it and felt I had more to contribute. The other 6 7 is in my work. Australia, as we know, has a terrible dilemma in how we manage bushfires. One of the most 8 9 evidence based approaches to reduce fuel is with planned 10 burns.

If we were to believe, for example, that there 11 were excess deaths in the town of Traralgon where smoke 12 13 impacts (indistinct), logically we would believe that some of the planned burns or Australia's planned burn fuel 14 15 reduction program has a mortality risk, that would 16 probably be unacceptable to most people. That's not what 17 I personally believe. But there was planned burn smoke impacts in Traralgon a year before, in 2003, that were of 18 19 a very similar magnitude, and it would be highly 20 improbable that they were associated with any deaths at all, given the rise in smoke associated (indistinct). So 21 22 this has big implications for how we cope with bushfires. That was one another of my motivation in contacting the 23 24 Inquiry.

25 MR BLANDEN: Is what you are saying in essence that it is the 26 particulate matter exposure itself which is the subject of 27 your concern? In a sense, it doesn't matter if it comes 28 from a mine fire or a bushfire, a controlled burn or 29 whatever the source of it is. That effectively is your 30 background concern. Did I understand you to say that, 31 effectively?

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1 DR JOHNSTON: Effectively, yes. The marker of the whole 2 mixture that makes smoke, particulate matter. So I use it in that context. You are right; you get a similar result 3 4 regardless of the source. Where you are combusting 5 hydrocarbons in an incomplete way, that's what you see. MR BLANDEN: How would you, for example, explain a divergent 6 result which is that for a controlled burn in Traralgon or 7 near Traralgon or affecting Traralgon there was no 8 statistical evidence of an increase in deaths whereas for 9 10 this fire there appears to be at least some evidence of a statistical increase? 11 DR JOHNSTON: That was the reason for me pointing out that the 12 13 result of the study was not consistent with the wider evidence about particle impacts. So there's a mismatch 14 15 there. 16 MR BLANDEN: What, if any, conclusion do we draw from that 17 mismatch? DR JOHNSTON: It means we have to look very hard before we 18 19 attribute - there was certainly a statistical increase in 20 deaths. I don't dispute that. I think it's likely particles contributed. But I'm very cautious about 21 22 attributing the increase in deaths to particles alone, given there may be other causes. We know it's small 23 numbers. We know there is background variation. I would 24 25 want to look a bit harder and do more studies before I became more confident of the conclusion. 26 27 MR BLANDEN: Thanks, Dr Johnston. Dr McCloud, just back to you 28 for a moment if I could. You were also asked a question 29 from Counsel Assisting that I think went along these lines, that you couldn't rule out that the mine fire could 30 be a contributor to deaths, effectively asking you to 31

.DTI:MB/TB 22/10/15 820 BY MR BLANDEN Hazelwood JOHNSTON/McCLOUD/ARMSTRONG/BARNETT/FLANDER/GORDON prove a negative which I suspect you rather sensibly declined to try and do. Can I put it to you a different way.

As I understand your position, it is that you are 4 5 not necessarily satisfied of that relationship for 6 effectively two reasons, as I understand it: (a), the statistical analysis doesn't show anything more than 7 natural random variation to your satisfaction; and, (b), 8 the causative element isn't satisfied because there's 9 effectively no practical factual evidence on which to base 10 a causative answer. Have I got that right? 11 12 DR McCLOUD: Sorry, for the second part, yes, that's correct. 13 That's what I respond there. For the first part, I guess perhaps there are two answers there. So, first of all, 14 15 with the chart I have produced, which is loosely based on 16 sort of control chart theory, we don't see 2014 as being 17 an outstanding point. To put it another way, there are three years where we are above the line - 2009, 2014, 18 19 2015. There are four years below the line. Given that we 20 have an odd number, basically you can't be more even than that. So there's no evidence here that we have an 21 22 outstanding result or a striking result in 2014. It's within the bounds of natural variation. 23

24 Secondly, to the more advanced analysis that 25 Associate Professor Adrian Barnett has done, although 26 there with the last analysis we do have a credible 27 interval around the estimate of 23 deaths, that interval 28 goes as low as two deaths and up to 46. I think it is a 29 very wide interval. So it raises some concerns about the 30 reliability of the estimate there.

31 MR BLANDEN: All right. Thank you. Lastly, Associate

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Professor Barnett, I just have a question or two for you. 1 2 You sent an email to the office of Counsel Assisting on 11 September 2015. This is behind tab 40(a), and I will 3 just read it to you and ask for your comment. It reads as 4 5 follows: "Dear Justine, I have had time to look at the Excel spreadsheets on the death data from the Latrobe 6 7 Valley. The daily data are more detailed than previous monthly estimates. There is the chance to do an improved 8 9 analysis as the period of the fire (in days) would be more 10 accurate compared with the previous analyses based simply on February and March 2014." Just stopping there for a 11 12 moment, you do of course appreciate that Dr Flander had 13 already done a daily data analysis?

14 ASSOCIATE PROFESSOR BARNETT: Yes, but not using the same 15 techniques that I used.

MR BLANDEN: You then go on to say as follows: "I'd like to do this analysis and publicly release the results as I have done with my previous two analyses." Stopping there for a moment, that would seem to indicate that when you wrote this email on 11 September you had not yet done the

21 analysis; correct?

22 ASSOCIATE PROFESSOR BARNETT: That's right.

MR BLANDEN: It then goes on to read as follows: "Would this be 23 24 allowable considering both any restrictions that were 25 reported to you when you received the data and any restrictions that you may have?" We know that your next 26 27 email communication with the office of Counsel Assisting 28 was on 15 September, and that in fact was sending the updated analysis to - in fact, it might have been to the 29 Inquiry rather than to the - no, no, it was to the 30 Inquiry, I beg your pardon, and that's tab 40(b), if the 31

.DTI:MB/TB 22/10/15 822 BY MR BLANDEN Hazelwood JOHNSTON/McCLOUD/ARMSTRONG/BARNETT/FLANDER/GORDON 1 Inquiry pleases.

2 What I want to ask you is this: the first email where you say "I would like to do this analysis and 3 publicly release the results" sounds to me like you are 4 5 asking permission to do it; is that right? ASSOCIATE PROFESSOR BARNETT: Well, if I was going to go to the 6 trouble of doing it I wanted it to be used or useful. 7 Τf it was never going to be used or useful, there is no point 8 in me going to the trouble of doing it. 9 10 MR BLANDEN: You were concerned enough about it to seek a view as to whether there was any restriction or reason why you 11 should not do it or should not circulate it if you did do 12 13 it; correct? ASSOCIATE PROFESSOR BARNETT: Yes, again, if it's not going to 14 15 be used or seen, I'm not going to spend my time doing it. 16 MR BLANDEN: So do we assume from that, then, that sometime 17 between 11 September and 15 September somebody gave you the green light to go ahead and do it? 18 19 ASSOCIATE PROFESSOR BARNETT: That's right. MR BLANDEN: And who was that? 20 ASSOCIATE PROFESSOR BARNETT: I think I spoke with Ruth on the 21 22 phone on 15 September. MR BLANDEN: On 15 September you had already done the analysis, 23 24 as I understand your email of that day, because it says, 25 "I spoke with Ruth on the phone earlier. She suggested I send my updated analysis to you." That would indicate 26 27 you had already done it by that time? 28 ASSOCIATE PROFESSOR BARNETT: I did the analysis in between 11 29 and 15 September, yes. MR BLANDEN: So what I'm asking you is: after your email of the 30 11th saying "can I do it" and before your email of the 31

.DTI:MB/TB 22/10/15 823 BY MR BLANDEN Hazelwood JOHNSTON/McCLOUD/ARMSTRONG/BARNETT/FLANDER/GORDON
1 15th saying "I have done it and here it is", who said "go 2 ahead and do it" or "you can do it" or "yes, we'd love to 3 get it"?

ASSOCIATE PROFESSOR BARNETT: Nobody said that. But if then it would have been a negative then I would have just deleted those results and that would have been the end of that. MR BLANDEN: So are you saying to us you got no response to your question seeking permission to do it at all, from anybody?

10 ASSOCIATE PROFESSOR BARNETT: Well, I got the indication that 11 the Inquiry would have liked to hear that extra evidence. 12 MR BLANDEN: Right. This is before you do the analysis? 13 ASSOCIATE PROFESSOR BARNETT: Before? I don't understand, 14 sorry.

MR BLANDEN: All right, let's do it again. Your email of 15 16 11 September says this: "I'd like to do this analysis and 17 publicly release the results as I have done with my 18 previous two analyses." You have already agreed with me 19 that that indicates two things: one, you had not done the 20 analysis at the time that you wrote that email, and, two, that you were seeking effectively permission to go ahead 21 22 and do it; correct?

23 ASSOCIATE PROFESSOR BARNETT: Not permission to do it

24 necessarily. An understanding that it would be useful and 25 used.

MR BLANDEN: Let's call it that. So what response do you get to that request before you go ahead and do the analysis? ASSOCIATE PROFESSOR BARNETT: I did the analysis in that intervening period between the 11th and the 15th. MR BLANDEN: I'm not asking you about the timing. I'm asking you what response you got to the request before you went

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ahead and did the analysis.

2 ASSOCIATE PROFESSOR BARNETT: Nobody had given me the green light to do the analysis. I did it out of scientific 3 curiosity in between that time. 4 5 MR BLANDEN: So, despite the fact that you thought on the 11th that you wouldn't do it unless it was going to be used and 6 7 it was going to be useful and you thought you'd better enquire as to whether you could do it, you didn't wait for 8 9 an answer, you just went ahead and did it anyway; is that 10 what you are telling us? ASSOCIATE PROFESSOR BARNETT: I'm saying, yes, the scientific 11 curiosity got the better of me and I did the analysis. 12 13 MR BLANDEN: In total I think you had six goes at your analysis; is that right? 14 ASSOCIATE PROFESSOR BARNETT: Six goes at my - - -15 16 MR BLANDEN: Six goes, yes. ASSOCIATE PROFESSOR BARNETT: I planned two analyses. I did 17 18 two analyses. Most of those other analyses have been in 19 responses to queries from other people, and I should say 20 that in almost every case the estimate of the relative risk of the fire remained largely unchanged. 21 MR BLANDEN: The one that you volunteered to produce and did 22 produce in the email of 15 September you tell us was not 23 asked for by anybody. You just did it. You volunteered 24 25 it; is that right? ASSOCIATE PROFESSOR BARNETT: Which one are we talking about 26 27 now, sorry? 28 MR BLANDEN: The one that brings us here today. 29 ASSOCIATE PROFESSOR BARNETT: The very first analysis? MR BLANDEN: The third one, your third analysis, the one that 30 you send to the Inquiry on 15 September. 31

.DTI:MB/TB 22/10/15 825 BY MR BLANDEN Hazelwood JOHNSTON/McCLOUD/ARMSTRONG/BARNETT/FLANDER/GORDON 1 ASSOCIATE PROFESSOR BARNETT: I sent that in because the 2 Inquiry said it would have been of interest. If the 3 Inquiry said it wouldn't have been of interest, that would 4 have been the end of the matter.

5 MR BLANDEN: What I'm trying to enquire from you is did you get 6 a suggestion that it would be of interest before you 7 undertook the further analysis or after you undertook that 8 further analysis? It's not a difficult question. I don't 9 quite understand why you are having so much trouble with 10 it.

ASSOCIATE PROFESSOR BARNETT: I don't understand. I thought we have got all the dates here. So on the 11th I spoke about it with - I sent an email about it. In between that time I did the analysis. On the 15th I got the go-ahead to share that analysis.

16 MR BLANDEN: So who gave you the go-ahead?

ASSOCIATE PROFESSOR BARNETT: As I have said, nobody gave me the go-ahead to do the analysis. I had the data there. I had the expertise. I did it myself.

20 MR BLANDEN: Thank you.

21 <CROSS-EXAMINED BY MS SZYDZIK:

22 MS SZYDZIK: Dr McCloud, I was wanting to ask you some 23 questions about the graph that you've prepared 24 incorporating the 2015 data that's located behind tab 58 25 and is in fact exhibit 58. Do you have that? As 26 I understand this graph, what you show here is the 27 95 per cent confidence interval for each of the particular

28 years?

29 DR McCLOUD: Yes, that's correct.

30 MS SZYDZIK: What we have heard - and you have relied upon this 31 particular graph in particular to indicate or to form your

.DTI:MB/TB 22/10/15 826 BY MS SZYDZIK Hazelwood JOHNSTON/McCLOUD/ARMSTRONG/BARNETT/FLANDER/GORDON view that the 2014 result fits within natural or random
variations?

3 DR McCLOUD: Yes, that's correct.

4 MS SZYDZIK: As you have heard Professor Armstrong say today, 5 there are three statistical tools, each of which is important to be able to rule out natural or random 6 variations, those being, one, which you have used, and 7 that is the confidence intervals, but, two, also important 8 is the relative risk, and three then is the P-value. 9 10 Neither of the latter two are displayed anywhere on this graph; that's correct? 11 12 DR McCLOUD: That's correct, yes. 13 MS SZYDZIK: Did you do that analysis at all? 14 DR McCLOUD: Not directly. 15 MS SZYDZIK: Not directly? 16 DR McCLOUD: No. 17 MS SZYDZIK: Indirectly? DR McCLOUD: We know that Professor Bruce Armstrong had 18 19 calculated risk ratios which were appropriate here when 20 you are dealing with Poisson distributed data. 21 MS SZYDZIK: Sorry, so that's his analysis in relation to the 22 dataset that he used? DR McCLOUD: Yes. 23 24 MS SZYDZIK: But the dataset that you were working with, and 25 you have made the point that you had 2015 data incorporated within this table whereas others didn't. Did 26 27 you do that analysis yourself for this dataset? 28 DR McCLOUD: No. 29 MS SZYDZIK: Not yet. DR McCLOUD: No, I haven't done it for this dataset, no. 30 MS SZYDZIK: Professor Armstrong, just staying on that point, 31 .DTI:MB/TB 22/10/15 827 BY MS SZYDZIK

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1 it was you that identified the three different statistical 2 tools that can be used to ascertain whether or not there 3 is a divergence from natural or random variations. Can 4 you explain why it is that all three are important when 5 you are making that enquiry?

6 EMERITUS PROFESSOR ARMSTRONG: Let me say, going back to a comment I made earlier, that really there are two broad 7 8 approaches in epidemiology, and we are talking about 9 epidemiology here, statistics being an important tool that 10 epidemiologists use, and one of those is a descriptive approach where you don't go in with a prior hypothesis 11 12 about what you might expect to find; you go in to examine 13 the way things are and to describe them, and describe them in a way that is informative for people who may wish to 14 15 formulate hypotheses as a result of that description.

16 What Dr McCloud presented here he refers to as a control chart. I would see it as a short-term trend 17 analysis in which one is describing the trend in deaths in 18 19 the Latrobe Valley across a period of time, and 20 95 per cent confidence intervals are put there because 21 they tell you very important information about the 22 certainty with which you know each result that is reflected there in the block. 23

24 The other broad approach is hypothesis testing 25 where you as a result of some other issues, not just - and not in fact as a result of looking at the data, you 26 27 formulate a hypothesis about what might be true. That 28 hypothesis in this case was that deaths in the Latrobe Valley in 2014 were, and if you use the general 29 terminology of putting the null hypothesis, not different 30 31 from those in preceding years, and you then calculate the

.DTI:MB/TB 22/10/15 828 BY MS SZYDZIK Hazelwood JOHNSTON/McCLOUD/ARMSTRONG/BARNETT/FLANDER/GORDON relative risk for 2014 in comparison with the relative
 risk averaged over the preceding five years, as was done
 in this case.

There, your P-value, the additional statistic that you mentioned, in addition to the 95 per cent confidence interval, is informative in telling you whether or not you have strong enough evidence to accept an alternative hypothesis, that is that it is different, or that you simply go along with a null hypothesis that it is not different.

So we are talking about two quite different 11 12 approaches here to statistical reasoning. Both of them 13 are correct in their own framework, but I fear in this particular case some confusion has arisen between the two. 14 I would argue that, notwithstanding what Dr McCloud has 15 16 presented here descriptively, the analyses that initially 17 Dr Flander did and subsequently Associate Professor Barnett did were valid, and the fact that they did not 18 include 2015 is not material to the interpretation of the 19 result that they obtained. However, of course, one takes 20 interest in it because of the wider context. 21

MS SZYDZIK: Professor Gordon, you made a comment that - or in answering a question in relation to the 2015 data you similarly observed that that data is relevant to this analysis. As I understand it, you received this graph during the conclave that took place on the Monday?
PROFESSOR GORDON: Correct.

MS SZYDZIK: Have you had an opportunity to consider this graph or certainly the data - I know that you noted some differences between the data that is recorded on here and that that's included in the tables separately. That

.DTI:MB/TB 22/10/15 829 BY MS SZYDZIK Hazelwood JOHNSTON/McCLOUD/ARMSTRONG/BARNETT/FLANDER/GORDON 1 suggests that you have certainly had a look at this
2 dataset. Are you able to comment upon it to any greater
3 extent?

4 PROFESSOR GORDON: Yes.

5 MS SZYDZIK: Please do.

PROFESSOR GORDON: First of all, there is this minor issue 6 7 about discrepancy with the data. We really only discussed 8 that aspect very briefly on Monday, and I'm sure that if Dr McCloud and I could talk about it sensibly we would get 9 10 to a resolution of that. I'm reading the data off the graph, and perhaps for the record it's worth doing that, 11 there's only seven numbers, as being 79 - this is for 12 13 2009, the dots I'm referring to here, 79, 59, 61, 67, 61, 83 and 77. There's a discrepancy in two places there with 14 the table at tab 53, namely for 2009, the discrepancy of 15 16 one death and for 2013 also a discrepancy of one death. 17 In particular, 2013 in the table says 62. I find it very hard to believe on that graph that 2013 and 2011 represent 18 19 different numbers, but - - -

20 MS SZYDZIK: They certainly look the same.

21 PROFESSOR GORDON: Okay. I have done some analysis of this 22 which leads to my view that it's not at all - it's entirely consistent with what we were discussing at 23 24 Morwell, essentially, and the inclusion of 2015 doesn't 25 change that much. At Morwell one of the things we were doing was comparing 2014 to 2009 to 2013, looking at the 26 27 months of February and March. There's a difference here 28 because we are now restricting to the fire period, so you 29 expect to get slightly different results. So, if you do that, then on the figures that I have quoted you have 83 30 deaths in 2014 and you have an average of 65.4 deaths from 31

.DTI:MB/TB 22/10/15 830 BY MS SZYDZIK Hazelwood JOHNSTON/McCLOUD/ARMSTRONG/BARNETT/FLANDER/GORDON 1 2009 to 2013.

But, again, this is quite sort of similar to the analyses that I was doing in my first report, which in turn went back to the work of Dr Flander and the figures quoted in the first report of Dr Flander and Professor English.

7 So if you do that you get a relative risk of 8 1.27. That's essentially just the ratio of 83 to 65.4. 9 If you include 2015 in the comparison group, the relative 10 risk becomes 1.23. They are both similar to, slightly 11 higher than, the corresponding figure that we were 12 discussing at Morwell, which I believe was 1.20 for 13 February and March.

The analyses are quite different. They adjust 14 15 for other factors and so on. But in my view the essential 16 sort of point estimate there will be driven largely by the numbers of deaths. That's what's driving the whole thing, 17 really. You do expect adjustment for other things such as 18 19 temperature and so on to make a difference. But it will 20 be largely driven by that. Therefore, I don't find it surprising that the relative risks obtained in this very 21 22 crude way aligned with the ones we were discussing in Morwell for the whole of February and March. They are a 23 bit different, but there's obviously explanations for 24 25 that.

26 MS SZYDZIK: So they are the relative risks for those periods 27 separately?

28 PROFESSOR GORDON: Yes.

29 MS SZYDZIK: Were you also able to take that separate step or 30 that additional step then to work out the P-values as well 31 for those different periods?

.DTI:MB/TB 22/10/15 831 BY MS SZYDZIK Hazelwood JOHNSTON/McCLOUD/ARMSTRONG/BARNETT/FLANDER/GORDON PROFESSOR GORDON: Yes. So, assuming just Poisson variation in the usual way that we have all discussed, the 2014 versus 2009 to 2013 comparison, that is omitting 2015, gives a P-value of 0.053.

5 MS SZYDZIK: Sorry, so that's 2009 to 2013 compared to 2014,
6 not taking into account 2015?

7 PROFESSOR GORDON: That's right. 0.053, and 2014 versus 2009 8 to 2013 and 2015, so now including 2015 in the comparison 9 group, 0.083.

10 MS SZYDZIK: I see.

PROFESSOR GORDON: Again, they are within the ballpark of what we were talking about at Morwell for the whole of February and March. So I don't find any of this surprising. In my mind, it is essentially consistent with the results that we were discussing at Morwell and my own findings in my first report.

MS SZYDZIK: Then just following on from that, even if we were to incorporate 2015 into the analysis, from what you just said it seems to me that that would not change the conclusions that you have reached to date?

21 PROFESSOR GORDON: That's correct .

22 MS SZYDZIK: Professor Gordon, just one other question in relation to the CSIRO modelling that you were asked some 23 questions about. In particular you indicated in answer to 24 25 some questions from my learned friend Mr Neal that you were not concerned by what could seem to be differences 26 27 between an analysis according to this model and a postcode 28 based analysis. I wasn't quite sure if I caught your answer fully on that. Could you just clarify for us why 29 that is so? 30

31 PROFESSOR GORDON: I'm not quite sure what - I may have said

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I'm not concerned. But, to be clear about that, it would 1 2 be desirable to do it in terms of the actual exposure experienced. I doubt very much whether that's feasible, 3 for reasons of practically geo-coding residents and where 4 5 people live in relation to the contour map shown in those levels of exposure. That's a common situation in 6 7 epidemiology. We resort to proxies for what would be the 8 ideal.

9 Having said that, the 3825 postcode in particular 10 at face value looks like there's a problem because there's such a large area that is not within the contour map of 11 12 the exposure. I'm talking about the area that includes 13 Tanjil and Walhalla and Jericho. From what I know, I'm not terribly concerned about that because I believe the 14 15 greatest concentration of people in that postcode is in 16 the town or city - I'm not sure which it is - of Moe, down 17 the south end of that postcode, and so the inclusion of that extra area is unlikely to affect the results much 18 19 because a relatively small fraction of the total postcode 20 population is in that large area.

MS SZYDZIK: So, without specific knowledge also, though, of the population concentration within these particular postcodes, that comment may or may not - we don't know without the data, but apply equally to any of the other suburbs, in fact?

26 PROFESSOR GORDON: That's right. The other point I would make 27 is the theory tells you that misclassification of exposure 28 is likely to lead to a result that is closer to the null 29 hypothesis result, so effectively reduce - the expectation 30 is that it would lead to a reduction of the relative risk 31 as a general rule, if you are using a proxy which is not

.DTI:MB/TB 22/10/15 833 BY MS SZYDZIK Hazelwood JOHNSTON/McCLOUD/ARMSTRONG/BARNETT/FLANDER/GORDON properly capturing the exposure. So given that, if we are using a proxy that is like that and we find a relative risk of the size indicated, the general expectation would be that a more refined analysis, if it could be done, would increase the relative risk.

6 MS SZYDZIK: I will just repeat that back to you in the way 7 that I understand it to make sure that I do. So if we are 8 capturing a set of data that is a population that is 9 unaffected by the pollution event, then we are in effect 10 diluting the relative risk that would otherwise be

11 observed?

PROFESSOR GORDON: Yes, that's the general expectation, if the exposure you are using is a proxy for the better measured exposure.

MS SZYDZIK: I see. Thank you. Professor Armstrong, just 15 16 going back to you for a moment, and I want to change topics now to an observation that you made about some 17 studies showing lasting effects of a pollution event. 18 19 I just wanted to show you a report that has been tendered 20 in this Inquiry, not by somebody who has appeared, and that is the report of Dr Burdon. I will just make sure 21 22 that it can be shown up. If it assists, it is exhibit 32. It was tab 16 of the Inquiry book for the first hearings. 23 24 It is page 7 of that report.

Before we go to that page, I might just go back to the front so that you can see the details of Dr Burdon before we move to the substance of that part of his opinion. You can see that this particular report is focused on respiratory effects. Now obviously we have been speaking about effects that go beyond respiratory effects. So please be mindful that his comments are

.DTI:MB/TB 22/10/15 834 BY MS SZYDZIK Hazelwood JOHNSTON/McCLOUD/ARMSTRONG/BARNETT/FLANDER/GORDON specific to that. But then you can see his
gualifications - - -

MR NEAL: Can I apologise but I do have to rise at this point. 3 My concern is this: the deploying of this report was 4 5 something that was I think in the offing at the last hearing, and an agreement was struck that this was a 6 7 substantive witness and that either the witness needed to 8 be called or the report would not be tendered. That's my 9 understanding. It is now being deployed in this hearing. I don't say that there is anything wrong from Counsel 10 Assisting's point of view, but it is contrary to that very 11 12 express understanding.

13 CHAIRMAN: I have a recollection of a report of Dr Burdon, but 14 I have no recollection of any reference. 15 MR NEAL: I don't want to talk out of school, Mr Chairman.

16 CHAIRMAN: You will get no help from this end. I look to 17 Counsel Assisting.

MR ROZEN: I must say I do recall a discussion about this, and 18 19 I'm not sure what the precise terms of it were. My recollection is a bit hazy. But it was tendered. That's 20 21 the reality. It is exhibit 32. It was tendered without 22 objection at the conclusion of the hearing. For Counsel Assisting's part, we don't place any particular weight on 23 it. But, it being an exhibit, I'm not sure that other 24 25 counsel can be prevented from examining on it.

26 MR NEAL: I don't want to embarrass either my learned friend or 27 myself, because this was a conversation that we had. My 28 understanding was we had a concern about the content of 29 that report. It's by far - - -

30 CHAIRMAN: Are you talking about a conversation between Counsel 31 Assisting and yourself - - -

.DTI:MB/TB 22/10/15 835 BY MS SZYDZIK Hazelwood JOHNSTON/McCLOUD/ARMSTRONG/BARNETT/FLANDER/GORDON 1 MR NEAL: Yes.

2 CHAIRMAN: Or that's on the transcript?

MR NEAL: No, no, not on the transcript. When it was in the 3 4 offing that that report might be tendered, after some 5 conversation it was agreed - because the objection that we were taking, no, that's quite a substantive document, that 6 7 should not be tendered unless that witness is being produced for cross-examination. The resolution of that 8 was it would not be relied upon and therefore that witness 9 10 would not be called.

11 CHAIRMAN: But why was it then tendered? I'm puzzled by the 12 comment made by Mr Rozen that it finished up as an 13 exhibit, which means it was tendered. That doesn't seem 14 consistent with your position.

MR NEAL: It is not inconsistent with the position he just put 15 16 to you, which I think was that it should not go into 17 evidence but it seemed it might have. I think it was very clear that we said, "We are concerned about the contents 18 19 of that document. If the author of that document is 20 called to give evidence, then so be it. But we would insist upon that happening if you are to rely on the 21 22 report." I think we had, with respect, a clear 23 understanding - - -

CHAIRMAN: I think we will proceed with the questioning, and we will then in effect put the matter on hold. When the matter is resolved you can deal with the matter as appropriate after this hearing today. But we have so many witnesses that will be tied up, I'm going to in effect segregate what follows so the matter can be the subject of further investigation at a later stage.

31 MR NEAL: Mr Chairman, you are proposing that it may be that it

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needs to be completely struck from the transcript? 1 2 CHAIRMAN: It may be, yes. That's really what I'm saying. We are going to treat it as a matter in isolation. 3 MS SZYDZIK: Thank you. If I could now ask that we move down 4 5 to page 7 of that report and the second paragraph. 6 Professor Armstrong, I understand that you will not have 7 had an opportunity to read this at all thoroughly. Ιt 8 deals with the same issue that I flagged a moment ago, 9 that is the lasting effects of a pollution event or indeed 10 any exposure event.

Could I ask that you quickly just have a read 11 through that and let me know when you have done so. 12 13 EMERITUS PROFESSOR ARMSTRONG: Let me say that, having read that, it seems - it's consistent with my understanding of 14 15 that subject matter. But, as I think I have previously 16 said, that is not an area of primary expertise of mine and in fact it's one that Dr Johnston would be much more 17 capable of responding to than I would be. 18

19 MS SZYDZIK: Thank you. Dr Johnston, if I could then turn to 20 you and ask you some questions about that same issue. You 21 were asked some questions by my friend Mr Blanden 22 specifically on this issue. As I understood your evidence, and so please correct me if I'm wrong, you noted 23 that as far as smoke studies go you had not seen that 24 25 there was evidence of long-term effects, and so we are talking beyond the lag period of a few days or even a few 26 27 weeks, and also that you were not aware of any studies 28 showing an increase in mortality, but that is specific to 29 there not being any studies as opposed to a first principles analysis of the health effects. Would you 30 agree with the kind of analysis that you can see in front 31

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of you in Dr Burdon's report?

2 DR JOHNSTON: Yes, this is the first time I have seen this. What I would say is that this could well be a clinical 3 observation, and it's a plausible clinical observation. 4 5 When it comes to smoke events the biggest impact on community health we see, if we are not talking deaths, we 6 are talking illness, the biggest impact we see is on the 7 respiratory diseases, and disease and exacerbation of 8 those diseases that may take some time to resolve is 9 entirely plausible and clinically possible. 10

When we look at deaths we don't tend to see that. So from clinical observations in some patients to what you might see at a population level with a study, I'm not sure how common this would be and whether it would actually drive a change in mortality when the biggest impact on mortality is cardiovascular disease.

MS SZYDZIK: But certainly it would seem that if we were to take a situation where somebody was susceptible because of a particular underlying condition and that then is aggravated, that perhaps not for all but probably for some there's a real risk that they may never go back to the state of health that they were in before the event; would you agree with that?

24 DR JOHNSTON: It could be theoretically possible. I think it 25 would be unusual, but it could be possible in an 26 individual case, certainly.

MS SZYDZIK: Thank you. Dr Johnston, I just have some other questions for you in relation to the meta-analysis that you set out in both your email and also your report. MR ROZEN: I'm very sorry to interrupt my learned friend's examination, but Professor Gordon has a previous

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commitment and I understand there is no further questions 1 2 of him by my learned friend and I won't have any in re-examination. So if he could be excused. 3 CHAIRMAN: If that's the position, I just accept that's the 4 5 position and, yes, thank you, Professor Gordon, you can 6 qo. 7 PROFESSOR GORDON: Thank you very much. It's much appreciated. 8 < (THE WITNESS WITHDREW) 9 CHAIRMAN: Sorry, I haven't included Mr Attiwill or Mr Ray, but 10 I have made a certain assumption that that's appropriate and you would have objected if there had been anything 11 12 otherwise. Thank you. 13 MS SZYDZIK: Dr Johnston, you were being asked some questions 14 earlier and you were making some comments about the, 15 I think the word that you used was, mismatch between what 16 the meta-analysis might show as compared to the relative 17 risk that is observed in this particular dataset. So I want to ask you some questions about that. 18 19 One of the observations that you made, as 20 I recall, in your evidence earlier about that meta-analysis is that there needs to be caution in 21 22 applying that to this particular circumstance. Am I accurately describing your position on that? 23 24 DR JOHNSTON: Yes, you are. 25 MS SZYDZIK: One of the particular reasons, again as I understood your evidence but please correct me if I'm 26 27 wrong, that caution needs to be exercised is because the 28 focus of that meta-analysis was on short-term health 29 impacts, short-term exposure and then responses to that short-term exposure, whereas that's not the situation that 30 we have here? 31

.DTI:MB/TB 22/10/15 839 BY MS SZYDZIK Hazelwood JOHNSTON/McCLOUD/ARMSTRONG/BARNETT/FLANDER DR JOHNSTON: Yes, there's far less evidence about exposures of
 weeks rather than days. But where we have that evidence
 it's actually consistent with the meta-analysis.
 MS SZYDZIK: When applying cautiously that particular risk

5 ratio of 1.04 per cent to this particular dataset, one of 6 the further comments that you made was that it's common 7 for small datasets to show a divergence from what might be 8 expected across a larger broader population; am I again 9 characterising that correctly?

10 DR JOHNSTON: You are, yes.

MS SZYDZIK: Thank you. So one of the reasons, as I understand 11 12 it, was, as you articulated, that there might be a 13 particular health profile of the population, which, as you said, this particular area had a reduced health profile or 14 15 a decreased health profile, but others might include, for 16 example, the nature of the exposure itself. So exposure to urban pollution by, say, office workers will be 17 qualitatively and - well, probably more quantitatively 18 19 different to, say, individuals who are working outside in 20 a regional area with a mine fire; would you agree with 21 that?

22 DR JOHNSTON: Yes, I would.

23 MS SZYDZIK: There are also differences where you may have a 24 constant baseline of an exposure, for example, in urban 25 pollution contrasted with the type of event we have here, 26 which is peaks of events over time with some high exposure 27 and certainly a number of exposures that are above what's 28 considered to be the standard for PM2.5, 25 micrograms per 29 cubic metre?

30 DR JOHNSTON: Yes.

31 MS SZYDZIK: Turning to your report, which I will just get

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the - do you have your report in front of you, sorry?
 DR JOHNSTON: Yes.

MS SZYDZIK: I was just wanting to seek some clarification about some of the data that you have relied upon. I'm looking now at table 1. You have set out Morwell South and then Morwell North, which you have put in brackets as Morwell East, which is how it is described in the monitoring, then Traralgon, Moe and Churchill.

9 The focus of my questions is going to be on 10 Morwell South. If you look across to the fourth column you will see that both best estimate and worst case are 11 12 footnoted, and the footnotes there specify that there are 13 no data for the first five days of the mine fire. Those footnotes are used for both the Morwell East and then also 14 15 the Morwell South monitoring. There was a difference 16 between those two monitoring stations, and so I will just 17 take you to that data.

It's located within the report of the first 18 19 Inquiry, and the page is 277. If I could ask that that be 20 brought up. If we could just scroll down a little so we could see the bottom of the graph. It's a little 21 22 difficult to - maybe scroll up a little so you can see the top of that peak. So for Morwell South, which is the 23 24 black line, you will see that that starts on 21 February, 25 which is - so the mine fire starts on the 9th, and the monitoring at Morwell South commences on the 21st. So 26 27 rather than five days, as we have in your report, that's 28 12 days. Would you agree with that? 29 DR JOHNSTON: From the 9th to the 13th? Sorry, can you say

30 that again?

31 MS SZYDZIK: For Morwell South, which is the black line, the

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monitoring doesn't start until the 21st? 1 2 DR JOHNSTON: Yes. But there's indicative data. MS SZYDZIK: There is. 3 4 DR JOHNSTON: From the south of the railway line that it was 5 based upon. So in your report there you are relying 6 MS SZYDZIK: Sure. upon the indicative data as opposed to the actual measured 7 data; is that right? 8 DR JOHNSTON: Yes. I used the data that was available to me, 9 10 and that was the data measured - - -MS SZYDZIK: Okay. So if we look at the best estimate and the 11 worst case, the numbers are 103 and 156, so that's an 12 13 average taking into account that peak there of over 700 being the indicative data; is that right? 14 DR JOHNSTON: Yes, that's included. 15 16 MS SZYDZIK: Just one further matter briefly, Dr Johnston, and 17 this arises from your email to Professor Catford dated 13 October. It's just relating to the comparison that you 18 19 make between the burning that takes place in 2013 both by 20 bushfire and also planned burning, and then the observations around the pollution resulting from the mine 21 22 fire. If I could ask that the controller scroll down to what are described as figures 2 and 3. Is it possible to 23 24 put that side by side on the screen with the same table 25 that we were just looking at from the Inquiry? No. We might have to switch back between them, then. Can we 26 27 focus in on the PM2.5 graph in particular? Perhaps not. 28 I will make the point without being able to show 29 it with the graphs side by side. If you zoom into the PM2.5, it has some peaks, it's estimated, not measured, 30 but there are certainly some peaks there that go above the 31

.DTI:MB/TB 22/10/15 842 BY MS SZYDZIK Hazelwood JOHNSTON/McCLOUD/ARMSTRONG/BARNETT/FLANDER 1 25 standard. But as you will see - please correct me if 2 I'm wrong - the majority of that data for Traralgon is 3 well below the 25 micrograms per cubic metre standard; is 4 that right?

5 DR JOHNSTON: Yes, that is right.

MS SZYDZIK: If we could just flick across now to the Inquiry 6 7 report again, page 277, what we can see in relation to this particular graph - and let's look at, say, the blue 8 solid line, which is Morwell - sorry, let's look at 9 Traralgon, indicative Traralgon, it's the orange dotted 10 line. It has in that short period five peaks at least 11 that go above the 25 micrograms per cubic metre threshold 12 13 and then sits at around that line for quite a significant period of that time; would you agree? 14

15 DR JOHNSTON: Yes.

16 MS SZYDZIK: So it then involves a sustained exposure above that 25 threshold, and that is a point of difference to 17 what is observed in 2013; would you agree? 18 19 DR JOHNSTON: There were peaks above in both years. In that 20 email I was more drawing on the PM10 data available in the public domain. I was more referring to that than the 21 22 PM2.5. I take your point about the PM2.5. MS SZYDZIK: If we go to PM10 I would suggest that the same 23 24 pattern is in fact there. So, if we stay in the Inquiry 25 report but go down to page 280, what we can see is that we again have for at least half of that period the level of 26 27 PM10 being sustained at around the threshold level, which 28 is here 50 micrograms per cubic metre. Would you agree 29 with that?

30 DR JOHNSTON: I believe there were four days when it exceeded 31 the threshold, and it hovered around for that week, yes.

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MS SZYDZIK: Just looking at that graph I would say that 1 there's more than four. I can see at least six peaks 2 there. But, in any event, it is hovering around that 3 4 line. Going then back to the email and the graph that's 5 extracted there - and so this is PM10, so it's the bottom 6 one - again, there are two peaks, but otherwise by and large when we are looking at Traralgon, which is the pink 7 one, it's significantly below that 50 micrograms per cubic 8 metre threshold; would you agree? 9 10 DR JOHNSTON: Yes. The peaks, the larger peak, but yes. MS SZYDZIK: No further questions. 11 12 CHAIRMAN: I take it, Mr Attiwill, Mr Ray, you have no 13 questions? MR RAY: That's quite correct, Your Honour. 14 MR ATTIWILL: That's so. 15 16 CHAIRMAN: Mr Rozen. 17 MR NEAL: Perhaps before he does that, sir, a quick mea culpa. The previous objection, it turns out we did have exactly 18 19 the agreement that I was talking about, it was just in 20 relation to another witness. 21 CHAIRMAN: Okay. 22 MR NEAL: My apologies. MR ROZEN: I'm grateful for that apology. It had me worried. 23 24 I think all just a result of a genuine misunderstanding. 25 CHAIRMAN: Yes. 26 MR ROZEN: I will be very brief in re-examination. 27 CHAIRMAN: Good. 28 <RE-EXAMINED BY MR ROZEN: 29 MR ROZEN: I knew you would appreciate that, sir. Could I start with a question for you, Dr Johnston, please. You 30 have told us that there are fewer studies that have looked 31

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at exposure over weeks to PM2.5 than either long-term 1 2 exposure or short-term exposure; is that correct? DR JOHNSTON: Correct. Yes, that's correct. 3 4 MR ROZEN: At the previous Inquiry one witness, Dr Torre, an 5 employee of the EPA, told the Inquiry there was a knowledge gap in that middle period, knowledge gap in 6 7 understanding the health effects of exposure over that period of weeks, particularly to smoke and ash from a coal 8

9 mine fire. Do you agree with that, that there is

10 something of a knowledge gap?

11 DR JOHNSTON: Yes, I would agree with that. There is some 12 evidence, but it is very limited.

MR ROZEN: I wonder if one explanation for the apparent misfit between the data we have about mortality rates in 2014 on the one hand and the literature on the other hand is that the literature is not necessarily applicable to this fact situation?

DR JOHNSTON: There are some studies of peat fires that go for similar durations, so we do have some evidence about this kind of duration, and where we have that kind of evidence it's consistent with the wider meta-analysis on particles. So there's no evidence to suggest it would be dramatically any different.

24 MR ROZEN: Professor Armstrong has to go, as previously

25 indicated. I have no questions for him and am quite happy 26 for him to be released.

27 CHAIRMAN: Thank you, Professor Armstrong. We do appreciate 28 your having endured what you have from afar and you may 29 go.

30 EMERITUS PROFESSOR ARMSTRONG: Thank you.

31 < (THE WITNESS WITHDREW)

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MR ROZEN: Is the knowledge gap, if that's what we can call it, about the type of exposure that we are here examining a gap that might potentially be filled by the long-term health study, Dr Johnston?

5 DR JOHNSTON: There's gaps in terms of understanding short-term 6 consequences of such exposures and there's gaps in 7 understanding long-term. So the matter before us today is 8 more about short-term during the event, and the matter 9 being addressed by the long-term health study is long-term 10 consequences of this particular exposure. So it will 11 address some of the gaps, but not all of them.

12 MR ROZEN: We need to be careful with long- and short-term.

13 There is long-term exposure and there is long-term effect.
14 They are different things, obviously.

15 DR JOHNSTON: Yes.

MR ROZEN: What the long-term health study will be looking at is long-term effects of exposure during this period of weeks?

19 DR JOHNSTON: Correct.

20 MR ROZEN: The reason I'm asking you these questions, it really 21 arises from the 2015 data and the observation that 22 Professor Armstrong made, which is that it's possible that the increase in deaths in 2015 might in some way be 23 attributable to exposure during the mine fire in February 24 25 and March 2014. I understand your evidence to be that that's not - that wouldn't be consistent with the 26 27 literature? 28 DR JOHNSTON: Yes, I'm not aware of any evidence that would

29 support that.

30 MR ROZEN: The reason I'm asking you about the long-term health 31 study is it might assist in our understanding of that one

.DTI:MB/TB 22/10/15 846 Hazelwood JOHNSTON, way or the other; is that a fair observation?
 DR JOHNSTON: Yes, that is a fair observation, yes.
 MR ROZEN: Thank you. They are the only questions I have in
 re-examination. I don't have anything for any of the
 other witnesses.

What I would like to do, though, whilst I'm on my 6 feet is just deal with something that has arisen in 7 questioning. It may just be a misunderstanding about the 8 9 provision of the 2015 mortality data to the experts. The record - and it is in exhibit 40, if anyone wants to look 10 at it, but the exhibit 40JJ through to MM, so there are 11 four letters there that were sent to the experts, and that 12 13 was on 16 October, so last Friday. Those letters attached the 2015 mortality data. I would concede that it was 14 15 amongst a number of other things that were provided to 16 them, and that they were obviously provided not long 17 before the meeting on Monday. But the data was provided. That concludes the evidence. 18

19 CHAIRMAN: What is the position in relation to submissions? 20 The position in relation to submissions that has MR ROZEN: 21 been communicated to the parties is Counsel Assisting will 22 provide submissions to the Board and to the parties by midday on Monday, 26 October - I'm being told 10 am, 10 am 23 24 on Monday. Ms Stansen is always right. That's the one 25 rule I understand.

The expectation is the parties will respond to those submissions by 5 pm on Tuesday, the 27th. What's proposed, sir, subject of course to the Board, is that that all be done in writing and that there be no further hearing.

31 CHAIRMAN: That's all from your end?

.DTI:MB/TB 22/10/15 847 Hazelwood 1 MR ROZEN: That's it from my end, sir.

2 CHAIRMAN: It only remains for me to - - -

MS BURGESS: I'm sorry, Mr Chairman, I thought perhaps some 3 tendering was going to take place. But, if not, we have 4 5 some further documents that for the sake of completeness we would like to tender. But I don't want to - I'm just 6 7 being told everything in the folder has been tendered. So 8 that's the final tender list that was sent yesterday 9 evening. If I may then supplement that with some further documents which we think - - -10

11 CHAIRMAN: Can you confer with Counsel Assisting because - - 12 MS BURGESS: I have not had an opportunity to do that yet. It
13 wouldn't take very long. I could just read them onto the
14 transcript or we could agree them.

15 CHAIRMAN: You are taking everyone by surprise by saying in

16 effect you want to tender documents that they haven't had 17 the opportunity of seeing.

MS BURGESS: Everyone has seen them. These are documents that are emails that have been between the parties, emails from Ms Stansen to Associate Professor Barnett, emails between Dr Johnston and Ms Stansen - - -

22 CHAIRMAN: Before you go any further, could you just

23 confer with - - -

24 MR ROZEN: Could I suggest that - we suspect that a number of 25 these emails are already in exhibit 40, and to the extent 26 that they are not then we will confer about them and 27 perhaps they can supplement exhibit 40.

28 CHAIRMAN: It seems to me that it's impossible to resolve this 29 satisfactorily without in effect those counsel remaining 30 after we adjourn it on the basis that if there is

31 agreement that certain matters should be in that haven't

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.DTI:MB/TB 22/10/15 Hazelwood 1 already been put in they will be included, but otherwise
2 that will not happen.

3 MR ROZEN: I'm quite content to do it on that basis, and 4 I'd ask people to stay behind and we will have that 5 discussion.

6 CHAIRMAN: Do you follow; that in effect they will be excluded
7 if there is no previous justification in the light of what
8 has been put in for them going in?

9 MR ROZEN: Thank you, sir.

10 CHAIRMAN: I hope it only remains for me to thank people who 11 have shown the stamina to get this far in the day. The 12 combination of giving expert evidence is trying enough in 13 itself, not only for the experts, I might say, but also for those involved in questioning them and listening to 14 15 them, but it is a very valuable exercise. I will now 16 refrain from calling it hot-tubbing, as I used to, and 17 call it a conclave of experts. Thank you, all members of 18 the conclave, including those who have now gone, because 19 it really has been helpful from our point of view to have 20 the proceedings conducted in the way that they have been 21 proceeding.

22 I otherwise thank - as I explained earlier, 23 there's been a lot of dislocation for a lot of people, and that is regrettable, but in the circumstances I think we 24 25 have finished up with a result that is as good as could be expected in all the circumstances. So making it very 26 27 clear that this is a very definite conclusion of the 28 position as to term of reference 6. We will now adjourn. 29 < (THE WITNESSES WITHDREW)

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