TRANSCRIPT OF PROCEEDINGS

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2015/16 HAZELWOOD MINE FIRE INQUIRY

MELBOURNE

THURSDAY, 10 DECEMBER 2015

THE HONOURABLE BERNARD TEAGUE AO - Chairman

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

MS RACHEL DOYLE SC - GDF Suez Australian Energy

MS MARITA FOLEY - GDF Suez Australian Energy

MR MATTHEW COLLINS QC - Energy Australia Yallourn

MS EMILY LATIF - Energy Australia Yallourn

MS JULIET FORSYTH - AGL Loy Yang

MS LISA NICHOLS - Environment Victoria

MS EMMA PEPPLER - Environment Victoria

CHAIRMAN: Yes, Mr Rozen.

MR ROZEN: Thank you, sir. Perhaps just reminding the parties that Professor Catford has been unavoidably detained this morning. We are expecting him I think at 11 is the indication.

If the Board pleases, the first witnesses have been kind enough to find their seats in what is a very large panel, as we can see, the mine expert panel. Perhaps if they could first be sworn in and then questioning can commence.

<RAE MACKAY, sworn and examined:

<JAMES MAURICE GALVIN, affirmed and examined:

<TIMOTHY DANIEL SULLIVAN, sworn and examined:

<CHARLES BENJAMIN SPIERS, sworn and examined:

<GREGORY PETER HOXLEY, sworn and examined:

<CHRIS MICHAEL HABERFIELD, affirmed and examined:

<CLINTON DAVID MCCULLOUGH, affirmed and examined:

MR ROZEN: A couple of housekeeping matters, if I could, please, from the transcribers. They have made a special request that you do your very best not to talk over each other. I'm not suggesting you will. I can't imagine you would, but just in case anyone is tempted to talk over anyone else, please don't. It makes it very difficult for the transcribers.

The second thing, and once again I don't think I need to ask you to do this, but can you please keep your voices up. We don't have quite enough microphones, so you are having to share, but if you keep your voices up so everyone in what is a large room can hear you.

What I propose to do, the order that I'm going to question you in, is to just ask each of you individually a

number of questions about your role here and the report or reports that you have provided to parties for the Board or to the Board itself and then I'm going to take you to the joint report that each of you signed, or each other than I think Mr Spiers, and then questions will rove over some general matters and they may be directed to individuals or I may direct questions to the panel and amongst yourselves you may decide who is best place to answer them, at least initially.

Once I finish questioning you, then there are other counsel in the room, as is obvious to you, who have indicated to the Board that they want to ask the panel some questions as well. The anticipation is that that process will probably take most of today. We all understand that you have commitments and that at least some of you have to be away at close of business today. So we will do our very best to accommodate that.

In no particular order, could I start with Professor Galvin, if I could, please. Can I confirm that you have provided a witness statement to the Board and for our purposes that is found behind tab 13, folder 10, and you should I hope have a copy of that in front of you, Professor Galvin.

PROFESSOR GALVIN: I do.

MR ROZEN: Have you had an opportunity to read through your statement before coming along and giving evidence today?

PROFESSOR GALVIN: Yes.

MR ROZEN: Is there anything you wish to change in your statement?

PROFESSOR GALVIN: Yes.

MR ROZEN: Can you direct me to that, please?

PROFESSOR GALVIN: Point 3, "Under the TRB's original terms of reference the advice covered", it is missing one of the terms of reference which you will find in the first two annual reports of the TRB that are attached. It is missing a term of reference covering work plans.

MR ROZEN: Can we do that by going to the first of the annual reports? Is that the easiest way to do it? For our purposes that's at a page number ending in 14, the Technical Review Board annual report 2011/2012. We all find the terms of reference on page 16 under the heading "Executive summary", which is the third page of that document.

PROFESSOR GALVIN: If I can go to page 21 of that document, and subsequently page 44. Both those pages have item (c), "Work plans. Assess work plans and variations to work plans and provide written advice to the department," et cetera. That term of reference was there for the first three or four years of the TRB's term and you will find it's missing from the third annual report that I have attached.

MR ROZEN: In terms of the correction to your statement, if we go back to page 2 of your statement, please. You will see the second dot point deals with the term of reference concerning stability reports.

PROFESSOR GALVIN: Yes.

MR ROZEN: You would seek, would you, to insert (c) work plans and everything that we see in the annual report setting out that term of reference at that point in the statement?

PROFESSOR GALVIN: It is inserted between what is currently (b) and (c).

MR ROZEN: Yes, and (c) would become (d).

PROFESSOR GALVIN: Something like that.
MR ROZEN: That will work.
PROFESSOR GALVIN: That's good enough, yes.
MR ROZEN: Just in relation to that, I'm already going off track, but are we to understand you to be saying that at some point in time that term of reference was removed from the board?
PROFESSOR GALVIN: Yes.
MR ROZEN: When was that?
PROFESSOR GALVIN: Specifically I don't know, but it's not in the annual report that starts September 2013. My memory is I think - and those annual reports coincide with the appointment of the board. So, it's formally been taken out at the end of the August - the board whose term was up at the end of August 2013 worked with that term of reference. The new board didn't have that term of reference.
MR ROZEN: I understand. Are you able to assist the Board at all with why it was removed? Obviously it was the government that did it, but do you have any insight as to why that was taken out of the terms of reference?
PROFESSOR GALVIN: It would only be conjecture.
MR ROZEN: I won't ask you to speculate. Can I ask you this, though. We do know that, despite that, the board has been asked to consider as recently as October of this year a revised work plan for the Loy Yang Mine. How is it that the board is still doing that work despite the term of reference being removed?
PROFESSOR GALVIN: When the term of reference was removed, the board didn't look at any more work plans or work plan variations. However, (b) you could still argue perhaps

that term of reference (b) still captures it because we are asked to still advise on mine and quarry stability. This year in the last few months we have had quite an involvement in aspects of the quarry sector, which required us to start and think again about work plans. However, I think what has triggered it now is the department is undergoing a reform process. People who looked after these areas in the past are no longer there. New people now don't have a mining background. The work that you are talking about was referred to the board at very short notice by new people for us to comment on what we thought of that work plan application. So that's the first work plan or work plan variation that the board has looked at since about February 2012.

MR ROZEN: It is probably an opportune time to ask you, Professor Sullivan. Am I right you were chair of the board at the time this term of reference was removed? Do I have the timing right? No, it was already Professor Galvin.

PROFESSOR GALVIN: I was.

MR ROZEN: Are you able to shed any light on its removal?

PROFESSOR SULLIVAN: It would only be conjecture.

MR ROZEN: I won't ask you to do that. We have managed to get seriously off track. I was merely asking you whether you wanted to make any changes to your statement. That's the one you have identified. Is that the only one?

PROFESSOR GALVIN: Yes.

MR ROZEN: With that change, are the contents of your statement true and correct?

PROFESSOR GALVIN: They are.

MR ROZEN: I tender the statement.

#EXHIBIT 17 - Statement of Professor Jim Galvin.

MR ROZEN: Before leaving that statement, Professor Galvin, can I go briefly to your CV which we find at page 10 of the statement. You will see 10 at the bottom of the page. For our purposes there is a Ringtail number which ends in the digits 10. Do you have your CV there?

PROFESSOR GALVIN: Yes.

MR ROZEN: For present purposes, probably the most important aspect of your professional work is that you are the Chair of the Technical Review Board?

PROFESSOR GALVIN: That's correct.

MR ROZEN: You have been a member of the board since 2009, since its inception?

PROFESSOR GALVIN: Since its inception, yes.

MR ROZEN: You have been the Chair since 2011?

PROFESSOR GALVIN: Yes.

MR ROZEN: Have you recently been re-appointed to that position this year?

PROFESSOR GALVIN: Yes.

MR ROZEN: That's for a term of how long?

PROFESSOR GALVIN: Ten months.

MR ROZEN: For 10 months.

PROFESSOR GALVIN: It is to align with the reform work that's going on within the department that the minister has set the end of the financial year as the review point for whether the board goes forward. The minister has aligned our appointment with the reform process in the department.

MR ROZEN: You have set out in your CV helpfully for us your academic and professional qualifications which speak for themselves. You are presently Emeritus Professor of Mining Engineering at the University of New South Wales?

PROFESSOR GALVIN: Yes.
MR ROZEN: That's a position you have held since 2006?
PROFESSOR GALVIN: Yes.
MR ROZEN: You are also a fellow or member or various learned societies and they are set out on the first page. If we can go to the second page of your statement, and I just can't resist asking you about the first job you had back in 1975 as a student trucker, and I have to find out what a student trucker does.
PROFESSOR GALVIN: I have to watch my language in this room. A gofer. A gofer to the miner, an offsider to the miner.
MR ROZEN: I won't take you through each job you are held since that time, but I will note that your working career has involved a mixture of academic and mining positions at a high level; is that a fair summary?
PROFESSOR GALVIN: Yes.
MR ROZEN: In particular, you were the mine manager of the Newcom Colliery in New South Wales, or the Angus Place Colliery, rather, working for Newcom Collieries between 1988 and 1992, having worked there in various capacities from 1982 to 1992?
PROFESSOR GALVIN: Yes.
MR ROZEN: Most recently you are the managing director of Galvin & Associates Pty Ltd. You have been in that position since 1998?
PROFESSOR GALVIN: Yes.
MR ROZEN: As you explain in the last box on page 11, the company, Galvin & Associates Pty Ltd, provides mining and geotechnical engineering design, practice and auditing in general with specialist expertise in mine management, underground mine design and stability, surface subsidence,

mines rescue and emergency response.

PROFESSOR GALVIN: That's correct.

MR ROZEN: You also list a number of publications that you have either authored yourself or co-authored. I won't go through those, but they are set out in your CV.

PROFESSOR GALVIN: Are they?

MR ROZEN: Some of them are, I think. I'm sorry, no, committees and roles are set out. Thank you. Professor Galvin, before leaving the preliminaries with you, you were asked by the Board, as well as making a witness statement for us, you were also asked to consider a draft report that was prepared by Jacobs for the Board?

PROFESSOR GALVIN: Yes.

MR ROZEN: You were invited to attend a meeting involving a range of mining experts on 26 and 27 October that considered the draft Jacobs report?

PROFESSOR GALVIN: Yes.

MR ROZEN: Subsequent to that, the Board has received a final report from Jacobs and I think you have seen a copy of the Jacobs final report; is that correct?

PROFESSOR GALVIN: Yes.

MR ROZEN: Finally, on 3 December, that is last week, you met with the other members of this panel, with the exception of Mr Spiers, and you were asked by the Board to consider a range of questions with a view to producing a joint report?

PROFESSOR GALVIN: That's correct.

MR ROZEN: There should be a copy of that joint report I hope in front of you. For our purposes it is behind tab 23 in volume 11 and it has the Ringtail number EXP.0012.001.0001. Can you confirm for us, please, that

that is a copy of the joint report which bears your signature on page 11?

PROFESSOR GALVIN: Yes, it is.

MR ROZEN: By signing the document was that your indication that you agreed with its contents and that it accurately summarised the discussion that you had on 3 December?

PROFESSOR GALVIN: That's correct.

MR ROZEN: I think now might be a time to tender the joint report as well, sir.

#EXHIBIT 18 - Joint expert report.

MR ROZEN: Thanks, Professor Galvin. We will come back to you. If I could go now to Professor Rae Mackay and the statement that you provided for the Inquiry appears behind tab 15 in folder 10. Do you have a copy of that in front of you, Professor?

PROFESSOR MACKAY: I do.

MR ROZEN: It appears at WIT.0006.001.0001. They are not numbers that need to concern you, Professor, but they are for our internal purposes and for the transcript. Have you had an opportunity to read through that statement before coming along to the Inquiry today?

PROFESSOR MACKAY: I have.

MR ROZEN: Is there anything in that you would like to change?

PROFESSOR MACKAY: No.

MR ROZEN: Are the contents true and correct?

PROFESSOR MACKAY: Yes.

MR ROZEN: I tender the statement.

#EXHIBIT 19 - Statement of Professor Rae Mackay.

MR ROZEN: Professor Mackay, your CV appears at page 8 and I think wins the longest CV of the panel award, running to some 34 pages, which I won't go through in detail. Your

academic qualifications are set out at the bottom of the first page of your CV, Doctor of Philosophy in Civil Engineering and the other qualifications set out there. You currently are the Professor of Geotechnical and Hydrogeological Engineering at Federation University in Gippsland at Churchill; is that right?

PROFESSOR MACKAY: That's correct.

MR ROZEN: How long have you held that position?

PROFESSOR MACKAY: I have held it since May 2011. I should add of course it was Monash University. We transitioned to Federation University in 2014, but it is the same job.

MR ROZEN: Same job, but different employer.

PROFESSOR MACKAY: Different employer.

MR ROZEN: Before that you had quite a lengthy stint as Professor of Hydrogeology at the University of Birmingham?

PROFESSOR MACKAY: Yes.

MR ROZEN: And earlier still held a range of other academic positions in the United Kingdom in the area of hydrology and hydrogeology?

PROFESSOR MACKAY: That's correct.

MR ROZEN: Prior to your academic career you spent some time as a water resources engineer with a consulting engineering company in Cambridge in the United Kingdom?

PROFESSOR MACKAY: That's correct.

MR ROZEN: If we can go to page 10 of the statement, which is the third page of your CV, you explain your role in what has been referred to on a number of occasions as the director of GHERG, the Geotechnical and Hydrogeological Engineering Research Group?

PROFESSOR MACKAY: Yes.

MR ROZEN: Can you tell us briefly about GHERG and particularly

its relationship to the Technical Review Board, because of course you are also a member of that board as well, are you not?

PROFESSOR MACKAY: That's correct. My position as the Director of GHERG requires me to also be a member of the Technical Review Board. That's included in my personal contract with the university and that's included with the contract between the department, DEDJTR, and the university. GHERG was set up in 2010 effectively, 2009 initiated, to undertake both a development of skills in the area of geotechnical engineering and hydrogeology as well as to undertake research in support of the development of new concepts for improving stability at the three mines in the Latrobe Valley.

MR ROZEN: Now might be an opportune time to ask you, Professor Mackay, to have a look at a chart that's been prepared by the staff of the Inquiry. This doesn't have a Ringtail number, sir, but it has been distributed to the parties. I'm not sure if the Chair has a copy. Sorry, it does have a Ringtail number HMFI.1009.001.0001. You will see, Professor Mackay, that this is our attempt to explain the relationships between the board, GHERG, the department, the minister and the mines. It is intended to be of assistance to the parties and to witnesses. Does it accurately describe those interrelationships as far as you are concerned?

PROFESSOR MACKAY: There is essentially probably a greater degree of separation between GHERG and the Technical Review Board. In commencing my role on the Technical Review Board I made a commitment that information that was provided to me through the Technical Review Board would

not naturally end up as part of the information that would be used by GHERG staff unless explicitly agreed by the mines. But other than that it's a fair reflection.

MR ROZEN: With that caveat, and I should perhaps ask you as the chair of the board, Professor Galvin, do you agree with that observation about the chart, if you can see it there, if I can ask you to look at it briefly, please?

PROFESSOR GALVIN: Yes, I have no problem with it.

MR ROZEN: Thank you. Perhaps I will tender the chart, if I could, please.

#EXHIBIT 20 - Chart.

MR ROZEN: Your witness statement includes at page 35, immediately after your CV, Professor Mackay, a document headed "GHERG overview notes". If I could ask you to turn to that. It ends in 0035.

PROFESSOR MACKAY: Yes.

MR ROZEN: Are you familiar with that document?

PROFESSOR MACKAY: I am.

MR ROZEN: Is that a document you are the author of?

PROFESSOR MACKAY: I am.

MR ROZEN: Does that accurately set out in perhaps a little bit more detail the role of GHERG and its responsibilities?

PROFESSOR MACKAY: Yes, it sets out the background to its development. It sets out the programs of research that are being undertaken.

MR ROZEN: Without repeating the questions that I just asked Professor Galvin about, his role in reviewing the draft Jacobs report, attending the October meeting and attending the December meeting and signing the joint report, do you agree that you did all of those things as well?

PROFESSOR MACKAY: That is correct.

MR ROZEN: Are you satisfied that your report accurately reflects the deliberations of that meeting?
PROFESSOR MACKAY: I am.
MR ROZEN: Thank you. If I could move down to the other end of the table and turn to you, Dr Haberfield, please. Have you prepared a report which was provided to the solicitors King & Wood Mallesons acting on what behalf of GDF Suez?
DR HABERFIELD: Yes.
MR ROZEN: You are aware that your report has been provided to the Inquiry by them?
DR HABERFIELD: Yes.
MR ROZEN: For our purposes your report appears behind tab 17 in folder 10 and bears the Ringtail code GDFS.0001.002.0001. Do you have a copy of your report in front of you, Doctor?
DR HABERFIELD: Yes.
MR ROZEN: Is there anything in that that you would like to change?
DR HABERFIELD: No.
MR ROZEN: Are the contents of your report true and correct?
DR HABERFIELD: Yes.
MR ROZEN: To the extent that you express opinions in your report, are they opinions that you honestly hold?
DR HABERFIELD: Yes.
MR ROZEN: I will tender the report.
#EXHIBIT 21 - Report by Dr Chris Haberfield.
MR ROZEN: You have attached your CV to your report. It appears at page 29. You will see the numbers in the top right-hand corner and the last two digits should be 29.
DR HABERFIELD: Yes.
MR ROZEN: Appendix B. You are a principal geotechnical

engineer for Golder & Associates?

DR HABERFIELD: Golder Associates.

MR ROZEN: Golder Associates, I'm sorry. And what does Golder Associates do? What's the nature of its business?

DR HABERFIELD: Golder Associates is an international geotechnical and geoenvironmental engineering consulting firm. We deal with a whole range of issues to do with the ground, which could include geotechnical engineering, environmental engineering, ecology and so on, groundwater. Basically everything that deals with the ground.

MR ROZEN: Overlapping with your time at Golder you held an academic position at Monash University or a range of academic positions, I should say, in the Department of Civil Engineering?

DR HABERFIELD: That's correct.

MR ROZEN: That was for some 21 years, and you have set out in summary form the work that you did there, including the research work and teaching experience that you have had. Was that all in the field of civil engineering as it applies to the mining industry?

DR HABERFIELD: No, it wasn't in civil engineering as applies to the mining industry. It was generally in geotechnical engineering and geotechnical engineering as it applies to any industry.

MR ROZEN: Yes, I see. You, as you have already indicated, were engaged by the firm King & Wood Mallesons. Is it in October this year you were engaged?

DR HABERFIELD: Yes, I believe so.

MR ROZEN: There are letters of engagement that are attached and I won't take you to those.

DR HABERFIELD: Yes.

MR ROZEN: Part of the brief that you were given by King & Wood Mallesons was to review the draft Jacobs report and attend the meeting on 27 and 28 October of this year?
DR HABERFIELD: That's correct.
MR ROZEN: And you did attend that meeting?
DR HABERFIELD: Yes.
MR ROZEN: You have seen a copy of the final Jacobs report?
DR HABERFIELD: Yes.
MR ROZEN: You also attended the joint expert meeting on 3 December this year?
DR HABERFIELD: Yes.
MR ROZEN: And are a signatory to the joint report?
DR HABERFIELD: Yes.
MR ROZEN: I will just ask you a couple of questions about the report and the brief that you were given beyond attending the meetings that you have talked about. If you turn to page 2 of the report, that's page 2 at the bottom of the page, and the Ringtail code ends in the digits 0004 for our purposes, do you see a list of questions at 1.3?
DR HABERFIELD: Yes.
MR ROZEN: You there set out the questions that you were asked by King & Wood Mallesons, I think nine questions, if I'm reading it correctly?
DR HABERFIELD: That's correct.
MR ROZEN: And the information that you were provided by them is then set out at 1.4?
DR HABERFIELD: That's correct.
MR ROZEN: You have in fact in your report addressed each of the nine questions that you were asked.
DR HABERFIELD: Yes.
MR ROZEN: We will come back to some aspects of your report in

a moment. If I could turn to you, Dr McCullough, please. Your report appears behind tab 18 in folder 10 for our purposes and there should be a copy in front of you, I hope.

DR McCULLOUGH: Yes, there is.

MR ROZEN: The Ringtail code for that is GDFS.0001.003.0001. That's a report dated 28 November 2015. Have you had an opportunity to read through your report before coming along to give evidence this morning?

DR McCULLOUGH: Sorry, I would just like to correct that date. I have the date 30 November 2015 in front of me.

MR ROZEN: Where are you reading that from, Doctor?

DR McCULLOUGH: This is the top of tab 18, the report ending in 0001.

MR ROZEN: This is a memorandum to Emily Heffernan?

DR McCULLOUGH: That's right. You may have a different revision number. Is your revision number A?

MR ROZEN: This is the project number reference you are talking about?

DR McCULLOUGH: That's correct.

MR ROZEN: I have rev B.

DR McCULLOUGH: Okay. I have rev 0. I have the finalised reference in front of me. You have the draft.

MR ROZEN: This may not be a simple question to answer, but are you able to tell us if there are substantive differences between rev B and rev 0?

DR McCULLOUGH: There are significant differences, but I would be able to identify them during the questioning process.

MR ROZEN: Perhaps we will do it that way, if we could. I might just enquire whether there are other copies.

DR McCULLOUGH: You can have my spare copy, if you like.

MR ROZEN: It's not so much me as everyone else.
Dr McCullough, your CV is attached to your report at annexure B as well?
DR McCULLOUGH: That's correct.
MR ROZEN: If I could ask you to go to that, please. It commences at page 30. This is obviously a summary for your CV headed "Resume", Dr McCullough?
DR McCULLOUGH: That's correct. It is a CV in brief.
MR ROZEN: You are an associate principal environmental scientist with Golder Associates Pty Ltd?
DR McCULLOUGH: Yes.
MR ROZEN: And, as the document sets out, you have over 20 years of research and consultancy experience in environmental management issues?
DR McCULLOUGH: That's correct.
MR ROZEN: Specialising in any particular area?
DR McCULLOUGH: Specialising in mine water and pit lakes.
MR ROZEN: The resume goes on to say that you have authored over 90 published peer reviewed papers and book chapters and most recently published the book "Mine pit lakes closure and management" through the Australian Centre of Geomechanics?
DR McCULLOUGH: That's correct.
MR ROZEN: Can you agree that you did all the things that Dr Haberfield did in response to a request from King & Wood Mallesons; that is, attended the various meetings, reviewed the draft Jacobs report and attended the joint expert report on 3 December of this year?
DR McCULLOUGH: No, I did not. I attended all the meetings bar one, which was the end of October.
MR ROZEN: So you didn't attend the meeting on 26 and

27 October?

DR McCULLOUGH: That's correct.

MR ROZEN: But other than that you reviewed the Jacobs report and attended the joint expert meeting?

DR McCULLOUGH: That's correct.

MR ROZEN: And you are a signatory to the joint expert report?

DR McCULLOUGH: Yes, I am.

MR ROZEN: Thank you. Adjunct Professor Sullivan, if I could come to you - - -

CHAIRMAN: Did I overlook the McCullough material coming in as an exhibit?

MR ROZEN: I may not have tendered it. I want to tender the 30 November.

CHAIRMAN: You want to tender the O rather than the B.

MR ROZEN: The O rather than the B.

CHAIRMAN: We will just leave that at the moment?

MR ROZEN: It is the O that's on the Ringtail version. It may be that I'm the only one suffering under the disadvantage.

CHAIRMAN: No.

MR ROZEN: You are also in the same boat as me.

CHAIRMAN: I have a B, yes.

MR ROZEN: I might just tender them both, I think might be the simplest thing. I will tender them as A and B of the exhibit. So if the rev B could be the next exhibit A and rev O can be the next exhibit.

CHAIRMAN: Yes, exhibit 22A and B.

#EXHIBIT 22A - Draft report by Dr Clint McCullough, Rev A.

#EXHIBIT 22B - Final report by Dr Clint McCullough, Rev O.

MR ROZEN: Thank you. Professor Sullivan, your report appears behind tab 16 of folder 10. Can I confirm that you have a copy of that in front of you?

PROFESSOR SULLIVAN: Yes.
MR ROZEN: It bears the Ringtail code AGL.0001.002.0001 and is a report that was prepared by you for Ashurst Australia, solicitors for AGL Loy Yang Pty Ltd, the licensee operating the Loy Yang Mine?
PROFESSOR SULLIVAN: Yes.
MR ROZEN: Have you had an opportunity to read through your report before coming along to give evidence today?
PROFESSOR SULLIVAN: Yes.
MR ROZEN: Is there anything you would like to change in it?
PROFESSOR SULLIVAN: No.
MR ROZEN: Are the contents true and correct?
PROFESSOR SULLIVAN: Yes.
MR ROZEN: To the extent it includes expressions of opinion, are they opinions that are honestly held by you?
PROFESSOR SULLIVAN: Yes.
MR ROZEN: I will tender Professor Sullivan's report.
#EXHIBIT 23 - Report by Professor Tim Sullivan.
MR ROZEN: Professor Sullivan, it's an adjunct professorship, is that right?
PROFESSOR SULLIVAN: Yes.
MR ROZEN: At which university?
PROFESSOR SULLIVAN: New South Wales.
MR ROZEN: You are also the principal of the firm Pells Sullivan Meynink and you have held that position since 1993?
PROFESSOR SULLIVAN: Yes.
MR ROZEN: What does that firm do? What are its services?
PROFESSOR SULLIVAN: It is engineering in soil, water and rock, in simple terms, and we specialise in mining and tunnelling and general civil geotechnical work.

MR ROZEN: At page 5 of your report, starting at paragraph 9, you set out in summary form your qualifications and professional experience?
PROFESSOR SULLIVAN: Page 5?
MR ROZEN: It is page 2 of your report, page 5 for our purposes.
PROFESSOR SULLIVAN: Yes.
MR ROZEN: You will see the number 2 at the bottom and our coding system is on the top right-hand corner. I will repeat that question. You have set out your qualifications and experience starting at paragraph 9?
PROFESSOR SULLIVAN: Yes.
MR ROZEN: Included in that experience is, at paragraph 12, in excess of 25 years teaching a course on stability for mines?
PROFESSOR SULLIVAN: Yes.
MR ROZEN: And if we go towards the bottom of the page there, perhaps most importantly for our purposes at 14(f) you tell the Board that you were the mining warden conducting the inquiry into the Yallourn Mine batter collapse for the Victorian Government in 2008?
PROFESSOR SULLIVAN: Yes.
MR ROZEN: In the following year you were the inaugural chairman of the Technical Review Board when it was established in 2009?
PROFESSOR SULLIVAN: Yes.
MR ROZEN: Did your membership of the board in 2011 cease as well as your role as chairman?
PROFESSOR SULLIVAN: Yes.
MR ROZEN: So it was a two-year period that you were on the TRB?

PROFESSOR SULLIVAN: No, I resigned.
MR ROZEN: Sorry, you resigned. Thank you. The work that you were engaged to perform for AGL through the solicitors is set out at paragraph 27 of your report, page 4 at the bottom of the page and 7 in Ringtail.
PROFESSOR SULLIVAN: Yes.
MR ROZEN: In summary, you explain that you were asked to prepare a statement - I'm reading from paragraph 26 - that sets out the key steps for developing a rehabilitation solution that results in a stable landform. You were asked to review the AGL Loy Yang rehabilitation options and process adopted by the mine?
PROFESSOR SULLIVAN: Yes.
MR ROZEN: Can I just ask you whether what you were asked to review included what was at this time, or at the time you were doing this work, a proposed work plan variation that was being submitted to the regulator by Loy Yang?
PROFESSOR SULLIVAN: Yes.
MR ROZEN: You in fact make comment about that proposal at various places in your report, do you not?
PROFESSOR SULLIVAN: Yes.
MR ROZEN: Thank you. You no doubt are aware that that's now been approved?
PROFESSOR SULLIVAN: Yes.
MR ROZEN: And has been the subject of some evidence already in this Inquiry and I will come back to aspects of it in due course. Can you confirm for us, please, that you were provided with a copy of the draft Jacobs report and asked to attend the meeting in October with other experts considering that draft?
PROFESSOR SULLIVAN: Yes.

MR ROZEN: And you subsequently at the Board's invitation attended the meeting on 3 December with the other members of the panel with the exception of Mr Spiers, and you are a signatory to the joint report?

PROFESSOR SULLIVAN: Correct.

MR ROZEN: Thank you. If I could turn then to you, please, Mr Hoxley, and can you confirm for us, please, that you are part of the Jacobs team that prepared the report which we find behind tab 10, which I will just go to. So it is at tab 10, folder 7. The final Jacobs report is dated 16 November 2015, Mr Hoxley?

MR HOXLEY: That's correct, yes.

MR ROZEN: When I say you were part of a team, the study team for the preparation of the report included - correct me if I'm wrong - 13 members?

MR HOXLEY: Yes, that's right. It is outlined in the report.

MR ROZEN: I don't need to go to it now, but it is at page 138 of the report. You and your colleague to your right, Mr Spiers, were members of that team?

MR HOXLEY: That's right.

MR ROZEN: You were engaged directly by the Board itself to produce that report and the Ringtail number for the report is EXP.0011.001.0001. So can I just confirm you were engaged by the Board to do that work?

MR HOXLEY: That's right, we were.

MR ROZEN: Or Jacobs was, thank you. Your CV is attached now, or not attached, but we find it after the report at EXP.0011.004.0001. Do you have a copy of that in front of you? I can just help you navigate your way to it.

MR HOXLEY: Yes, I do. I have that in front of me.

MR ROZEN: You are the principal hydrogeologist with Jacobs?

MR HOXLEY: That's right.

MR ROZEN: And you have over 25 years experience in the areas of groundwater and hydrogeology?

MR HOXLEY: That's right.

MR ROZEN: Your professional qualifications are a Bachelor of Science with honours?

MR HOXLEY: Yes.

MR ROZEN: And when did you commence with Jacobs?

MR HOXLEY: Jacobs merged with a firm known as Sinclair Knight Merz about two years ago, so that's when I commenced with Jacobs. Prior to that I was with the predecessor organisation, Sinclair Knight Merz, since 1995.

MR ROZEN: You held the position of principal hydrogeologist there?

MR HOXLEY: That's right.

MR ROZEN: A bit like Professor Mackay; same job, different employer?

MR HOXLEY: Indeed.

MR ROZEN: Before your time with Sinclair Knight Merz you were a senior hydrogeologist with the Rural Water Corporation of Victoria for some eight years?

MR HOXLEY: Yes.

MR ROZEN: You set out in your CV some of the work that you have been involved in in the field of hydrogeology and I won't go to those in detail. Mr Hoxley, you were present at the meeting on 26 and 27 of October that has been referred to?

MR HOXLEY: Yes.

MR ROZEN: And as a consequence of that meeting some further work was done by Jacobs, which we can see the changes from the draft report to the final report?

MR HOXLEY: That's right.
MR ROZEN: We will come back to that in a moment. I think I should tender your CV. Perhaps if it could be part of the same exhibit.
CHAIRMAN: Yes, part of exhibit 24.
MR ROZEN: I'm not sure that I tendered the Jacobs report, sir.
CHAIRMAN: Not the report. I only have Hoxley down, so I better refer to the transcript or you tell me what it is.
MR ROZEN: I will revise that.
CHAIRMAN: The Jacobs report is 24?
MR ROZEN: The Jacobs report is entitled "Review of future rehabilitation options for Loy Yang".
CHAIRMAN: That's 24. The Hoxley CV is treated as part of that.
MR ROZEN: Yes, I think perhaps the report should be 24A. The Hoxley CV can be 24B.
CHAIRMAN: Yes.
#EXHIBIT 24A - Jacobs report entitled "Review of future rehabilitation options for Loy Yang".
#EXHIBIT 24B - Curriculum vitae of Mr Greg Hoxley.
MR ROZEN: Last, but certainly not least, Mr Spiers, if I can come to you, please. You are also a member of the Jacobs team?
MR SPIERS: Correct.
MR ROZEN: Did you attend the meeting on 26 and 27 October?
MR SPIERS: No.
MR ROZEN: You didn't, and you didn't attend the meeting on 3 December either?
MR SPIERS: Correct.
MR ROZEN: Your CV is included in our materials at

EXP.0001.005.0001. Do you have a copy of that in front of you, Mr Spiers? You will find it immediately behind Mr Hoxley's CV in the folder in front of you.

MR SPIERS: Correct.

MR ROZEN: Your professional qualifications are set out on the first page of that, Diploma of Civil Engineering, Postgraduate Diploma of Labour Management Relations and an MBA as set out there; is that right?

MR SPIERS: Correct.

MR ROZEN: If you can go to the second page of that, you have set out what is described there as a very brief career history. Perhaps for our purposes I note that your career experience seems to be particularly relevant to the subject matter of this Inquiry. You were between 1982 and 2009 employed at the Loy Yang Mine?

MR SPIERS: Correct.

MR ROZEN: So you must have been involved at the very early stages of the development of that mine?

MR SPIERS: Yes, complete commissioning right through to full operation and management of the mine.

MR ROZEN: During your time you worked there initially for the SECV?

MR SPIERS: Correct.

MR ROZEN: Then when ownership ultimately passed to AGL you worked for them; is that right?

MR SPIERS: No, incorrect.

MR ROZEN: Sorry, you worked for Loy Yang Power Management Limited?

MR SPIERS: Correct.

MR ROZEN: What is the relationship between that company and AGL?

MR SPIERS: Loy Yang Power was purchased by AGL.
MR ROZEN: I see. Whilst working there you held the positions of production manager for a two-year period and then general manager mining for 12 years up to 2009?
MR SPIERS: Correct.
MR ROZEN: You then made the move into the public service with the Department of Primary Industries?
MR SPIERS: Correct.
MR ROZEN: And worked as the Director of Clean Coal Victoria between 2009 and 2013, albeit that the name of the department in which that body sat changed during that time?
MR SPIERS: Correct.
MR ROZEN: You are now enjoying semi-retirement?
MR SPIERS: With a bit of consulting, yes.
MR ROZEN: Including being dragged into inquiries from time to time. You then set out in some more detail in your CV that career experience and I won't go to that. But can you confirm for us, Mr Spiers, that you are also a member of the Jacobs team?
MR SPIERS: I can.
MR ROZEN: I will just ask that Mr Spier's CV, please, be added to that exhibit.
#EXHIBIT 24C - Curriculum vitae of Mr Charles Spiers.
MR ROZEN: Thank you. Just whilst I am with you, Mr Spiers, and also Mr Hoxley, can I just ask you some questions about the process by which the Jacobs report came into existence and what you were asked to do by the Board, and perhaps if we can do that by reference to, firstly, page 4 of the report. You will see page 4 in the bottom right-hand corner. The Ringtail reference ends in the

number 5. It is a document headed "Important note about this report". Do you see that? If I can direct this initially at Mr Hoxley, if that's all right, Mr Spiers, and you can jump in if there is anything you want to add to this. But as you explain there, what the Board asked Jacobs to do was align very closely to terms of reference 8 and 9 that the Inquiry is being asked to complete?

MR HOXLEY: That's right.

MR ROZEN: And in particular Jacobs was asked to provide a report in which it set out short, medium and long-term options to rehabilitate the land that's described there in paragraphs (a) and (b) of term of reference 8 we see at the top of the page?

MR HOXLEY: Yes.

MR ROZEN: And specifically by reference to term of reference 9, Jacobs was asked for each rehabilitation option identified, and then a list of questions from (a) to (i) are set out there; is that right?

MR HOXLEY: Yes.

MR ROZEN: Then halfway down the page, "In considering terms of reference 8 and 9, Jacobs were requested to" and then we see set out in (a) to (g) particular ways in which the Board asked you to carry out that work?

MR HOXLEY: Yes, that's right.

MR ROZEN: And in particular the information that you were asked to consider. Was it part of the brief that Jacobs received from the Board to visit the mines and physically look at them and learn about their characteristics in that way?

MR HOXLEY: No, there wasn't.

MR ROZEN: So far as Jacobs were concerned, what was to be the

source of information about the particular characteristics of the mines that Jacobs were to use in preparing the report?

MR HOXLEY: So we were provided with reports and information through the Board that in some cases was sourced from the mines, and it was from that information provided that we formed our opinions.

MR ROZEN: If you could turn to page 20 of the report, the Ringtail reference in the top right-hand corner ends in 21. You will see a heading "Study approach" at 1.3?

MR HOXLEY: Yes.

MR ROZEN: You will see it says there, "The study was conducted over the period August to October 2015. The study was multi-disciplinary in nature, drawing on professionals from across the fields of mine closure/rehabilitation, hydrogeology, hydrology, slope stability, fire management for rehabilitated landforms, environmental management, quantity surveying and land use strategic planning." That's a correct statement of the nature of the team that did the work?

MR HOXLEY: Yes, it is.

MR ROZEN: Then you go on to explain the data sources. Then towards the bottom of the page there's a reference to a multi-criteria analysis which was undertaken by the study team looking at each of the preliminary final landforms and rehabilitation options that had been identified. Can you just explain to the Board what a multi-criteria analysis is and what Jacobs did in performing that analysis?

MR HOXLEY: Certainly. Multi-criteria analysis is an approach to assessing preferred options or preferred approaches in

light of multiple, often competing, criteria. So there's an analysis process of identifying what the criteria are, the scale or score which will be given to those and then a weighting that is used to bond all those up, to come up with an overall score or an overall approach that incorporates all of those multiple criteria.

MR ROZEN: Is that a conventional methodology that is used in the mining industry?

MR HOXLEY: Yes, it's quite commonly used, particularly in complex areas where there are competing criteria.

MR ROZEN: One of the questions that the joint expert meeting on 3 December was asked to consider related to that analysis. If you have a copy of the joint report in front of you, if you could go to page 4 of the joint report, please. You will see towards the bottom of the page under the box a heading "Four options". Question (c), "Do you agree that the Jacobs report" - that is the report we are presently discussing - "appropriately identifies the risks and control measures relevant to the rehabilitation options discussed?" That's a reference, is it not, to the outcome of the MCA, the multi-criteria analysis?

MR HOXLEY: So, the multi-criteria analysis led into that and then there was a risk assessment component of that and, as I take it, it refers to the risks that were identified following the multi-criteria analysis and in particular the control measures that were put against each of those risks.

MR ROZEN: I probably should ask you can you just explain to us the relationship between the risk analysis component and the MCA? What is the difference between those? If there is an aspect of the report you can draw our attention to,

then please do.

MR HOXLEY: So I think it's probably worth looking at section 1.2, which is on page 19. So that's point 20 on page 20 which is point 0021 which outlines the sections of the report and what they seek to do. For example, section 6 looks at the mine rehabilitation assessment criteria which describes what those criteria use to assess the preliminary and potentially viable options. There is an options assessment of that which uses the multi-criteria analysis to identify potentially viable options and then there's assessment of those potentially viable options that includes an assessment of risks and controls. So, the multi-criteria analysis was used on the broad spectrum of options and then the risks and controls were looking at the ones that were refined from that. So the report goes through and starts with a broader set of possible options and refines those down and the risks were applied to a smaller set of those.

MR ROZEN: Thank you for that. If I can take you back to the joint report to question (c), the meeting was asked whether they considered or the members considered the report appropriately identifies risks and control measures relevant to the options discussed. If you go to the top of page 5, there is there the response of the meeting to that question, and the fourth line in the box at the top of page 5 comments, "In response to (c)" - that is the question about the analysis of risks and control - "the group believes that generally the risk assessment is at a very high, broadbrush level and is consistent with Jacobs' brief from the Inquiry. However, the risk assessment falls well short of the standard required in order to

properly assess the risks and controls for an option." That was an observation which led to everyone in the group agreeing with (c) subject to that caveat, and you yourself agreed to that as well?

MR HOXLEY: That's right.

MR ROZEN: Are you able to tell us from your perspective what the reference to a very high, broadbrush level of risk assessment means, what that's a reference to?

MR HOXLEY: Yes. So because of the nature of our study considering a wide range of options and then trying to narrow them down and in particular looking across a series of mines and mine pits that as we have heard evidence here are quite complex, given the timeframe that we had within the study and the range of options in front of us, it was necessary to take a broad overview of the range for those options. Within the discussion within the expert meeting last week, and I'm sure others will correct me if I misrepresent this, there was a number of discussions had around the nature of risk assessments as they might be formally done for mine closure planning. There is a more formal set of guidelines and an in-depth detail that if you had a particular mine and a particular detailed option, that a risk assessment would of necessity involve a broader and more detailed set of steps than we have taken. An example of that would be that if you were doing a full risk assessment as part of a mine closure study for one particular site, you would typically involve operators of that mine in the risk assessment as they would bring knowledge and information about that risk assessment.

MR ROZEN: That's a workshopping process that we often see.

MR HOXLEY: That's right. Clearly the risk assessment that we

presented in this report, by the nature of the timing and the scope that we had, didn't include such detailed discussions, so it is of necessity a high level. It looks over the mines, it looks over all of them and tries to bring together a consistent approach whilst not trying to solve individually in detail for each mine. So, in the discussion in the expert panel the view was put that if you were doing a full risk assessment for a complete option, for example for the preparation of a mine plan, you would necessarily do it in more detail and it is clear that our report does not present such a detailed risk assessment.

However, our approach, and as noted in the report, is consistent with the brief that we were given. We were looking across it at a strategic level review. So for that purpose we have a strategic risk assessment which has informed our consideration of the overall options.

MR ROZEN: Could I ask, just before leaving your report for the moment, could you look at page 72 of the report and the Ringtail reference ends in 73. You should see the heading "assessment of potential viable mine rehabilitation options" and then a box with the heading "Key finding"?

MR HOXLEY: Yes.

MR ROZEN: It there says, "For each of the three mines the pit lake and partial backfill below the water table were assessed as providing the lowest level of overall residual risk." If I can just stop there for a moment. Are you able, please, to explain to us the difference between the pit lake on the one hand and the partial backfill below the water table options, because there is some suggestion in the material that they are really two variations on the

one option. Can you address that, please?

MR HOXLEY: Yes, indeed. It is important to understand the way in which the phrases "pit lake" and "partial backfill below the water table" appear in our report, particularly because the term "pit lake" is used quite broadly and in some cases a little differently in our publications and elsewhere. The context for pit lake is within the reference to this report and to the way that we have tried to describe that.

It is true in some way that the option that we describe as the "partial backfill below the water table" is in itself a form of pit lake because there is a lowered landform, there is water, there is a lake feature of some sort within that, but we found in describing this in the report it was important to draw the distinctions. These distinctions between the two options are outlined in the report. If you bear with me for a moment, I will find you the page where that's described. So, there are descriptions of the preliminary options, along with what some people have referred to in some of the meetings as cartoons, and - - -

MR ROZEN: We can perhaps come back to you about that, Mr Hoxley.

MR HOXLEY: Sorry, there is a stage in the report which I won't find immediately. But the key differences between the pit lake and the landform below the water table is the ratio of fill and fill material that's placed in the pit as opposed to water that is in the pit. In our end member case, the bulk of the filling of the void is taken up with water and from a stability point of view the pit lake option as an end member would use water as a primary means

of achieving a weight balance or achieving stability. In the partial backfill below the water table there is a combination of fill material, could be overburden, could be a range of other things, and water, that is used to achieve a stable landform and it could be a lowered landform of some type.

Pit lake level is something which could be variable. So, for example, I have heard in some discussions that a pit lake must necessarily be full. We would expect in this terrain that if you are using water as a balance for stability, that you would probably need more water than you would if you were using a mixture of water and fill. So it is likely that the water level would be higher in a pit lake option. It may or may not necessarily be full.

So there's a presumption, I think, being made in some people's minds that pit lake equals full to the surface. That's not necessarily the case for the pit lake option that is described in our report. It is one where the bulk of that stability or the bulk of that fill area is provided by water. The final level is a matter that could vary.

MR ROZEN: Professor Sullivan, if I could come to you, please, and I'm looking now at the joint expert report. Just before I leave that, Mr Hoxley, is it 0010 the page that you were looking for?

MR HOXLEY: Let me have a look. There will be an executive summary. Yes, that's right. That's the executive summary of that. There's a slightly expanded description in addition to that which was dealing with others that I will attempt to find.

MR ROZEN: Thank you. Sorry, Mr Sullivan, I will come back to you. Can I ask you some questions about some general objectives and principles. It is a matter which you deal with in your report, and then that finds its way into question 1 of the joint expert report. Perhaps the simplest way to do it is by reference to the joint expert report.

Question 1 asked the panel members whether they agreed that a list of objectives and principles for the rehabilitation of open-cut coal mines in the Valley was appropriate for each of the three mines and, secondly, if there were other objectives and principles that were relevant to identify those. As the joint report indicates, that was drawn from a list in your report at paragraph 127. My question is what's the importance from your perspective of starting from a statement of objectives and principles along these lines? What do you say to the Board about the significance of this list?

PROFESSOR SULLIVAN: I included each of those items very deliberately. I believe we needed to have as detailed a list or as comprehensive a list as we could at that objective and principle level. I tried not to get into the detail of all of the considerations that would flow under each of those particular items, but every one of those points based on my experience is important in the Valley.

MR ROZEN: Thank you. Could I ask you in particular about item (j), which says that it's an important objective or principle, and I know there's some discussion about those terms. Dr Haberfield, I think in particular you have something to say about that and I will come to you in a

moment. Putting that to one side, the principle that stakeholders, including the local community, should be consulted about the matters there, and I think (k) and (l) should be (i) and (ii) of (j), should they not? That was I think the original way in which it was set out, that is that they are parts of (j).

PROFESSOR SULLIVAN: Yes.

MR ROZEN: Firstly, can I ask you what's the significance of or the importance of consultation with the local community about the matters there?

PROFESSOR SULLIVAN: In relation to (k) and (l) as well or just as (j)?

MR ROZEN: Should we be reading (j) as (j)(i) and (ii); in other words, (k) should be (j)(i) and (k) should be (j)(ii)?

PROFESSOR SULLIVAN: I think so.

MR ROZEN: Talking about them as a group, why is it important for there to be stakeholder and particularly local community consultation about those matters?

PROFESSOR SULLIVAN: It is fundamental, from my perspective, because to achieve that safe and stable objective, which I have dealt with separately in my report, each of the mines will be different. It is fundamental that the setting in which each of those mines and the individual domains within each of those mines plays a role in that element of how we achieve a safe and stable position. There will be separate criteria that needs to be developed and they won't be the same. They will be different for each mine and different for each domain within the mines. So that is a process that needs to be explained to everybody and understood by everybody because it informs

the achievable final landform and therefore achieves the final land use. Then coming back from that we have to look at how safe and stable relate to those two elements.

MR ROZEN: The Board has heard some evidence in relation to the Loy Yang Mine operated by AGL of a recent change; that is the recent work plan variation approval has approved a plan to produce a lake for the mine to be turned into a lake but for that lake apparently not to be available for public use, whereas the original approved plan from 1996 had a lake that was to be available for the public. Is that the sort of end use question that would be important to be the subject of consultation?

PROFESSOR SULLIVAN: Yes, and I believe that change is an example of good rehabilitation process. There was an understanding in 1996 with the initial work plan that was based on certain concepts of stability and final stability that could be achieved with that mine. As the level of detail and engineering analysis develops - and there has been more developed since 1996 and some of that has been included in the work plan variation in 2015, some of it hasn't but I have seen it as well - the results of that evolving process indicate that based on the current understanding it would be best to put the plan forward excluding public access at this stage. But that is not to say that as further engineering studies are undertaken and a more developed understanding of the issues becomes available that that would not be revisited and would change perhaps or be more limited or more controlled. There's quite a distance and a path to travel here.

MR ROZEN: I understand the concepts you are explaining. I'm sure the Board does too. But my question is more going

back to the principle about consultation and the importance of consultation in relation to those sorts of changes. The evidence before the Board would seem to suggest that there hasn't been a lot of community consultation about that change. My question is: are you and the other members of the panel saying that's the sort of thing upon which there ought to be consultation?

PROFESSOR SULLIVAN: Yes.

MR ROZEN: Perhaps if I can just tease that out. The absence of consultation in a practical setting, the fact that there apparently wasn't consultation about it, is a function of the existing structure around which work plan variations are approved. Are you saying that perhaps there ought to be a different structure or different process that mandates a process of consultation around those sorts of changes?

PROFESSOR SULLIVAN: I haven't turned my mind to a different process or another form. I just believe stakeholder communication and discussion needs to take place fundamentally as part of this program. I don't know what form it should take.

MR ROZEN: Whatever mechanism is there, it ought to achieve that outcome is what you are saying?

PROFESSOR SULLIVAN: Yes, as a principle.

MR ROZEN: The other thing I wanted to ask you about in relation to (j) is the reference to success criteria; and that is that the members of the panel, with the exception of Dr Haberfield, who qualified his agreement, agreed that the consultation ought to lead to agreed success criteria. What does success criteria mean in that context? What are you referring to?

PROFESSOR SULLIVAN: There are very, very many parts to this mine rehabilitation aspect.

MR ROZEN: I think we are learning that.

PROFESSOR SULLIVAN: And each one of those will have certain objectives to be achieved and then somehow each of those objectives or considerations then needs to have some basis on which it can be measured or accepted by the stakeholders. That has to be developed, and we don't have that at the moment.

MR ROZEN: Just before leaving this question, Dr Haberfield, you expressed some concern about the use of the verb "agree". You think that's perhaps setting the bar a little bit too high; is that the point? I see Dr McCullough nodding as well.

DR HABERFIELD: Yes. I think a word like "develop" success criteria or something, but I can't see how a broad range of stakeholders and that can all agree on a set of criteria. So, yes, I believe success criteria should be developed, but I don't think they will necessarily be agreed upon.

MR ROZEN: Dr McCullough, I saw you nodding there. Is there anything you would like to add to that?

DR McCULLOUGH: The standard industry process is to engage with stakeholders, seek their concerns and feed back the mine closure planning process to them. It is certainly not to achieve agreement, as my colleague indicated. You will never achieve agreement on criteria. There will always be either poorly informed people or people with extreme views. So that's not the process that we are seeking here.

If I may add to that as well, given the stage of

mine closure planning as well, criteria particularly for these mines at this level would only be preliminary and they would be expected to change. A lot can happen in three decades.

MR ROZEN: Perhaps I can just explore that a little bit with you and with other members. We have heard references to the need for flexibility in rehabilitation planning. Is that what you are referring to there, that one learns essentially as one goes along with engineering tasks of this scale?

DR McCULLOUGH: Yes, I believe that there's been a general misunderstanding of the mine closure process with the Inquiry. Mine closure planning is a process. It is a life of mine activity. It begins usually at the approval stage and extends past the actual completion of the mining operation. It is certainly not a one-off event. It is designed to be flexible and to meet the needs of the environment, the operation and the social community as it develops. If it is fixed and definitive at any point in time it will not achieve those at closure. For example, if we put fixed criteria in place now, people who are not even born who will live with those rehabilitated mines would be being influenced by criteria that they had no say in.

MR ROZEN: I'm just trying to understand this. Are you saying that the success criteria can change along the way as well or are they to be determined in advance of the work that - - -

DR McCULLOUGH: I'm saying the success criteria will change.

MR ROZEN: Professor Sullivan, you in your report make reference to some specific examples of the lessons that

can be learnt from some progressive rehabilitation that's taken place at the Loy Yang Mine and how that can be inform an understanding of risk and assist with the development of further planning. Am I understanding that correctly, that that's what you are referring to?

PROFESSOR SULLIVAN: Yes.

MR ROZEN: Is that essentially what Dr McCullough is talking about? I won't ask you to speculate on his state of mind, but is that consistent with what Dr McCullough is saying about the development of planning?

PROFESSOR SULLIVAN: That's part of it.

MR ROZEN: Can I just stay with that because the Inquiry has heard a lot about progressive rehabilitation which seems to play at least two roles in terms of final rehabilitation. It is an end in itself. It can achieve, for example, a reduction in fire risk and other such qualities, but it also can feed into final planning, can it not?

PROFESSOR SULLIVAN: Correct.

MR ROZEN: Professor Galvin, can I come to you, please, in reference to your statement. Do you have that in front of you?

PROFESSOR GALVIN: Yes.

MR ROZEN: Can I start with paragraph 7, please, on page 3 of the statement. The Ringtail reference ends in 3.

PROFESSOR GALVIN: Yes.

MR ROZEN: At paragraph 7 you say in the context of a very recent change to the terms of reference of the Technical Review Board which have been expanded now for the first time to include rehabilitation, you say that as you understand it rehabilitation was included in the terms of

reference of the TRB because of the consequences of the Hazelwood Mine fire. What in your view is the connection between the fire or how has the fire acted as an impetus to raise rehabilitation on the agenda?

PROFESSOR GALVIN: We were told as a board, unbeknown to the regulator that we report through, that the new government as part of its election commitment had committed to changing the terms of reference of the TRB to include rehabilitation. So I got a call one day to say, "We have discovered this and the terms are changing." My understanding is that was a response to the Hazelwood Mine Fire Inquiry.

MR ROZEN: As you explain in your statement and the various annual reports that are attached to it, at least as far back as 2011 the TRB has been raising this issue of the importance of giving attention to rehabilitation in quite clear terms, has it not?

PROFESSOR GALVIN: It certainly has. We have been coming purely from the stability aspect. We thought the concepts at the moment for rehabilitation, what was being proposed, were too simplistic to properly cater for providing for long-term stability.

MR ROZEN: There is a reference in the first of the reports that you have attached and I'm looking at paragraph 12 of your statement. Perhaps I can do it this way rather than going to the report. You advised the then minister that steps needed to be taken immediately to begin an assessment of the issues, the processes, the risk and their amelioration, the timelines and priorities and most importantly the cost liabilities required for closure of each existing mine. The evidence the Board has heard is

that the timeframes for closure of the three mines are well off into the future, the earliest perhaps in 2026 and with the Loy Yang Mine it may well be not until 2050 or later. Given that, why has the board said - and it has said it several times - that there needs to be an immediate examination of those issues?

PROFESSOR GALVIN: Early on in the board's day, when Professor Sullivan chaired the board, it was identified, for example, that there were seven at risk batters. Within two years five of those batters had moved, some quite substantially. That was already sending signals that if we continued to mine the way we were we're going to continue to create these sorts of liabilities going forward and they would have to be addressed at some stage as part of mine closure. It was also clear that to address some of them required a lot more research and it was going to require a lot more money than what people had been anticipating to get on top of that problem.

Having had five collapses or five movements in a couple of years, and elsewhere in the reports you will see the board gives no commitment that there won't be more of these, it's something that needed attention now and needed to be factored in now to how at the end of the day are we going to close these mines in a way that these types of events still do not continue to impact on community in decades to come.

MR ROZEN: You go on at paragraph 13 once again by reference to the annual reports the board has provided to refer to, your words, "a critical loss of corporate knowledge regarding mine stability and the risks associated with instability". What are you referring to there? Can you

please expand on that?

PROFESSOR GALVIN: Perhaps I can give you an example that makes it simpler.

MR ROZEN: If you could.

PROFESSOR GALVIN: One of the areas that the board identified in its first term that we were concerned about was sinkholes developing in the Morwell main drain. We pointed that out to the regulators and to the mining companies. It was 18 months, Tim, perhaps, 18 months later, of that order, that we then had the major movement on the Hazelwood batters that closed the Princess Highway for seven months because water got into the batters through that drain. If you go back to the literature you will find a paper published in 1966, I think it is, on the design of that drain and why it was designed that way and how important it was to keep water out of that batter and how the system had to be maintained.

So there is a classic example that somewhere along the line that knowledge was lost and, even when the issue was flagged, there was still no - the mine responded, but there was no real appreciation by a range of stakeholders why this was critical and why we had flagged it as being of concern. So that's one example.

There is another paper published that talks about movement, an anomaly that runs through Morwell, the Lewis anomaly. It talks about gas pipes in the town itself being bent by movement towards the mine. This occurred in the 1960s as well. That anomaly is still there. We believe it is still a player in the movement that's occurring on the Hazelwood batters, and we still believe that it's yet to be addressed. So there's another point

of reference.

MR ROZEN: The impression I get from reading the annual reports that are attached to your statement is there seems to be a degree of frustration in the board in having to refer back constantly to this issue about the need for immediate action. Is that a fair observation, a fair reading, of the reports?

PROFESSOR GALVIN: The degree of frustration is certainly fair. Immediate action, I don't know that I would - there are some elements that we think need immediate action, but I would just say action now to plan for the future. So an example is the batter stability project, which is only seed funding, it is only the tip of the iceberg to get on top of the problem, but certainly that is frustrating to see how a project like that is taking so long to initiate.

MR ROZEN: It is a matter that you refer to specifically. Can you just explain to the Board what the background to the batter stability project is? It goes back to the Yallourn collapse, does it not, in 2008; is that right?

PROFESSOR GALVIN: That particular project doesn't, but from the Yallourn Inquiry and the warden's report Professor Sullivan identified there knowledge gaps, gaps in research, things that we needed to understand better. The government has been proactive in that area in bidding for government funds to develop the research project as, I guess you would say, it's focusing on the critical issues but it's also viewed as, I guess, seed funding, an initiative to get the research started and to get others to come in and continue it. At the time that that project was proposed the TRB and the department in its own right and through engaging Professor Sullivan put a lot of work

into developing quite a sound research project based on using the Latrobe River batters as a point of learning, and we had very strong support from Yallourn Mine to use that as a research site. So the budget was there, the research program was thought through and industry support was there.

The frustration we have is that, having got a proportion of that money, we are more than two years later yet to see that project start. Meanwhile the mine has had to move on and start to move soil and buttresses around and that site now has lost some of its value. That's the sort of frustration that we are referring to.

MR ROZEN: You deal with this at paragraph 26 of your statement, I think I'm right. In the fifth line you say, "The board considers this project to be an important, albeit small, step forward in developing a proper understanding of mine stability and rehabilitation options. Unfortunately, the study has yet to commence." What explanation has been given to the board by government as to why it hasn't commenced?

PROFESSOR GALVIN: In fairness to government, again there are a lot of legal issues to be sorted out between government and the research people undertaking the research and particularly the mine site. I haven't gone into it here, but it perhaps is in our last annual report. The bottom line is simple. Government is not the place to undertake research. This project has got caught up with all the bureaucracy, all the lawyers in the government department who don't understand research, they don't understand how mines work and it's just got bogged down. The solution is had that project gone to a research institute it would

have been finished by now. So, with government's best intentions, that project then should have been handed over to a professional research facility.

MR ROZEN: This issue of government's ability to oversight research is something you deal with, Professor Mackay, in your statement; am I correct?

PROFESSOR MACKAY: Yes.

MR ROZEN: If I can summarise, you express similar concerns to those that Professor Galvin has expressed. Do you share the degree of frustration about the apparent inaction?

PROFESSOR MACKAY: Of course, yes. GHERG actually undertook a fairly significant amount of work in 2014. At that time it was expected the project would be under way in 2014. Then complications appeared at the contractual side because there needs to be two contracts - one let to the mine, one let to GHERG - that actually have to interact between them and that's a significant level of interaction.

The research group will have quite a strong management role in there, but the risks for the mine need to be managed and managed extremely well. Therefore who takes ownership of the risks and how those risks are apportioned is quite interesting. So it has taken a long time and we are very close. A final contract has been signed at least from our side and maybe we will start in January. Maybe.

MR ROZEN: You are referring to the same batter stability project?

PROFESSOR MACKAY: Yes.

MR ROZEN: The Board has before it a statement from DEDJTR, from Mr Luke Wilson, who is the Lead Deputy Secretary in

DEDJTR. He deals with the batter stability project. This is part of exhibit 5B. I don't think I necessarily need to take you to it, but Mr Wilson tells the Inquiry at paragraph 57 of that statement dated 30 November that a technical advisory group for the project will be formed which will include participation from DEDJTR, the mines, GHERG and the TRB. He tells us that fieldwork is expected to be completed by 30 June 2016 with a PhD academic review to commence from 30 June 2016 to run for a number of years. Does that accord, Professor Mackay, with your understanding of the timeframe for the project?

PROFESSOR MACKAY: That is my understanding, yes.

MR ROZEN: All right. They do seem to be rather long lead times for setting up advisory groups and so on. Is this really an example of the point that Professor Galvin is making about the limited ability of governments to oversee such projects?

PROFESSOR MACKAY: I think it is an example. A technical advisory group was established in 2014 and actually undertook oversight of the work that GHERG was doing during 2014; so a technical advisory group including representatives from all three mines, including representatives from the TRB, it was chaired by a TRB member, and representatives from GHERG and the department were all included at that time. Subsequently, of course, the work has ceased. Work ceased on 18 December 2014 and will restart as soon as the contract is approved.

MR ROZEN: They are going to set up a new advisory group, it seems?

PROFESSOR MACKAY: I would hope that they will actually be able to reconstitute the original advisory group. But that may

or may not be possible.

MR ROZEN: At paragraph 19 of your statement under the heading "The way forward", Professor Mackay, you say in page 6 of the statement, "In my opinion it will be important for all relevant agencies and departments that can affect and be affected by the rehabilitation of the mines to work both together and with the mine owners to deliver a beneficial outcome. Management of the interactions between the mines and the regional environment and population will involve significant planning decisions with wide-ranging implications for the Latrobe Valley." You give an example of water allocation. Can you expand on that? Why is collaboration and cooperation so important in relation to this area?

PROFESSOR MACKAY: I think there are a number of things that are probably worth describing. One is the definition of what a beneficial outcome would be, and that needs to be worked through. Clearly the mines and the power stations offer a significant economic advantage for the Latrobe Valley. When they close, then the question will be whether additional economic advantage can be leveraged from the legacy that is created by these mines. That introduces immediately the community into the consideration.

The implications of water in particular are significant. These mines will become fairly significant sinks for water in the sense that they will become open lakes and those lakes will have significant evaporation. That means that there will be a change in the hydrology of the area for a period of time. It may be that that change in the hydrology will become a permanent feature of

the region and that will have implications, both positive and negative, for the region's water users. The potential that the stability of the mines and the management and maintenance of the mines in their rehabilitated closed form will be a significant expense exists and therefore there will need to be some reconciliation of that.

So there is a whole series of reasons why all the stakeholders who are involved in the consideration of what closure will mean for the Valley should come together to actually address those issues.

MR ROZEN: I just want to understand what you are referring to there. Are you saying that, for example, there needs to be greater coordination of existing arrangements; that is the regulator, the water authorities, the mines, expert bodies, planning agencies?

PROFESSOR MACKAY: Yes.

MR ROZEN: Or is there a case for some new coordinating entity that is brought into existence to achieve that?

PROFESSOR MACKAY: Potentially, yes. But how that would be formed and shaped, that's not something I'm particularly comfortable with speculating about. But I would expect to see some sort of overarching coordinating group.

MR ROZEN: You talk about the need for a common vision in the last paragraph of your statement.

PROFESSOR MACKAY: Yes.

MR ROZEN: I think I can fairly summarise the evidence the Board has heard which would suggest even at the level of the two relevant government departments, DEDJTR and what's now called DELWP, a lack of coordination, a failure even to have meetings when those meetings are identified as being important in government policy documents would seem

to suggest that at the very least what's there now is not working as well as it could be, if I can put it in a mild way.

PROFESSOR MACKAY: I think some of the questions that would actually bring those groups together have not yet been properly formulated and I think that probably they need to be formulated in an open way so that the individual departments can begin to tackle that.

MR ROZEN: The changing personnel at the head of departments - and I'm thinking particularly of DEDJTR; there was a reference by Professor Galvin, and I will come to you in a moment about this, to people being in charge now not having a mining background - is that significant in relation to what we are talking about?

PROFESSOR MACKAY: It is significant in the period while mining is progressing. It potentially will be significant during the closure period. It will become less significant as we go forward beyond that. So in the short-term it's very significant.

MR ROZEN: Professor Galvin?

PROFESSOR GALVIN: I think you need to clarify that. The reform process in the department is only a matter of weeks old. The people that are in those roles at the moment I don't think are permanent appointments. They are plugging holes. So with issues right at the moment we don't have a Chief Inspector of Mines, for example. People filling those gaps don't have a mining background. In time to come I would expect that to be sorted out for the better. So this is just a transition at the moment. Had you asked the question 12 months ago we wouldn't have raised that.

MR ROZEN: There was one other matter I wanted to ask you about, Professor Mackay, and that is the reference you make at paragraph 20 to the need for an open access knowledge management system and database. I suspect this refers back in part to this loss of corporate knowledge that Professor Galvin was talking about. What are you referring to there? What do you envisage?

PROFESSOR MACKAY: I'm aware that there is a significant amount of work that the individual mines are undertaking that has cross-relevance between the mines and it would be appropriate for the mines to share that knowledge in a way. I'm also concerned that there is going to be potentially a need to broaden the research programs going forward and, in order to be able to achieve a broadening of those research programs, new research groups will have to enter this space and they will need to be able to progress the work very quickly. By actually having an open data system that will allow them to get access to the information effectively and efficiently, they will be able to come up to speed very quickly.

One of the problems that is traditionally faced in research is that many researchers come from a slightly different field, apply the common sense that they have learnt from that field assuming that it doesn't need to change. One of the things about the Valley is that it is fairly unique in some of its behaviour in terms of its geotechnical and hydro-geological environments. So I think it is very important that people come up to speed very quickly. It will be to the benefit of the mining community. It will be to the benefit of the wider community and government planners.

MR ROZEN: What needs to change for there to be a greater sharing of that information amongst the mines, for example?

PROFESSOR MACKAY: I think we heard yesterday that there is a sharing of information, but that is information on an as needs basis. I think that the ability to bring together something in a form which allows all of the non-commercially sensitive data to be put in an open format on an open access site through a database or something like that would be very helpful.

MR ROZEN: Does that link to what you talk about in the last paragraph of your statement, that is the notion of an integrated rehabilitation plan for the three mines? Do you see the sharing of information and the integration of plans, are they things that are related to each other?

PROFESSOR MACKAY: I believe they are. Again, I take water as a prime example. There may be value - and this is something to be considered - for a couple of the mines to hold back on their water demand for a period of time while they use the water that is available to actually rehabilitate another mine. So, by actually having a common understanding of how these systems will interact, there will be less competition, there will be a much greater degree of coherence in the way that the resources are allocated and the way that the resources are used.

MR ROZEN: What role is there for the regulator and the water authorities in that vision?

PROFESSOR MACKAY: I think it's very important.

MR ROZEN: Professor Sullivan, you have been around in this area a long time. I know you are here having been engaged by AGL. But perhaps if you are able to take that hat off

and look at these issues more broadly along the lines that those to your right have been referring to them, can I explore with you this question of coordination and the need for coordination between government departments, the mines, researchers and the like. Do you have anything to add to what has been said about that?

PROFESSOR SULLIVAN: Yes, I do. To a large extent I think the mines have been looked at in isolation. But the mines and the Latrobe Valley are now part of what I would term a complex system. They are just parts of that system. It is a very large system and there are interactions happening within that system. We don't understand all those interactions. There's an increasing potential for adverse outcomes from those interactions. While ever the regulatory authorities for all those elements aren't coordinating and understanding the elements and the gaps, there's potential risks. So I think it's fundamental.

MR ROZEN: Do you think there is a case for some new type of coordinating authority or mechanism or something from your experience? It has been raised with some witnesses before the Inquiry and in submissions.

PROFESSOR SULLIVAN: It is not clear to me that another group will necessarily make things better. I'm not an expert in this area. There are a lot of different departments.

MR ROZEN: Yes. Mr Galvin, I see you making a note. Is that to contribute to this?

PROFESSOR GALVIN: In my statement I have made some comment to the effect of approval conditions. I believe you found a letter when I wasn't here the other day that's quite to the point about approval conditions. I have sat through yesterday and heard lots of discussion about where will

the water come from and how can we have a closure plan when we haven't got security for the water. I'm listening today to lots of questions about community engagement and questions to be answered and what success criteria will be and they will change with time.

To me they are all just symptoms of the problem. The problem is that the way that the approvals for these mines are conditioned, recognising that they were conditioned decades ago, is quite different to how a new mine would be conditioned today. That process today would give all those issues that I just went through a tick because it would start with doing an environmental impact statement or something to that effect, then assessing what risk do those impacts present and then what controls can we do to mitigate the risk - this is the proponent - the regulator having a look at it, making a first pass assessment whether it is adequate, flicking it back again, and when people think they have got it right you then open it up to public scrutiny, to agencies, to NGOs, to community, public hearings, run by an independent panel. From there you go through the processes, "Is this project approvable and, if it is, what conditions do need to be placed on it?" Out of that process, if it is done properly, it is first of all done on a risk based platform and from that you get a series of management plans.

If I was having this discussion at the moment in New South Wales I would expect to see a water management plan, a biodiversity management plan, a rehabilitation management plan, a fire management plan and they would clearly identify which agencies have oversight of them. They have checks in them for how often they will be

reviewed. Where there are unknowns - and there always will be unknowns; if you are going to run a mine for 30 years there will be unknowns - but those management plans will make provision for things like putting money into research with the view that, "We will have an answer by the time we need that answer."

My frustration with that document the other day - and unfortunately I believe it came back to bear on Loy Yang - my frustration shouldn't have gone to them. It should have gone to the department. Four years ago the board gave formal advice to the department when we were working with work plans that we considered the detail in them to be insufficient, inadequate. We thought that the information they were referring through to us had not been properly distilled and sorted through by the department before it ever got anywhere near us. We gave the department model approval conditions for mines recently approved, other open-cut mines, and then as I said we were out of the picture for a while. When that work plan was sent to us a few weeks ago and asked to be turned around very quickly - - -

MR ROZEN: Sorry to interrupt you, but just so we know what you are talking about, the Loy Yang work plan variation, you were sent version 5, I think?

PROFESSOR GALVIN: I don't know what version I was sent. I wasn't sent the complete document either. It was because it was a work in progress and time was short. I know, for example, the figures didn't match the text. It doesn't matter. The point I want to make is that I was quite annoyed four years later that nothing had changed and that there were things in that plan that should never

have got through a regional office as part of the approval process, let alone come to a TRB.

So the long and the short of it is that my view on this is that I don't know how you go back without a lot of pain to reapprove existing mines, but certainly these issues reflect severe gaps in the approval process. Done properly, that sorts out your stakeholder involvement, your community, your interaction between agencies, all gets captured in that process if it is done properly.

MR ROZEN: I know what you are talking about, you know what you are talking about, but others may not. Can we bring up the letter you are referring to. This is at DEDJTR.1020.001.0560 and it is annexure 15 to the statement of Mr Wilson dated 20 November. Perhaps we can get a copy of that in front of you, please, Professor Galvin, and it is now up on the screen.

PROFESSOR GALVIN: Can I actually have a minute to read it?

MR ROZEN: Yes, please do. Just confirm for us this is the letter you are talking about, please.

PROFESSOR GALVIN: It is the letter.

MR ROZEN: The context here, as I think you have already explained, is that you had been asked - rather the board had been asked - was it you personally or the board?

PROFESSOR GALVIN: The board was asked to review it. The reality was that it was only available in hard copy. To get it done within the timeframe I basically did the review on the only hard copy. I did have some discussion with other board members, but basically I did the review.

MR ROZEN: The context here is this is the first major work plan variation for the largest open coal mine in Victoria, is it not?

PROFESSOR GALVIN: I don't know.

MR ROZEN: There hasn't been a major variation of the work plan since the original one was approved for Loy Yang in 1996, I think I'm right in saying.

PROFESSOR GALVIN: I don't know.

MR ROZEN: It was provided to you by the department. I'm just a little bit confused given that the approval of work plans term of reference was removed from the board's terms of reference. Perhaps you don't know this, but how is it that the board is being asked to review this work plan variation application?

PROFESSOR GALVIN: Well, it's probably captured in some of the other terms of reference of the TRB. They are very broad. Advice to the minister, it would fit in there. I think the other reason is, as I said to you earlier, the department for the moment has lost some of its mining capabilities and the TRB was the logical place to look for assurance.

MR ROZEN: In the third paragraph, the middle of the first page, you wrote to Mr Florent of DEDJTR, "In summary, the application is highly conceptual and based heavily on descriptions of proposed activities and statements of intent. The underpinning technical information is scant and, furthermore, the reader is required to distil for themselves the little technical information that there is from the appendices. In the main, performance criteria appear to have been set by the proponent rather than by an independent assessing body." If I could pause there in the reading, does that stand in contrast to the New South Wales experience that you were referring to a moment ago?

PROFESSOR GALVIN: Yes.

MR ROZEN: So that's what you would expect to see in a document of this nature were this process occurring under New South Wales law?

PROFESSOR GALVIN: Yes.

MR ROZEN: You then make reference to rehabilitation in the final paragraph, "A range of aspects critical to successful rehabilitation are not assessed or even discussed. For example, rehabilitation is premised on final slopes of 1 to 3, vertical to horizontal" - - -

PROFESSOR GALVIN: Sorry, on the first page?

MR ROZEN: Yes, I'm reading from the last paragraph on the first page and I'm at the third sentence in the second line, "As far as I know, this is an historical assumption that is yet to be confirmed by geotechnical, hydro-geological and environmental engineering studies. Critical factors such as drainage systems for rehabilitated slopes are not discussed." Once again, matters that you would expect to see in an application of this nature?

PROFESSOR GALVIN: Yes. I would expect to see those sort of issues raised. I'm not saying I would expect to see technical solutions or answers to them. But, going back to what I said a moment ago, the starting point is, "What are the potential impacts that can arise from this operation, what level of risk do they present and how do I deal with that?" That's where you would capture some of these issues. So I would expect to see these things at least flagged as issues and some discussion on how they were proposed to be addressed.

MR ROZEN: If I can take you over to the second page of the letter, please, the top of the page. You say, "It seems

that the proponent has no intention of reducing the fire fuel load on the northern batters until the final rehabilitation is carried out at the completion of stage C mining in about a decade's time. The presence of a range of mining and other infrastructure on this batter has been put forward as the reason for this delay. Notwithstanding this, the proponent still claims to be undertaking progressive rehabilitation. The matter does not appear to have been independently tested to date from both technical and risk management perspectives."

If I just pause there in the reading, the Board has heard quite a bit of evidence and it heard yesterday from the mines themselves about the limitations that presently exist on carrying out progressive rehabilitation because of infrastructure and other operational demands. What sort of independent testing are you suggesting needs to be done there about that issue?

PROFESSOR GALVIN: I didn't expect the letter to end up in this forum. It wasn't written for this purpose. By the way, it is in our terms of reference because while you have been talking I realised the terms of reference changed prior to receiving this brief. So it does sit in our terms of reference.

What that's really saying is again the process I took you through before, that a proponent wants to do something, it develops a thinking, puts it before the regulator for a first pass assessment, the regulator gives the feedback, the proponent goes back again, when people think it's ready for public view it goes out on public display, you have your inquiry, you have your agencies, other agencies look at it. That's the process I mean of

getting it tested. "Is what we are being told in the impact statement and how we are going to manage it, is it robust? Can we rely on it?" So that gets tested. That forms a basis then for decision making in going forward.

All I'm saying here, and you picked it up earlier, is the proponent has made lots of statements of intent. I'm not for one moment doubting the proponent's intention. I'm not saying for one moment that they are not going to honour that. But that's all they are at the moment, is intents.

MR ROZEN: Is your point that you shouldn't be approving a plan based on intent; it should be approved on the basis of - well, what? What is the difference?

PROFESSOR GALVIN: There will be some issues where you can't do anything else but express good intentions at the moment, "In time to come we will sort through this or we will put money at it." But then those intents are normally captured in part of the approval conditions. The approval is conditional on the proponent honouring the following statements of intent, and they are normally an annexure to an approval document. But they are tested first.

MR ROZEN: And with timeframes presumably?

PROFESSOR GALVIN: In some cases, yes.

MR ROZEN: Just before leaving the letter I want to ask you about the second last paragraph. You say, "I can go through the list of queries raised by agencies in attachments 1 and 2 that you sent me and comment on whether I consider they have been addressed in the latest Loy Yang work plan variation. However, I do not know what value that will add against the preceding background. In most cases the answer will be that the proponent has

addressed the query. However, as in the example of water sources to flood the mine noted earlier, the answer is meaningless. It does not contribute to properly assessing risk and rehabilitation and such a meaningful assessment is likely to take several more years given the point at which the mine approval process is currently at in Victoria." In what sense are you saying the answer to the question of water sources is meaningless?

PROFESSOR GALVIN: Is the answer there? I think I gave the answer somewhere earlier in that letter.

MR ROZEN: I think it is the second paragraph on that page. Perhaps if you just take a moment to read that.

PROFESSOR GALVIN: On the second page?

MR ROZEN: The reference to "using best endeavours to source all available supplies of water".

PROFESSOR GALVIN: Okay, I can't see but that's what I said. My point is this. I was sent two sets of questions that have been raised by a range of agencies primarily and asked had the mine addressed those questions in their work plan variation. My first point is a lot of those questions were meaningless. So therefore the mine had no hope of answering them with a meaningful answer.

Secondly, a lot of them were open ended and you can't say that the mine didn't answer them. But again the answer added no value. The water one is not a bad one. All right. So have we got any closer to knowing whether we are going to have water to fill these mines and what the impact of that will be on other people? It hasn't taken us anywhere.

Standing back from it, what this is showing is that those questions that were sent to me were just almost

like, I guess, going around the room today and surveying people, "What do you think, what do you think, what do you think," getting it all together and then giving it to the mine, to the proponent, and saying, "Answer this." There is a step missing.

This process currently lacks structure. It is not systematic. So we are getting different agencies popping up what's in their head without it fitting in to some sort of structure. That comes from much earlier stages in the process, as I said, of identifying the impacts, risk assessing them, handing them out to the agencies and then getting their feedback and then having someone start to coordinate them and put them in their homes. "Okay, this is a water management issue. This is a fire management issue. This is a social impact management issue." So that's where I think we have a long way to go. That comment, "it will take several more years given the point at which the mine approval process is currently at in Victoria" is saying Victoria is a decade behind practice in mine approval processes.

MR ROZEN: Can I just take you up on the question about availability of water because it has taken up a lot of time in the hearing this week. As I think you have just observed, it seems we are not getting anywhere in terms of answers about the availability of water, which would seem to be a very central question for the rehabilitation plans for each of the mines. What do you think needs to be done before a plan like this is approved for the filling of the mine with water in terms of some understanding of what water will be available to do that very thing?

PROFESSOR GALVIN: That's a very difficult question to answer,

especially without notice.

MR ROZEN: Sorry about that.

PROFESSOR GALVIN: The difficulty is this. I'm going to put my mine manager's hat on now; take my planning hat off and put my mine manager's hat on. Here I am as a mine manager. I have a mine that was approved 20 years ago. It has conditions attached to that approval. I'm honouring those conditions. In many cases I'm going beyond what those conditions required. This was the rehabilitation concept that was embedded 20 years ago and that I'm working towards.

The point is that the real problem here is the legacy issue; that 20 or 30 years ago someone should have been looking at this problem before we were locked into what I think from what I see with Jacobs reports and everything else is really, frankly, no other option but to flood those mines and to flood them reasonably quickly. So that's where we are.

The other aspect that is always difficult in these situations - and again this is where a more contemporary approval process would help, but it will never solve the problem totally - is that community expectations are also changing with time. Perhaps 20 years ago when those mines were approved no-one had a concern at all that we would flood the mines. But our community values are different today. If I solve the problem for you now, I suspect in 20 years time my solution is also going to be out of date.

The benefit of the approval process done properly - and it comes back to some earlier comments on the table today about what are acceptable criteria and

agreement versus consensus - is it doesn't matter. Once the mine is approved, "Here are the conditions, here are the performance criteria, this is how it is." These approvals, by the way, have a sunset. They normally only for 20 years. Then there's clarity exactly what's going to be done by who. Whether you like it or not, whether you agree or disagree, they are the approval conditions for this particular project.

MR ROZEN: I notice the time. I wonder if it might be an appropriate time to take a break.

CHAIRMAN: Yes, we will do that. We will resume at or about half past.

(Short adjournment.)

MR ROZEN: Professor Galvin, I think I was just finalising asking you about the letter and if I could just take you to the very last paragraph on page 2. This is your letter of 12 October. This is the summary of the advice, as I understand it, that you were providing to the department. "Based on my experience, the reality of the situation (presumably, the mine must continue to operate) might be dealt with through a staged approval process." What did you have in mind for a staged approval process?

PROFESSOR GALVIN: That's where the approval is conditioned for a period of time. During that time certain undertakings have to be met, certain things have to be achieved and subject to them being achieved, then the mine can move on then to the next stage of the approval. Sometimes that could just be determined by - I don't know the right name these days - but the head of the government department, in my language the Director-General, could have the authority just to say, "I am satisfied. You can go to the next

stage." Sometimes it might come back for another formal review with public input.

MR ROZEN: You will be aware that what in fact happened subsequent to receiving your advice is that the department did approve the work plan variation but subject to a number of conditions?

PROFESSOR GALVIN: I'm aware of that, yes.

MR ROZEN: Have you seen the conditions that were imposed by the department?

PROFESSOR GALVIN: I have.

MR ROZEN: Did you have any role in drafting those or any input into those?

PROFESSOR GALVIN: I was sent a first set of conditions. I got them at literally midnight in New Zealand and they wanted a reply immediately, type of thing. So at 2 a.m. I sent back a reply saying, "I've just sped read them and I notice you rely a lot on risk assessment and I suggest you consider how you condition this that you can be sure that the risk assessments that you are relying upon are done robustly." That's from my recollection about all I had to say. I have seen the final conditions that came out of that.

MR ROZEN: In general terms do the conditions address the substance of the concerns you had about what was lacking in the work plan variation application, leaving aside the process for the moment?

PROFESSOR GALVIN: Mr Rozen, I have to be honest with you. I'm having a lot of trouble understanding what the conditions say. They are quite convoluted. I can see what they are trying to achieve and I think it is a big step in the right direction. But it's a long way behind the person

that's out in front of the race. I think again it just reflects that the problem is that the original groundwork to identify the issues and compartmentalise them is lacking and now sort of on the run we are trying to put together - we are trying to address that on the run by having that form of approval.

I have a model. I have one here that I can show you. It's on the internet. It's the last open cut mine that was approved in New South Wales. It's just very easy to follow. You want to know about something about biodiversity, you go to the biodiversity management plan. You want to know something about cultural heritage, you go to the cultural heritage plan. The approval conditions for the Loy Yang work plan variation are endeavouring to go to that risk based approach, but it lacks the clarity, it lacks these little boxes where you can easily find things and see how they talk to each other.

MR ROZEN: I would ask you, please, if you can provide us with a copy of the New South Wales one that you are referring to. I think that would be of benefit to the Board. The conditions in a number of places require Loy Yang to take certain steps to the satisfaction of the department head or to provide documents to the satisfaction of the department head. Have there been discussions between the TRB and the department about what role, if any, the TRB will have in assessing the various plans that are required to be submitted?

PROFESSOR GALVIN: No, and I don't know that the TRB has met in any case since the conditions were put out.

MR ROZEN: Do you think the TRB has the capacity, the time to provide meaningful input to the department in relation to

whether or not the department head ought to be satisfied by the documents that are envisaged by the conditions?

PROFESSOR GALVIN: The TRB has a role - could play a role in that area. I think you need to be conscious first of all that the TRB, my mind set was the TRB was never set up as in perpetuity. It was to meet a need recognised out of the Yallourn Inquiry. That need is quite different now to what people perceive because I think the nature of the problems weren't appreciated at the time. But in my mind the days of the TRB are numbered or should be numbered. I think there's a need for an alternative model. I'm not just saying shut the TRB down, but I think that model is getting close to its use by date.

What I don't want to see happen is the situation that we have had and that is that the TRB is dragged down; instead of operating at the high level that it should be, and strategic level, it gets dragged down all the time to a low level, it is basically doing a job that others should be doing. The regulator or the agency should first of all be processing the information for themselves and critically reviewing it and then once they think they've got the situation nailed, to then provide the TRB with an executive summary, a summary report of what the issues are, for the TRB then to provide advice either to the minister or to the department head. What you are proposing I think has got merit, but it would need to be done in a way that the TRB doesn't just become a department employee.

MR ROZEN: Thank you very much, Professor Galvin. Professor Mackay, can I just take you back to your statement. There was a matter that I neglected to raise with you. At

paragraph 16 you have a somewhat more optimistic heading in your statement which is "Some promising developments". Is it fair to say that, perhaps in response to the concerns that have been raised over the last few years by the TRB, that we are actually seeing some significant initiatives both in terms of research and also which demonstrate a commitment by the mines to examining a number of these issues, particularly in the stability area?

PROFESSOR MACKAY: Yes, absolutely. I will take the batter stability project first. The data that exists at Yallourn Mine has been provided in its entirety for the area that is going to be under study and the mine has committed to working with the researchers to actually deliver a very strong positive product.

Similarly, if you look at Loy Yang, they have a program going forward to look at the, if you like, the surface stability of the mine batters and that contains a considerable amount of field activity and that's a significant piece of work that will actually add a lot of value in its early stages, but will provide a lot of information moving forward so that they can actually deliver a safe, stable batter, and there will be significant research.

MR ROZEN: Can you expand on a bit more detail about the nature of the research and the timeframes, preferably in language that lawyers can understand, if you don't mind?

PROFESSOR MACKAY: I might have trouble in the latter bit. I will try. I'm not always good at doing it simply. The Loy Yang work is targeted at creating a number of batters that will be monitored and those batters will look at

different aspects of the final landform that might exist above the water table, above the waterline of the lake. So that will investigate the slopes that should be adopted to actually achieve stability so that erosion and other movement processes in the surface do not lead in the medium term to loss of material that will lead ultimately to re-exposure of the batters.

That is partly tied to the way in which the material that will be brought to actually cover over the batters, to actually both reduce fire risk but also to provide a cover to reduce dust issues, to reduce erosion issues, to control water flows, et cetera, will operate. Above that, there will be a vegetated layer, if you like, at this stage, which will actually help reduce erosion.

So, the idea is to really get a full understanding of all the movement processes that will take place and all the water flow processes that will take place that may actually lead to a failure, with the expectation that there will be a design, if you like, that will ultimately be approved for different parts of the mine.

That's a really valuable activity. In the first instance they are going to adopt, as I understand it, what they would regard as their preferred option for constructing the final batters to see how well that performs, and then go for variations of that to see whether they get an improvement. Of course, these batters take quite a lot of time to mature, if you like, so they settle down over a period of time. So, the time period to collect data is relatively long. They have a five-year period for creating these slopes and monitoring, but they

will need to go beyond that and I think they are aware of that to actually continue the process of understanding how these are performing so that when they get to final batter form - doing major rehabilitation works going forward, they have something that they are confident will actually deliver a result for them.

MR ROZEN: Professor Sullivan, is that something you are involved in at an advice level with Loy Yang, this project?

PROFESSOR SULLIVAN: No.

CHAIRMAN: Just to follow that up, though, is it something you think it's a good start but that much more needs to be done in relation to stability? Would that be an area on which you could comment?

PROFESSOR SULLIVAN: It is a good start, yes.

CHAIRMAN: There's a lot more that needs to be done?

PROFESSOR SULLIVAN: A lot more that needs to be done and it will be a long time before the answers come out.

MR ROZEN: Just in relation to that "a lot more", you make the point in a number of places in your report, Professor Sullivan, that a mine by mine approach is necessary and you point to significant differences, for example, between Loy Yang with its considerable buffer zone from Traralgon and you contrast that with Hazelwood, which we know is far closer to a town, being Morwell. You make reference to some stability issues in relation to the northern batters of the Hazelwood mine in the context of the fire suppression activity that occurred there.

Can you expand on that? What's the work that's been done, as far as you are aware, to assess the impact of the water that was used to suppress the fire last year

and its impact on the stability of the northern batters?

PROFESSOR SULLIVAN: I'm not aware of any particular detailed analysis of that that's happened. I just understood what was happening on the basis of my 40 years of looking at things like this.

MR ROZEN: So if you put that much water at the toe of a batter of that nature, the chances are it will have some impact on stability or it might do?

PROFESSOR SULLIVAN: As I have said in my evidence, these materials are very sensitive to water anywhere in the system. Simply saying "we'll just fill the mines up with water" I have some great concerns about and just that process itself and after that process it's not clear to me that we are not going to have undue risks in that process itself.

CHAIRMAN: Could I just follow up. In relation to there being such a variation in problems as to stability across the three mines, one of the concerns expressed at community consultations was in relation to the area, if you like, of the northern batters for Hazelwood because they are so close to the township. My impression as very much a lay person is that that's the area in broad terms which is likely to have most impact upon the general public or the community, but you would have a knowledge of the stability issues across all of the three mines. Is there anything that comes close to that potential impact upon the community broadly?

PROFESSOR SULLIVAN: At the other mines?

CHAIRMAN: Yes. I just put the northern batters at Hazelwood as being very important from a stability point of view above all others. But are there any other - is that

assessment sort of just an ill-informed one?

PROFESSOR SULLIVAN: That's not ill-informed. It is probably highest on the list. Then you get a number of other areas dependent on whether it is public exposure due to roots or whether there's significant natural infrastructure.

CHAIRMAN: It seems that Loy Yang is lucky in that it is relatively away from public contact.

PROFESSOR SULLIVAN: Correct, and that's why you have a completely different approach to the landform and the land use and achieving success criteria which could be at a much lower level than you would have to substantiate for ones like the Morwell example you gave.

CHAIRMAN: And Yallourn seems to have had its problems, but because it's not expanding to the same degree, its kind of problems are still there because it's near important roads and important rail line, but, if you like, it's still relatively less than the north batters in Hazelwood, but that the rest of Hazelwood perhaps is almost into the Loy Yang situation in general terms. There are risks of batters for the internal running of the mines, but not likely to have the same impact that has been had with the three collapses within the last 10 years.

PROFESSOR SULLIVAN: That's correct. You can do a risk ranking for each of the mines and isolate the particular areas, the domain. You are right; if you start with Morwell, there is just that one northern batter section there and probably now that it's approaching another Morwell River diversion, that would be another one of lower ranking, and then the rest of the batters, and so on. Then you go to Yallourn, you obviously have the railway line and some other public area access in the old township field. You

certainly have the river diversions, you have the Latrobe River and then probably public land outside the Yallourn east field extension towards Latrobe road. But again, each one would be lower in its potential significance.

CHAIRMAN: I just wanted to get that, I suppose, impression as to whether my ill-informed impression was generally right.

PROFESSOR SULLIVAN: You are generally right.

MR ROZEN: Professor Galvin, that notion of a risk ranking, is that a little bit akin to the hazard maps that you refer to in your statement?

PROFESSOR GALVIN: Yes, it is.

MR ROZEN: What are you referring to? This is paragraph 22 of your statement on page 7. "The Board recommended in 2011 and subsequently that hazard maps be prepared showing all infrastructure within a kilometre of mine crests and the risk presented to this infrastructure by significant mining induced ground movement."

PROFESSOR GALVIN: It is a little bit subtly different to what Professor Sullivan was talking about and what the Chairman is talking about. What we are saying is don't start with, "Oh, well, the Hazelwood batters or the Morwell River diversion are risk". Park all that. Just start with drawing a line around the mines a kilometre from the edge of each mine and let's have a look at what's in there. There's a power station, there's a telecommunications cable, there's a railway line, there's a hospital, there's a highway, there's a dirt track, so what's there.

Then, having identified what's there, go through and say, "Okay, now let's rank them. What's the consequence if there is an instability?" The railway line, for example, is only 60 metres from the edge of a

mine. It's a no-brainer that's going to end up with a high risk rating. That's not to say it is about to fall in. But it's to say that, if it did, a high consequence. There are a lot of hidden ones here that I think people need to do more work on.

I know from my experience, I do a lot of work in ground subsidence in New South Wales and one of the surprises we had there was the impact if we break a telecommunications cable these days. Banking systems go down, ATMs go down, national security can go down. So something that's hidden, you wouldn't think was there, can have a very high risk rating. Then there's others. The dirt road that has one car a day, well, yes, you don't want to see someone get hurt, but the risk is going to be low.

Let's understand for the moment what is there. Once we understand what is there, then you can start to decide on a strategy. That's a good point, I think, to put something else on the table that I haven't heard come out yet which is important. I have heard a lot of discussion yesterday about placing overburden into the bottom of mines and is there enough overburden. I haven't heard anyone recognise yet that we may need to use a lot of that overburden in fact to stabilise existing batters such as the Hazelwood northern batters. That again comes back to Professor Sullivan's point and Professor Mackay's about how site specific some of these responses are. That's where there's still a lot of work to be done to understand how we rehabilitate a mine. The northern batters at Hazelwood can end up consuming quite a large amount of overburden that we haven't taken into account.

So, the hazard plan comes back to having identified these sort of areas, colour coded them, then you focus on this one, this one and this one. Maybe we are better to move this infrastructure, let's move the railway line, let's put a duplicate powerline in, let's have switching so if that powerline goes down we can immediately switch to another powerline. This is stuff that's routinely done in other sectors in the mining industry.

MR ROZEN: It is basic risk management, is it not?

PROFESSOR GALVIN: Yes.

MR ROZEN: Has that work been done, the hazard mapping?

PROFESSOR GALVIN: No.

CHAIRMAN: I'm talking from a back protection point of view, in the sense that if a report is handed down that hasn't mentioned matters, it seems to me there'd be some criticism made, but it does seem in the light of that discussion that I perhaps should relatively upgrade in my head the notion of a problem in relation to the railway line and it comes still perhaps second to the problem that might arise in that northern batter section of Hazelwood?

PROFESSOR GALVIN: Hazelwood - and I know that Professor Sullivan and I are of similar thinking here, we have had this discussion - Hazelwood concerns us quite a lot. I will speak for myself. I mentioned earlier that there's the Lewis anomaly that moved back in the 60s that's a reasonable way from the town. We know the department has had a lot of sink holes repaired in another part of the area. There's cracks in netball courts. The town has subsided several metres because of the water situation and will continue to subside and for a while and it has

infrastructure that's too close to the mine and it was silly to ever put it there.

The image I have in my mind is basically a fractured dinner plate, if you like, just sitting there and one edge of the plate sits at the edge of the Hazelwood northern batters, but the whole thing is fractured. In my statement I try to do it in layman's terms for you, that when you get a fracture you get water in the fracture and if you can't get the water out quickly, everything moves. To me that northern batters area extending for a significant distance back into the town is a fractured dinner plate and I can't give you any assurance in time to come when and how and how much that will move.

However, you bring your risk management in and you say, "I'd better go and put a big buttress against that now and get rid of the problem once and for all." That's the thinking that's still lacking. I suggest you ask Professor Sullivan's comments.

MR ROZEN: I think I have to. Would you like to add to that, Professor Sullivan?

PROFESSOR SULLIVAN: I will add to two elements of what Professor Galvin said. In terms of the hazard mapping, I referred a bit earlier in my evidence to talking about that the Latrobe Valley is now a complex system and that things are interacting with each other in a complex system in a global sense. So, when that happens, the chances for things to interact in surprising combinations increases. That's where the hazard mapping and extending out a kilometre partly tries to capture those elements. In regard to the Hazelwood northern batters, it's been on the

radar for a long time and it's still on my radar and I am concerned about the impacts of critical loading events still on the stability of that batter.

DR HABERFIELD: Can I make a comment, please?

MR ROZEN: Yes, Dr Haberfield. Please.

DR HABERFIELD: I think a few points there require clarification. It is not really hazard mapping we are looking at. We know what the hazard is. It is really about susceptibility mapping, what is susceptible, what elements are susceptible and then extending that. The hazard is from the movement of the high wall or whatever wall you are looking at, the batter at the mine.

What we need to do to understand that is what drives that mechanism. As Tim and Jim have said, it's water. So, to reduce that hazard we have to deal with the water and the problem is when you have concentrated sources of water like the Morwell main drain when it is full of water, the Latrobe River, Morwell River, they are concentrated sources of water which, if they empty into coal joints, can cause movement.

We have to understand what is the risk of that happening - sorry, what the probability of that happening is and then, should that occur, what are the elements of risk and then those elements of risk, what is susceptible there? So, it is more than a hazard map; it is a whole process we have to go through, and every part of every mine will be different.

So one of the solutions for the northern batter of Hazelwood may be to buttress it. Another solution may be to move the Morwell main drain. But there are different solutions. The highway, the freeway, still goes

through there. That risk is currently regarded as tolerable, otherwise we would close the road and allow no one through it. So everything has to be assessed in terms of risk and every one of those batters has to identify those items at risk and whether they are tolerable or not. So it's not just being safe and stable; it's what risk. I think that is an important thing we have to understand.

MR ROZEN: It is a point you make in your report, isn't it, about acceptability of risk rather than absolute safety; is that what - - -

DR HABERFIELD: Yes. Acceptability is also a risk term, because you can have tolerable risk and acceptable risk. I would class something like the road toll as a tolerable risk. It is something that we are willing to accept, but we want to try and lessen, we want to try and improve, whereas acceptable risk is something which everyone accepts and says, "We really can't improve it much further and we're willing to accept it." So, there are different levels of risk we must look at.

CHAIRMAN: Would you accept when you are assessing risk you put way up above any other matter that has to be taken into account the value of human life?

DR HABERFIELD: That is not for me to judge. There is a risk to life and risk to property you have to do, but risk to life is paramount. But it is up to the community to accept what the acceptable risk to life is, just as I said about the road toll. We accept currently in Victoria 200 and whatever people getting killed per year, otherwise none of us would be driving cars. So that is a tolerable risk we accept. Do we want it to be zero? Of course. But how much money, how much effort is it going to take to

get that to zero and is the community willing to accept that?

So, I really can't answer your question in that term. It is really what value you put on things. I know that's a very hard thing to accept, but normally when we look at risk assessment we look at risk to assets and non-human things and then risk to life.

MR ROZEN: Can I ask you, I think this is to Professor Mackay or Professor Galvin, is work taking place or planned to look at the stability issues at Hazelwood?

PROFESSOR MACKAY: I'm not aware of that. I think you would have to talk to the mine.

MR ROZEN: It is necessary, is it not, in light of the evidence that we are hearing?

PROFESSOR MACKAY: Yes, it is definitely necessary.

I certainly would add that should we decide to flood Hazelwood Mine, that will raise the groundwater levels in the area around, that will have an interesting effect in potentially reversing some of the subsidence that's taken place. These things never go back the way they started out, so it won't be just coming back to its original surface, it will go back to a different surface with different problems. So things like the Lewis anomaly where you might get shearing processes may suddenly become reactivated and it may not be possible to avoid that.

MR ROZEN: Perhaps just taking you up on that and something Professor Sullivan has said, the Board has been presented essentially with the material before it with what is almost a fait accompli; that is, there is really only one option here and that is to fill the mine voids with water and turn them into lakes. But at the same time it is

hearing there are so many questions associated with that: water quantity, water quality, stability. We are hearing that water and coal can lead to stability problems and at the same time we are hearing "let's put a whole lot of water into these coal mines".

Professor Sullivan, I understood something you said a moment ago about the sort of residual concerns you have about this whole idea of filling these voids with water. Should we be looking at alternatives, I suppose, is what I'm asking? Are there any viable alternatives?

PROFESSOR SULLIVAN: I don't believe there are any viable alternatives, but there's a lot of engineering and science that has to go in to arriving at a solution that fits what societal norms would be for acceptable criteria.

MR ROZEN: I guess the question is if we do all the research, we do all the science, but we don't get satisfactory answers on questions like stability and water quality, then what? Professor Galvin?

PROFESSOR GALVIN: I might need to move back from my colleagues because we've had this discussion and I've lost it before . I think you raise a good point. The reason I say that is that the mines are not flooded today. The only thing we are talking about is batter stability. We are well ahead of the game now to where we were six, eight years ago in identifying the problems and also remediating those that are already there.

So the question that I've asked, and I haven't asked it of Professor Sullivan. One of our other board members, Professor Johnson, took exception to the question and Professor Sullivan supported him. "Why don't we just continue to pump? Turn the bottom of Yallourn into

whatever you want to, soccer fields, whatever you want to do. Why don't we just continue to pump?"

Now, I'm showing the limit of my knowledge here in terms of hydrology because my colleagues have come back and said you can't continue to keep pumping from that aquifer. But I haven't heard anyone challenge at the moment, well, no-one is questioning we're proposing still to do it for 20 years or 40 years. I think I'd better hand it to Professor Sullivan. He's getting a bit agitated.

MR ROZEN: The microphone is yours, Professor Sullivan.

PROFESSOR SULLIVAN: You keep pumping, you keep affecting the system, the global system. Subsidence keeps going on. You have the broken plate analogy of Professor Galvin. You keep moving the bits of plate together or apart, one up, one down. So, I don't believe it's viable to have a long-term proposition to just keep pumping in perpetuity for these mines.

I believe we can achieve the right levels of stability that will most probably be acceptable in terms of societal norms for criteria for safe and stable, but it will need more nuanced engineering than just fill the bottom of the holes with the dirt and then add water on top. We have to use the dirt more effectively because it's the one physical thing that can probably withstand the sort of critical loading events that will happen in the very, very long term, which is what we are talking about here.

DR McCULLOUGH: If I may add to that. I think what we need to remember here is again we are not coming up with a definitive design now. Knowledge will change over the

next few decades, studies will occur, they may demonstrate that we do not want a pit lake, they may demonstrate that a pit lake can be quite feasibly and safely developed. So we don't want to pre-empt that process here.

But I think equally we are focusing at the moment solely on risk and that is very much a regulator perspective, just risk, and by doing so we are missing an opportunity. So what we would normally undertake in this situation is something like a SWOT analysis and also look at the opportunities.

Now, having a dry void is not going to lend many opportunities to itself. We have been doing the exact same planning in New South Wales up in the Hunter Valley where we have identified very few end uses from dry voids. However, we have identified extensive uses from wet voids, i.e. pit lakes, benefits to the community, benefits to the economy, benefits to the environment, and those opportunities can trump some of those risks. Risks will always be there. It may be they are a significant measure, but there may also be significant opportunity and if we fail to recognise the opportunity, then we may fail to recognise the best closure outcomes for the region.

MR ROZEN: It is a bit half glass full, half glass empty?

DR McCULLOUGH: It is how you tend to look at it.

MR ROZEN: You have identified in your report, Dr McCullough, you were asked the question what more needs to be done to implement the Hazelwood proposal of a pit lake, and you have identified I think it is 17 areas of study, short, medium and long term. The questions that you throw up in those are complex questions that don't lend themselves to easy answers; would you agree?

DR McCULLOUGH: That's correct. Pit lakes are very complex landforms. They hinge upon the interaction of a number of different technical disciplines. They also involve of course a number of different stakeholders.

MR ROZEN: I think I understood you a moment ago to say that it is conceivable from your perspective that the outcomes of those studies might tell us that a pit lake is not a desirable outcome?

DR McCULLOUGH: It is conceivable, but I believe it very unlikely. I've been working with these landforms for a number of years now. I have yet to find an options analysis that found that pumping in perpetuity, which is quite a long time, yields better outcomes.

MR ROZEN: Can I open up that general question of the what if scenario. What if we do the research, we do the science, we conduct the studies, and the answer comes back that pit lakes in one or more of these mines are not viable, not safe, can't lead to stable outcomes, what then in the long term? Dr Haberfield?

DR HABERFIELD: I'm going to be a little bit arrogant here. We are engineers, or I am and a few of the others are, and our job is to find solutions and we will turn those solutions. Yes, some solutions will cost more money than others and will take longer to achieve, but I have no doubt that there is a solution for these pits. Currently the best solution that I can think of is a lowered landform with a pit lake.

Having said that, you could equally - I kind of disagree with the other end of the table. The reason I don't think you can pump in perpetuity is simply because it is not sustainable. It is not something we want to do

is keep pulling groundwater out just to put it somewhere else, and then there's a whole problem with the water licences and so on and so on. So, with respect to subsidence, this whole area has been going down ever since they started de-watering, and it will continue to creep down while they de-water, but it will be at a slowing rate because the reason it is consolidating is because of the weight of material above it which has increased due to the water being pumped out of it. I know that's a bit hard to understand, but that's effectively what's happened, and while you keep those water pressures down there at about the same level, if you don't decrease them, the material up the top will settle, it will what we call consolidate, it will settle over a period of time and then it will gradually slow down. But if you increase the pumping so you reduce the aquifer pressures further, then you will get an increase in settlement.

So there's very complex issues here at hand and, to summarise, I believe we can make a solution work and it just requires the science to do it. So I don't think what you are proposing is at all credible.

MR ROZEN: I can cop that. Thanks, Doctor.

DR HABERFIELD: Sorry.

MR ROZEN: Far worse things have been said about me in court cases. Mr Hoxley?

MR HOXLEY: Thank you. I have been listening with great interest to this conversation because it does mirror a lot of the journey that we went through in preparing the report and you will see that there are elements of these trade-offs and all these competing factors that come together in a number of the landforms.

So, when we went through and looked at the range of possible landforms, the reasons why some of them were excluded as viable was around a combination of factors such as understanding our expectation about the sustainability outcomes of that and understanding of the cost and practicality. These have often got judgments about what is practical and what is not practical, so we have had a conversation today around is the lowered landform with a lake in it, some type of lake feature, the only viable option? The answer we've got, and in the expert panel, is effectively it is. Underneath that assessment of viability are a number of value judgments that are informed by our view of what society will bear, about our view about what the costs of those would be.

If, in your case, we found that the engineering was not possible or too difficult to bear to achieve that landform, then I would suggest that that would open up an ability to look at some of those other things that up to that point had been regarded as not moveable or not feasible . For example, lining the voids and leaving them open has been ruled out through our study because of some of the technical difficulties. It could well be that in the course of understanding why a pit lake may not work, that some type of lowered landform, say, the one that we have ruled out as the dry void or the backfilling above the water table case, so that's not completely filling to the surface, but putting something in there that would obviate the need to have a water body in there, it may well be that we will then see a solution to that. It might be that that requires the unlocking of some aspects that had otherwise been seen as too difficult or too

expensive; for example, relocating of a large amount of material from across the three mines into one particular area.

The other comment is, and it has been well made by the panel today, is that there probably isn't a one size fit all. If we decide that a minimal amount of water is a preferred option, it may be you can optimise that across two of the three pits and you are left with one of them that has an amount of water but that's regarded as the least worst outcome, but you do it across all of those. At the moment our observation would be a lot of the thinking is in the individual silos and that some of those opportunities or options, the "what if" in response to your question, may be able to be resolved when you take a broader view.

So, in my view I think what would happen is we would unlock some things that at the moment we think are constraints that are immoveable, they would come into the mix and a physical answer would be found, because often a lot of those constraints come down to the cost that people will bear, and I think that is something that could be readdressed.

MR ROZEN: Mr Spiers?

MR SPIERS: I would say almost the same as Greg said. My big take out of this study, and I'm possibly the least technically qualified on this table - - -

MR ROZEN: A long time at the coalface, though.

MR SPIERS: That's exactly right. My big take is my 20 years operational experience where I was at the cutting edge of make sure there is power to supply the community of Victoria. You have lots of engineering problems, day in

day out, and you take advice from experts who don't want to run mines, but who know the technical stuff that supports mines. In taking that technical advice, you come up with solutions to problems. As Chris said, it's about solving problem, problem, problem, and engineers, that's what we are trained to do, so you find the solution that is the best mix, least risk, et cetera. That's the constant game we are in.

MR ROZEN: Professor Sullivan, anything you want to add to this current discussion?

PROFESSOR SULLIVAN: No, I think I have covered most of the bits so far.

MR ROZEN: Back to you, Professor Galvin.

PROFESSOR GALVIN: No, but I'm not prepared to roll over on the other option.

MR ROZEN: Perhaps I can conclude all of this with you, Professor Mackay. Firstly, anything you want to add to this general discussion, the what if?

PROFESSOR MACKAY: Yes, for me the issue in terms of viability is about whether we can actually create a landform for which there is no continuing management required. Viability in that sense may prove to be a fundamental issue and I think that's something that we will have to look at. I think you have heard along the table that when you get an engineering problem you can find an engineering solution often by continuing to maintain or continuing to monitor or continuing to develop, and that is probably undesirable, but it may be necessary for this particular set of lakes. I am a great believer that we will end up in a lake system and I am as a hydrogeologist rather against Professor Galvin in respect of pumping, not least

because I do think it will have quite serious consequences in terms of subsidence, but it will also have serious consequences in terms of the water resources, and as a hydrogeologist I don't like to waste water for the sake of it.

But, overall, I think there has been a demonstration that if you put in appropriate management practices in place while mining, you can actually minimise the risk of movements. That doesn't say we have done that all the time, but we can do that. Similarly, when you go back to a new landform there is absolutely no reason why we can't manage the risks that are attached to that by appropriate engineering. So, I am confident that we will achieve a solution. What I'm not confident about is that we will achieve an unmanaged solution.

MR ROZEN: Can I just take you up on that because it is an issue that's arisen. That is, there's a world of difference between a lake where we've got water quality issues for decades to come because it's not connected to a river system; for example, there's no flow-through, there's no flushing. Is that the sort of level at which these decisions need to be made? In other words, you are less likely to have ongoing water quality monitoring problems if you are able to achieve flow-through with these lakes?

PROFESSOR MACKAY: Definitely you are less likely to have water quality problems if you can continue to have some sort of through-flow. There is no reason why you cannot get an engineered form of through-flow. I would not expect either Loy Yang or Hazelwood to have water levels which would allow a direct movement of water over land back into

the river system. They will be enclosed lakes and their primary discharges if left to nature will be evaporation.

MR ROZEN: Yallourn of course is a different category?

PROFESSOR MACKAY: My view on Yallourn is it is different because it has a reasonably large catchment around it that can actually accommodate putting water into it. It will bring it up, in my opinion, fairly close to river level and you could actually connect it to the river if you chose to do so. The desirability of that has to be determined.

MR ROZEN: Dr McCullough, do you take a different view in relation to Hazelwood? That is, the ability to achieve some sort of flow-through with the Hazelwood lake?

DR McCULLOUGH: I take a different view that we can determine at this moment, without information on the community values on the river and the lake, without information on the water quality of the river and the lake. I have here a published paper on flow-through of a south-western lake which was short listed for an environmental award this year. I also have a copy of my peer review paper on engineering flow-through around the world. We cannot determine at this point in time whether or not flow-through will be a good idea. There can be a number of dangers both for the lake and also for the river and for users of both of those entities.

Just to expand upon a couple of the other points. I agree with Jim. We can keep that option on the ground about pumping a lake. There is no reason to take that off. The only point at which we'd take that option away is when we reach what's called a Rubicon moment in mine enclosure planning; for instance, when that option is

irretrievably lost due to mining design or other achievements.

I think the other really important point to be made here is that I plan mines around the world for closures of pit lakes. I'm planning a Peruvian mine at the moment where there is danger of rockfall from half a kilometre above the lake surface which will propagate a 50-metre tidal wave downstream of a village. I'm planning a mine in south-western Australia which has water quality worse than lemon juice; boats literally dissolve in it. The outcomes for pit lakes in this area from the evidence I've seen look good. The risk looks low. I think that needs to be borne in mind.

MR ROZEN: I have probably taken up enough time. There are other counsel that have questions for the panel, so I will sit down.

MS PEPPLER: The first question that I wanted to ask is for Professor Galvin. It relates to an assumption that we have an end use rehabilitation concept for a filled or partially filled lake and that some form of public recreational use is desired. Are there particular standards or criteria for remediation that need to be implemented in order to provide for a public recreational use as compared with an end use that would be purely private?

PROFESSOR GALVIN: That's simple to answer in that it is outside my area of expertise and that's why the board has just been expanded to include someone who is more up to speed on that. I have obviously a general knowledge of it from my roles on planning assessment commissions. The answer to your question is yes, but the detail is for

others.

MS PEPPLER: Thank you. I might turn now to Dr McCullough then. Dr McCullough, you have just been talking about the opportunities of lakes and the opportunities for community. What would you say about any standards or objectives that should be set?

DR McCULLOUGH: There are not so much standards as there are guidelines. So that needs to be interpreted differently. The most relevant guidelines are either the National Health and Medical Research Council guidelines 2008, amended 2011, for swimming, for example, recreation, both primary and secondary contact, and then there are the ANZECC/ARMCANZ guidelines from 2000, which are also known as the Australasian Water Quality Guidelines. They are mainly for livestock drinking, aquaculture and other forms of primary production and also ecosystem values. Because those are guidelines they are very loosely defined and there needs to be development as to the final end uses.

I have also co-authored this year the Commonwealth guidelines on pit lake closure and I talk there very much about how guidelines and derivation of criteria from those guidelines is something that must be treated as flexible over time and it is something that we will only know the answer to when these mines are getting close to closure.

MS PEPPLER: Are you able to provide us with copies of those guidelines?

DR McCULLOUGH: Yes. They are currently in draft, but they should be published in March next year.

MS PEPPLER: The question that follows from that, and I will stay with you, Dr McCullough, is what do rehabilitation

plans and steps taken between now and mine closure need to cover in order to accommodate the types of standards we are talking about at the end?

DR McCULLOUGH: Largely most of the 17 studies which I describe in my expert evidence.

MS PEPPLER: So is there anything different that we need to start doing now in order to be able to meet those standards?

DR McCULLOUGH: I believe if those studies which I recommend are undertaken then we will understand those standards in a timely manner.

MS PEPPLER: Professor Sullivan, the next question is for you. You said in answer to Counsel Assisting's questions about the recent change to the Loy Yang work plan that putting forward an end use concept that excluded public access was best but it may be subject to change over time. The reasons why AGL considers that the end use is best have not been explained in evidence to this Inquiry. Given the importance of stakeholder engagement, would you agree that the basis for the change and the reasons why AGL has proposed it should be explained to stakeholders, in particular the Latrobe Valley community?

PROFESSOR SULLIVAN: Yes.

MS PEPPLER: Following from that, is the rationale that excluding the public will permit a lower level of success criteria?

PROFESSOR SULLIVAN: No. The rationale is that it is trying to cover the safety aspect. We haven't developed a criteria or the criteria haven't been developed, and that's what I alluded to in my earlier evidence, that based on the knowledge at the moment they have followed a proper

process and arrived at a position, which I think is appropriate at this stage, but more detailed engineering may well show that that can come back into public access of some more limited form.

MS PEPPLER: Do you have any ideas about when that might be done?

PROFESSOR SULLIVAN: No.

MS PEPPLER: I wanted to turn to a question of timing, and this question will be for Professor Mackay and Professor Sullivan. You have both referred to the need for long-term monitoring. Have you considered how long monitoring might be required post closure post filling to a final level? So assume we fill the pits to what we consider to be the final level. How long do we need monitoring after that?

PROFESSOR MACKAY: I don't actually have an answer for you. I am sure that there will be need for monitoring going beyond. Whether it is for a decade or whether it is for longer than that, I cannot give you any answer at this stage. The research is not strong enough to give a clear indication of how quickly we can expect to see stability reached.

MS PEPPLER: Following on from that, it would depend upon the results of the monitoring?

PROFESSOR MACKAY: Yes, absolutely.

MS PEPPLER: Professor Sullivan?

PROFESSOR SULLIVAN: Looking now on the basis of current knowledge, which is inadequate, it is a considerable period of time that the monitoring will have to continue. But the length of time will be dependent on the monitoring and the results of the monitoring. So it is a process.

MS PEPPLER: When you say "considerable period of time" are you able to give us your understanding of what you mean?

PROFESSOR SULLIVAN: If I guessed, it's not years, it's probably decades.

MS PEPPLER: I wanted to ask Professor Galvin a question about progressive rehabilitation and the scope to increase the rate of progressive rehabilitation. What do you see that scope to be and what changes to the mine's processes would be required to increase the rate of progressive rehabilitation?

PROFESSOR GALVIN: I can only answer that in general terms at the moment because, as I have said a number of times, the board's TORs have only just been changed to look at rehabilitation. I can only answer you from my mining experience, and pretty much along the lines of my colleagues when they rebutted my idea of leaving the pumps running, and that is that you can engineer anything if you throw enough money at it. There is a lot of infrastructure on those batters at the moment and it is an impediment to progressive rehabilitation. But I'm sure that if you threw more money at it you would get more progressive rehabilitation done.

MS PEPPLER: The next question is also for you, Professor Galvin, and it relates to submerged batters which you have referred to at paragraph 21 of your statement. What are the consequences of a submerged batter collapse?

PROFESSOR GALVIN: That's simple to answer. I don't know. That's why it's there, because they are the sort of issues that people like Professor Mackay and Professor Sullivan and Professor Johnson, if he were here, have to convince me, tell me what they are about. I just have the vision

that we have a lake. It's full of water. We are all worried about the rehabilitated grasslands that the public are going to use sliding into the lake. What do we do if actual instability occurs under the water and we have a large section subside under water? How do we treat that? I don't know.

I was asked by the Inquiry to give some examples in layman's terms of issues that cause me to say this is complex. This is just to whet your appetite, to open your mind up to the sorts of things we have to look at.

DR HABERFIELD: Can I make a comment there, please. Underwater slope stability is quite a well researched, defined area of geomechanics and oceanography and other things like that. The offshore mining industry, oil wells, so on have been dealing with this for a long time. There is a lot of information out there. So there's knowledge. It just hasn't been applied to this situation. So that information can be gained. It is just part of the studies.

The other comment I would like to make with respect to monitoring, what monitoring are you referring to? There's monitoring for water quality. There's monitoring for stability. There's monitoring for all types of stuff. Some will go on longer than others. It just depends on what you measure, as the others have said.

MS PEPPLER: Certainly. Have you considered what timeframe you might need for those types of monitoring that you are referring to?

DR HABERFIELD: I think water quality monitoring, just like all the rivers and that, goes on forever. It is just something we keep doing. Landslip to do with stability

and that is going to depend very much on the solution of what you get on the batters and what the risks are. There might be some batters, like the northern batter of Hazelwood because it has a freeway going past it, that VicRoads may monitor in perpetuity simply because they need some system, whether there is a movement - and I'm not talking a failure; just a movement - which could cause a road accident, they will have to deal with it. Just like in many, many other parts of the world, like I said before, it all comes down to tolerable risk and understanding it.

DR McCULLOUGH: If I could further expand upon that, please. Looking at submerged batter collapse, there are a number of impacts which have been found. Water quality. Dangerous surge waves which of course can impact upon recreational users, leading to further instability and of course direct life loss or property loss from that.

Looking at monitoring, there are guidelines. I wrote them for the Western Australian government on pit lake water quality monitoring for example, and that looks at a number of other values. There is also a very good chapter - yes, I am making a plug - in my book on pit lake monitoring. However, what we need to be very clear about is what we are monitoring for. So we need to look at the values and end use of that. So we won't know that for some time either. As my colleague mentioned, a number of these things we will continue to monitor for a very long time and that's not dissimilar to most of the water bodies of this region.

MS PEPPLER: Thank you. Could we also ask you to produce those guidelines that you have just referred to?

DR McCULLOUGH: I may have to charge you for the book, but yes.

MS PEPPLER: And a copy of your book. I wanted to ask Professor Mackay if there is anything that you wanted to respond to in Dr Haberfield's comment that we do have knowledge already in relation to the potential for submerged batter collapse.

PROFESSOR MACKAY: I think I wrote in my evidence that I think it's dangerous to transfer unchallenged information from other domains. Brown coal is a fairly interesting material. It's a very light material. It moves in interesting ways. It's a jointed material, so parts of it can move independently. It's very easily moved by rapid changes in groundwater pressures. I actually think that it is something that will need to be looked at. I think it is something that could be of issue. I am not sure that it is a simple, straightforward transfer of knowledge, that it's fine because other areas have shown that to be fine.

DR HABERFIELD: If I might just reply. I don't disagree. What I'm saying is that there is a whole area of study out there which we can learn from and apply. Yes, it will have to be applied for this particular application. But there is knowledge there. We understand the consequences. We might not understand the processes fully for coal, like brown coal, but with study we can.

PROFESSOR SULLIVAN: Can I add as well, please. Sorry, I know you want to get to the end of this, but seiche analysis, landslide wave generation, is a reasonably well developed science. There are a couple of different methods you have to use. All of these final end use which involve water will have to have those sorts of studies done. It's most

frequently undertaken as part of dams because you are filling a dam up and then you might have a landslide attached to that filling process which then could overtop the dam and threaten it. So it is reasonably well developed. But it would be part of the quantitative studies that then look at the impacts, that then look at the impacts on individual societal health and safety and downstream impacts. It's just one little area of the detail that needs to be completed.

MS PEPPLER: Thank you. I wanted to ask you to cast your minds back to the joint report question 1 where Professor Sullivan suggested the addition of health and safety and management of fire risk to the objectives that were agreed. In particular if I can ask Dr McCullough and Dr Haberfield, would you agree that those factors of health and safety and management of fire risk should be added to the agreed objectives?

DR HABERFIELD: Absolutely.

DR McCULLOUGH: Yes, I agreed with those additions but with the qualifications that there is a number of other things as well that need to be added. What Professor Sullivan generated was a preliminary list.

MS PEPPLER: Certainly. In your report is there somewhere that we can readily go to to find the other objectives that you would suggest?

DR McCULLOUGH: Yes. The best place to start is by engaging with the community, engaging with the mine operators, determining a final land use and, once you have your land use, you can then work back from that to determining objectives. Objectives should not be defined in a vacuum of final land use.

MS PEPPLER: The next question is for Professor Galvin and it refers to the joint report question 8(c). In what ways could the State Government be more proactive in regulatory oversight?

PROFESSOR GALVIN: I think, frankly, I have answered pretty much that for you already in talking about the regulatory approval processes, conditioning approvals. That gets captured in what I mean by adopting contemporary rehabilitation policies and practices. In promoting research in collaboration between all stakeholders we have just had a discussion about there is information in each of the mines and the mines are doing their own work, and I have said in my statement that I think the mines are ahead of the regulator in many areas. But you have heard Professor Mackay talk about a central bank of knowledge where that information is shared. So that's captured in that. In conditioning work plan approvals, I'm not going to say anything more about that.

MS PEPPLER: I was intending to ask you a follow-up question about it, but we will get there in one moment.

PROFESSOR GALVIN: Regulatory oversight of rehabilitation, rehabilitation to me is very broad. It's not just putting a dozer down the slope and flattening it and putting a bit of grass on it. It is broader than that in terms of not only mine closure but just the fact that to me slope instability and avoiding slope instability is part of effective rehabilitation. We just don't want it to happen after we finish mining.

How can they be more proactive? As I said earlier, the TRB identified seven at risk batters. The regulator had that list and yet five of them still went on

to fail. So I think there could have been a bit more proactive intervention there.

MS PEPPLER: Professor Galvin, I will ask you about the Loy Yang work plan variation conditions. As touched upon, the conditions asked the mine to do detailed risk assessments in stages and provide those staged risk assessments to the department to the department's satisfaction. Mr Wilson gave evidence that the department has not yet developed its processes for reviewing what the mine provides. So the process leaves the risk assessment in the hands of the mine, then with the department for evaluation. In terms of looking forward to the next time the department approves a work plan variation are you able to comment on how that staged approval framework might be different?

PROFESSOR GALVIN: The TRB allocates two days a month to this work. At the moment and for the last month we have been working virtually full-time for the Inquiry. I had those conditions emailed to me a few days ago . I have sped read them. That's all I have turned my mind to. It is too premature.

MS PEPPLER: Thank you. Professor Sullivan, you said in response to Counsel Assisting that Loy Yang Mine might have a different approach of a lower level in terms of - we are talking about the particular identification of hazards, and I wanted to ask you about the proximity of the northern batters of Loy Yang to the future Traralgon bypass. I'm not sure if you have had a chance to read the RAMP that's been put in for Loy Yang which refers to the risk for that freeway or future freeway as a 10, so quite high. How might that affect rehabilitation planning?

PROFESSOR SULLIVAN: I have already given evidence about this

aspect at the Traralgon planning tribunal. In the light of what happened at Morwell where the freeway bypass was put between the town and the mine, I find it unbelievable that at this day and age we are considering doing it again next to another mine. I told the planning tribunal that it should not be placed in that position. The knowns and the unknowns are too large for a piece of infrastructure like that.

MS PEPPLER: Thank you, Professor. The last question is for Mr Hoxley.

CHAIRMAN: Can I just clarify that. Is the matter still current, still being delivered? I understood there are some sort of questions as to distance might be relevant or are there other options? I'm not sure of whether one can just say that it's still an uncertain area.

PROFESSOR SULLIVAN: The matter is still live, as far as I understand it. I believe VicRoads are still planning on placing it there. I believe there is a bit of tension between the mine and Latrobe City Council about that position. I can't be any stronger in my feelings about this particular element.

CHAIRMAN: I'm not sure whether it's a matter of distance or being there at all.

PROFESSOR SULLIVAN: Being there at all.

DR HABERFIELD: Can I make a comment on that, please. I don't think we know. Like I talked about before, there has to be a risk assessment done and those risk assessments must identify the hazards and the risks and so on. Maybe VicRoads is going through that process and they might come up with an assessment of risk which they consider tolerable and which might be tolerable to the public.

I don't know what the outcome of that will be. But that process would have to go through, I would imagine - and I think this is where Tim's concern comes from, is that perhaps that process hasn't been done or has yet to be done and that process may well indicate that the road should not be there.

PROFESSOR SULLIVAN: Could I please follow up on that. I'm aware of the bit of the history there as well about this particular bypass. The geotechnical engineer at the time for VicRoads, he decided that a 400-metre gap was enough based on his understanding of things, and that was something like two times the depth of the pit. I think that was the level of scrutiny that was put into it. We now know we are getting movements back 1.4 kilometres from the edge of the mine. So the decision about placing it there and the separation distance was based on the understanding of the technical issues at that particular time and made in good faith. But we don't understand all the issues yet about this system.

MS PEPPLER: Are you able to assist the Board - do you know in that process there's a suggestion that the planning buffer should move from one kilometre to two kilometres; are you familiar with that?

PROFESSOR SULLIVAN: No, I'm not.

MS PEPPLER: If the freeway is not moved but is put into the identified location, what are the implications for rehabilitation planning?

PROFESSOR SULLIVAN: Could be quite significant.

MS PEPPLER: In what way?

PROFESSOR SULLIVAN: I don't want to say too much. You would have to really think hard about all the elements and

I would like to do more engineering before I actually give an answer to that.

MS PEPPLER: Mr Hoxley, I did promise you the last question. The Jacobs report refers to the ALARP, as low as reasonably practicable, being the appropriate level of risk. Why do you say that that's the requisite standard?

MR HOXLEY: That's a commonly used standard for mine planning and it encompasses the aspects that you are making a tradeoff between a number of different risks, and it's a matter of as low as is reasonably practical. It's not the likely ever achieved most smallest number regardless of cost or regardless of any other impact. So there is an element in there about practicality that needs to be taken into account allowing for all of those different objectives. That process is used quite commonly within policy. For example, I'm aware that it is used within contamination land policy, within contaminant management. It's a pragmatic standard around what is practicable and can be achieved. There is no point setting a standard which is impossible to achieve and then being disappointed that you don't achieve it.

MS PEPPLER: How does that ALARP standard interrelate, if at all, with the tolerable risk?

MR HOXLEY: The two are sort of yin and yang of each other, in my view. So what is practicable has to take into mind what is the tolerable risk or the outcome that you are going to achieve. So if you have a risk that is too high then you haven't reached a practical level. But also it comes into the domain of knowledge. So do we have the knowledge and the understanding to be able to practically achieve a goal or a risk that we might desire? That in

turn will inform what is a tolerable risk, because the essence of how much of a risk you can tolerate is informed by the effort you need to get there as well. So the two are counterpoints of each other.

MS PEPPLER: Dr Haberfield, did you want to comment?

DR HABERFIELD: It's a difficult question, but I think the risk level that Jacobs are talking about is a risk level which is I think in many ways higher than tolerable risk. I think it is probably closer to acceptable risk and there is an additional cost associated with that. There are guidelines put out by the Australian Geomechanics Society which deal with landslip, for instance. They define tolerable and acceptable risk using some words which are in my report. It really comes down to how much the public is willing to accept and how much they are willing to pay to get that benefit. There are two different levels there.

You could go to something like the Health and Safety Act where, basically, occupational health and safety is there to prevent people being injured at all basically. You don't allow people to get into trenches deeper than 1.5 metres and so on. But even at 1.5 metres, if someone is lying on a pipe and a trench collapses, they are dead. So, even though it is as low as practicable, there is still a risk that someone could get injured or so on. So it is just specifying those different levels. So it is very hard to compare one to the other. But I think it is probably in order of magnitude lower risk than tolerable risk.

MS PEPPLER: Thank you. I have no further questions.

CHAIRMAN: Mr Rozen, I note the time. We can either adjourn

until 2 or we can have a further set of questions put to the witnesses. What do you suggest?

MR ROZEN: The estimates that I have received from those behind me are that there's about two hours of cross-examination from the mines' counsel. So on that basis lunch now and returning at 2 should enable us - - -

CHAIRMAN: Then we should be able to accommodate them.

MR ROZEN: Yes, I think so.

<(THE WITNESSES WITHDREW)

LUNCHEON ADJOURNMENT

UPON RESUMING AT 2.00 PM:

DR COLLINS: Ms Latif and I represent Energy Australia, the operators of the Yallourn Mine. Can I pose some questions first of all to Mr Spiers and Mr Hoxley in respect of the Jacobs report. Can I ask you what material you had available to you describing what you call the "Yallourn approved solution" in your report?

MR HOXLEY: Yes. We had a copy of the current approved mine plan and some associated reports that were related to that document.

DR COLLINS: By the "approved plan", do you mean the plan dated December 2001?

MR HOXLEY: I believe that's right.

DR COLLINS: Did you have available to you a suite of reports that had been prepared in 2011 and 2012 and submitted by Energy Australia to the department in response to a condition attached to a work plan variation at that time?

MR HOXLEY: Yes, I believe we did.

DR COLLINS: For example, did you consider a lake filling model report prepared by Energy Australia?

MR HOXLEY: Yes.

DR COLLINS: And a peer review of that report?

MR HOXLEY: Yes.

DR COLLINS: The six options that you canvas in your report, and I understand from the tenor of the evidence this morning that this is a conceptual high level review of options for rehabilitation of mine voids, but none of the six options that you canvas include an option that interconnects with existing water courses as proposed in the Yallourn approved plan; have I got that right?

MR HOXLEY: That's right.

DR COLLINS: Is a reason for not considering that as one of the available options that it is feasible only with respect to Yallourn and not the other two mines?

MR HOXLEY: Yes, in part, and also we were focusing on the landforms that might be applicable across all of the three mines and there is also some question about where is a landform and in the river connection whether that is part of the landform or whether that is part of enabling the end land use. There is an allowance for connection and in the work and the consideration that we had we considered degrees of connection, but it wasn't specifically put up as one of the overarching options. It was more of a detail for that particular mine.

DR COLLINS: Are there other respects in which the Yallourn approved plan differs from the two options that you identify as being feasible for filling these three mine voids?

MR HOXLEY: Certainly in detail there are a number of areas that are different to the broad outline that's been given, in particular one that I can think of in detail is the Morwell River diversion through the middle of the site. If you look at the figures and the descriptions that we have got, we don't specifically point that out as a feature of our general statements. It's clearly part of the Yallourn Mine. There's also a history of development of that mine and the sequencing of it, that other than being captured in an overall description of the mine doesn't feature in the general descriptions we have of the options.

DR COLLINS: It wouldn't be right, would it, to understand your report as suggesting that what is described as the partial

backfill below the water table option is a more appropriate solution than the approved solution that Yallourn presently has?

MR HOXLEY: No, we wouldn't put that up as more appropriate. What we are saying is from our options that's the one that probably most closely matches the approved solution. It was never our intention to say that that was superior.

DR COLLINS: Thank you. I take it for the purpose of your report you didn't analyse questions of the implications of interconnection for water quality within the final lake?

MR HOXLEY: So "analyse" is the key word there. We considered the need for a degree of interconnection and flushing and in fact in all of the reports one of the matters that we raise around further study is in fact how is the water quality of the water body to be maintained. At the moment we are aware of the fact that that is proposed under the current plan to be maintained by - that's through-flow by interconnections. We talk about that as being one possible remedy for long-term water quality management. What we have said is that it is a matter that needs further study to ensure that it is actually viable.

DR COLLINS: On the assumption that you could reach a position where water quality within the lake was consistent with the water quality entering the lake and then exiting into existing water courses, what implications would that have for the risk factor arising in respect of both ground and surface water contamination?

MR HOXLEY: If I understand you correctly, what you have just asked, is it possible to conceive of a situation where a lake in Yallourn could have no change to the water chemistry at all of the water that's coming in, is that

what you are suggesting?

DR COLLINS: No, sorry, let me break it down. Let's deal with water coming into the system first of all. Do you accept that you could reach a position where inflows into the lake would result in an improvement in the water quality within the lake?

MR HOXLEY: Yes, it could.

DR COLLINS: Do you accept that you could reach a position where, whether with treatment of a greater or lesser degree, water quality within the lake could be managed such that outflows could safely be discharged into existing water courses?

MR HOXLEY: Yes, indeed, and that's one of the control mechanisms we have identified within our work, is that some level of treatment or control of that water quality would be necessary to actually enable that such a through-flow to occur.

DR COLLINS: Another of the risk factors that you analyse in your report concerns landform stabilities. You differentiate the risk factor of batter collapse as between your pit lake option and your partial backfill below the water table option. Can you just explain why there is a differential in the perceived risk as between those two options?

MR HOXLEY: Yes, it comes down to the amount of material, soil or overburden or other material that's used, between the two options. So, again just to reinforce the term "pit lake" has been used variously today to describe a water body within a pit. Within the context of our report, the description of a pit lake is one where minimal material other than water is used to hold stability. The way that

that works is that if you achieve stability or holding up of those batters with water alone, you need a greater volume of water than you would need of soil or other material. So the differences between our two options, I guess, comes down to the extent to which soil or other placed material or buttressing, for example, assists and supports that stability. In our assessment we believe that by using soil or other material, overburden, for example, within the pit, you end up with a better outcome than you do if you use water effectively on its own or to a large extent. That's irrespective of the final water level.

So, also I might add that our view is that the current mine plan and the way in which Yallourn is headed is more in keeping with that second option where the stability and balance is held by a mixture of overburden and buttressing and water. It happens to be that the water level is potentially quite high in your preferred solution.

DR COLLINS: But it must follow, must it not, that the risk of single or multi-batter collapse with respect to the approved Yallourn solution is closer to the risk that you assess for your pit water below the water table than the pit lake option?

MR HOXLEY: Yes.

DR COLLINS: Thank you. Just one question for Drs Haberfield and McCullough, if I could. For the purpose of preparing your respective reports on behalf of the operators of the Hazelwood Mine and for the purpose of your participation in respect of the joint report, did you read or consider any of the suite of reports prepared in respect of the

Yallourn Mine in 2011 and 2012 in connection with a work plan variation at that time?

DR HABERFIELD: No.

DR COLLINS: Dr McCullough?

DR McCULLOUGH: I read the witness statement of Ron Mether. That was the only document I read with respect to that mine.

DR COLLINS: Thank you. Did you read the exhibits to that statement? They were voluminous.

DR McCULLOUGH: No, that was without the annexures.

DR COLLINS: Professor Galvin, if I could just ask a few questions of you. I think the tenor of some of the evidence that was given this morning was to the effect that there is a balance between the degree of detail in a work plan or a rehabilitation master plan on the one hand and the need for a mine operator to have flexibility as one progresses along the journey to rehabilitation which may take many years or decades. Do you agree with that proposition and, if so, could you develop it?

PROFESSOR GALVIN: Yes, I agree with it. There are some things in mining that no matter really where you mine, what part of the world, I will coin the term just for the moment, there are core risks common to all operations. There are also issues, normally your core risks, that you do have already a good understanding of and you can apply that understanding in most sites. So, when you are looking at assessing a mine plan you would be focusing on those areas that you have a higher level of confidence in what you are dealing with and what the likely impacts will be and then having identified the impact you can then do a sensible assessment of the consequences.

But then you have your site specific features and so forth where it would be unusual not to have some site specific issues which you just simply don't have the answers to at that time. You may not even be able to properly assess what risk they present and so they remain the unknowns. Sometimes because of that they are the show stopper and the project doesn't proceed. In other cases the project proceeds, but they are the issues that get a high focus in conditioning the approval, so that as time goes on you do develop an engineered solution for dealing with them.

DR COLLINS: But flexibility, a degree of flexibility is important?

PROFESSOR GALVIN: Yes. In most simple terms it really is that the approving agency specifies the performance standards, but leaves it up to the operator to determine how to satisfy those performance standards. That's not always the case or not for every issue, but that's the philosophy. "This is the standard. We leave it up to you to achieve it."

DR COLLINS: Is that a philosophy that commands consensus among the other members of the panel? I will start at the end, Professor Mackay.

PROFESSOR MACKAY: Yes, I believe so.

PROFESSOR SULLIVAN: I believe that's correct.

MR SPIERS: Likewise.

DR COLLINS: Mr Hoxley?

MR HOXLEY: I'm sorry, I was searching through the book there.

DR COLLINS: I was asking whether the whole of the panel agreed with the philosophy that was outlined by Professor Galvin; that is, the distinction between setting the plan and then

leaving it to the operator as to how that plan is ultimately implemented.

MR HOXLEY: Yes. As we have heard, I think there's often a conversation that goes about the interplay between how prescriptive the setting is and then the way that is achieved. But the normal approach is to set a performance standard to some extent and then enable people to perform to that standard.

DR HABERFIELD: I'm not sure I can comment on that, other than to say that I think it seems reasonable.

DR McCULLOUGH: I think that's a reasonable approach as well.

DR COLLINS: Professor Galvin, at the time the TRB prepared its 2011/2012 report, the first report we have heard some evidence about, that report covered activities broadly over the financial year leading up to about June or July 2012?

PROFESSOR GALVIN: That report covers from 1 September to however many days there are in August.

DR COLLINS: Thirty-one, to August 2012. At the time, and you may or may not be able to answer this and if you can't just say so. But at the time that report was prepared, did the TRB have available to it and had it considered the suite of materials that the operator of the Yallourn Mine had provided to DEDJTR in connection with satisfaction of a condition on a work plan variation that was in play at that time?

PROFESSOR GALVIN: Let me tell you what I know to answer that. TRB 1 - the convenient way we refer to ourselves is TRB 1, 2, 3 and we are now in TRB 4. TRB 1 had put before it an application by Yallourn for the Maryvale work plan.

I don't know if it was a work plan or work plan variation,

but Maryvale. The TRB 1 made some extensive commentary on that and then that flowed over to TRB 2, and TRB 2 dealt with that approval.

DR COLLINS: The suite of reports about which I'm referring are the review that was submitted to DEDJTR accompanied by a lake filling model report, a peer review of that report by GHD, and various other reports also by GHD and SMEC?

PROFESSOR GALVIN: I wouldn't have a clue. I can't remember. I have metres and metres of papers. But I see Professor Sullivan is keen to answer that for you.

PROFESSOR SULLIVAN: No, I don't believe so.

DR COLLINS: It wasn't available. Reports of that kind are the kinds of positive developments that you talk about in your report, Professor Galvin, in the years since TRB 1; is that right?

PROFESSOR GALVIN: I would need to see what's in those reports before I could make that comment. When the TRB was set up, these mines viewed themselves as strict competitors and, at least from what we saw, were islands that didn't engage or share even the most basic information that not only am I used to from my mining background, but in fact the legislation that I have worked under over the years requires adjacent mines to share information of a nature for health safety to the community. So, TRB 1 and part of TRB 2, we would meet with the mines separately. It's a completely different culture now, different atmosphere. There's a lot of interchange between the mines, with the TRB. It's a very different atmosphere and environment to work in.

DR COLLINS: All of which are positive?

PROFESSOR GALVIN: Which is positive, yes.

DR COLLINS: Thank you. No further questions.

MS DOYLE: I'm going to start, Dr Haberfield and Dr McCullough, by asking you about the caveat you both put on your answer to the joint report answer to question 1. If you still have that in front of you, it's a long question set out on page 2 of the joint report. I'm not going to trawl through all of these subparagraphs to it. But in the response, Dr Haberfield, you indicated that you agreed with certain qualifiers and one of them was that you suggested terminology like "maximise" or "minimise" ought be replaced with terminology in the nature of "tolerable risk" and similarly, Dr McCullough, in terms of your caveat which is on page 3 you made a similar remark saying that terminology should focus on "tolerable risk". Both of you have therefore focused on that word "tolerable".

Can I ask you in turn, first of all Dr Haberfield, the use of the terminology "tolerable" you explain in your report can also be found in what are called the landslip risk management guidelines. Can you tell us a little bit about those guidelines, how they were developed and what the terminology "tolerable risk" means in the context of those guidelines?

DR HABERFIELD: The guidelines were developed in response to the Thredbo landslip and in respect to development on hillsides susceptible to landslip. So the Australian Geomechanics Society was approached, and I was on the national committee at that time, and they were approached to get a group of experts together to develop those guidelines. Those guidelines took a few years to put together. They are quite extensive and they are generally for practitioners, for planners and for other parties

which were involved in the planning process, which guide you through how or guide professionals through how to undertake a risk assessment, how to assess risk, how to identify mitigation measures and so on, how to develop a susceptibility map, how to develop a hazard map and a lot of other things. So it is an all-encompassing document. It is quite difficult to read because it's just so large, but it is now in planning legislation in several councils in Australia and those councils use that legislation to assess whether a development on a site could proceed or not.

Those guidelines have a definition of "tolerable risk" and "acceptable risk" and that's the definition that I have used here. There are different definitions of "tolerable risk", but that's the one that's been adopted in these guidelines. That's referred to in - - -

MS DOYLE: I believe it's paragraphs 82 and 83 of your report?

DR HABERFIELD: Thank you very much. So in paragraph 82 it talks about tolerable risk as "Risk within a range that society can live with so as to secure certain benefits. It is a range of risks regarded as non-negligible and needing to be kept under review and reduced further if practical." That's why I likened it before to the road toll. It's something that we allow people to drive because the public sees that as a necessity just for day-to-day living. There are risks associated with it, we would like to reduce the road toll, but you can only spend so much money in doing that and so it's regarded as a tolerable risk.

There is a level of risk below that which is "acceptable risk" which is defined in the Australian

Geomechanics Society guidelines as "Risks which everyone affected is prepared to accept. Action to further reduce such risk is usually not required unless reasonably practical measures are available at low cost in terms of money, time and effort."

The AGS guidelines go on further to suggest, "For most developments in existing urban areas criteria based on tolerable risk levels are applicable because of the trade-off between the risks, the benefits of the development and the cost of the risk mitigation."

So, in this whole process someone has to - and I don't know who that is - define what risk level is acceptable to the public, not an acceptable risk, whether it is a tolerable risk level. What does that mean in terms of risk to life? Currently with the road toll it's about annual probability of 10 to the minus 4, about one in every 10,000 people in Victoria could get killed on the roads. With respect to landslip, it is one to 10 to the minus 5 is defined as tolerable risk.

MS DOYLE: That example you gave there as to landslip, to translate that into lay person's terms, those guidelines you mentioned, the landslip risk management guidelines of 2007, can you translate that into a real life example? What does it suggest is tolerable in terms of risk to life and limb caused by landslip?

DR HABERFIELD: It basically means that - and you can interpret it different ways - but it basically means that you have one in 10,000 people will lose their life - no, let's just be careful how we express this. It basically means that your annual probability of being killed by a landslip is 10 to the minus 5, so one in every 100,000 years. That's

what it means. So, with the population, it's kind of different because it depends whether you are talking about a number of people or at one location.

MS DOYLE: Yes.

DR HABERFIELD: So it's kind of a little bit confusing.

MS DOYLE: So you have given an example in the context of landslip. Dr McCullough, in your statement you speak about Western Australian guidelines that have been developed for mine closure in the context of pit lakes, and in that context you refer to risk assessments and risk minimisation. As I noted at the outset, you have put the same caveat on your response to question 1. Can you perhaps elaborate upon your preference for use of the term "tolerable" in that context ?

DR McCULLOUGH: I have to state that it is not just Western Australian guidelines, it is Australian guidelines, so Commonwealth guidelines and also international guideline standard and practice, that there is recognition that there is always risk; there is, as my colleague stated, differential levels of acceptable risk and they depend upon the community at the time and the benefit that community experiences, so they often change with time, and they also must be mitigated with the opportunities, so we will usually take more risk if we see more opportunity as well. So, without consideration of all those different factors, we really can't evaluate risk.

MS DOYLE: Can I ask both of you or the panel generally: when we talk about risk, is it fair to say there's initial risk, so a risk unmodified by any mitigating steps or controls, and then residual risk after one has applied the

controls? Perhaps I will work down the other way.

Dr McCullough, would you agree that there's risk at large or risk per se, but then there's also residual risk after you have applied some sort of mitigatory controls?

DR McCULLOUGH: That's right. There are a number of different ways of calculating risk, likelihood, consequence, duration, spatial extent, et cetera. The Commonwealth approach which I authored this year is to first of all take into account the initial risk without controls, then to apply different controls, evaluate the residual risk and that residual risk if it is low or of similar magnitude, inconsequential, then there would be no management response further. If there was still residual risk, then there would have to be of medium or greater magnitude, then one would have to look at some other sort of controls. But certainly it's not the risk in the first instance that we consider.

MS DOYLE: Before I take this to a more specific example, was there anyone on the panel who wanted to express a different view or elaborate upon that notion of there being uncontrolled risk and then residual risk? Perhaps Dr Haberfield and then Professor Galvin?

DR HABERFIELD: Yes. The purpose of doing a risk assessment is identifying those areas which do not have tolerable risk, and I'm assuming that tolerable risk level is what is acceptable to the public. Those levels which do not have tolerable risk, you then have to mitigate such that they achieve tolerable risk and presumably you put those mitigation things in place such that you get tolerable risk, so that's what you are trying to achieve.

MS DOYLE: Professor Galvin, I think you had something to add?

PROFESSOR GALVIN: My appointment to the TRB originally was as oversight of risk, and that's an area where I spend most of my time these days. I refrained from saying something before lunch because I want to get on the plane this afternoon, but I think some of this stuff just needs to be clarified a little bit. When you do basic risk assessment and you classify risk under a number of headings, always, always safety is first, then health, and then you can go on to business and reputation and political or whatever you like. Always anything that can result in a multiple fatality is classified as "extreme". Anything that can result in a single fatality is classified as "high". Those classifications stay there. "As low as reasonably practicable" only applies to the next level of risk down. So, if there is the risk of a fatality on this particular site, it will not score "as low as reasonably practicable".

From there - and this is your area today, not mine, but the Institution of Engineers are trying to educate us at the moment - the goalposts have moved now and "as low as reasonably practicable" has been now succeeded by "so far as is reasonably practicable". That is a much higher onus on you to do everything possible, not just rank things "and once I get to a certain score, anything below that I can live with." I have to go further, because what people often forget is we rank something as extreme or high and then we get down to medium or low. A low risk is not for one moment saying that there can't be a fatality or risk to health. It's just saying the likelihood is so much lower.

So, when you now move on to "tolerable",

tolerable is very subjective. What's tolerable to me may not be tolerable to you. When we did the risk assessment on whether we re-open the Princes Highway, one of the things we considered carefully was do school buses use that highway and at what time of the day, because that brings you into what is acceptable to society. A school bus involved in hitting a pothole on that road carries a lot more spotlight than a motorist in a car on their own.

So, you are getting now into the "tolerable" area and before lunch this concept of society will accept one in 100,000. The reality is that society doesn't accept fatalities at all, but in determining whether we have something under a reasonable amount of control or not, whether I get on the plane tonight or not and who I fly with tonight, then society then comes in. "Okay, if I fly with X, it is one in 100,000. If I fly with Y, it is one in 10,000." So that's where it now determines what you would consider tolerable or intolerable. But "tolerable" is very subjective. I don't like the term and we are moving more anyway towards quantifying things.

When it comes to the landslide risk assessments, that is just one, and we have heard that, that is just one organisation's way of ranking risk. I could put half a dozen different systems on the table for you, all with the same philosophy, all trying to get to the same outcome, but different scoring systems. So it is not something you can get locked up rigidly on.

MS DOYLE: No, I think it's understood; there is a general approach and then each entity for different reasons in a different regulatory landscape might develop different guidelines. Against that background, can I ask you again,

Dr Haberfield and Dr McCullough, taking all those principles and all of that discussion about what terminology might be used in a particular context, when assessing risk in relation to mines, is it fair to say that any risk assessment needs to be not only mine specific, but also domain by domain within a mine and it may even get down to the granular level of needing to be batter by batter that you assess risk and then develop controls for that particular batter? Do either of you have any remark in relation to that level of detail that may be required?

DR HABERFIELD: Yes. This was part of the susceptibility or hazard map which Jim was referring to earlier. You need to identify the items which are at risk. I also agree with Jim - - -

MS DOYLE: Can I just stop you there. By that you mean not in the broad, you mean by looking at perhaps an aerial map of a particular mine and literally assessing what are the public and private assets in particular parts and what are the assets or byways or roads which are used by which types of people, to pick up on Professor Galvin's suggestion. Is it used once a day by a commercial vehicle? Is it used at all hours of the day by private entities, including school buses? Is that the kind of degree of detail?

DR HABERFIELD: That's correct, because that comes down to probability - there are several aspects to it. You have to identify a hazard. You then have to identify the probability of that hazard occurring, the probability that someone will be impacted by that hazard, that they are there, the probability that should that hazard impact on

them, to what extent it will affect them and so on. So there are lots of different aspects of that.

I agree with Professor Galvin with respect to tolerable risk, but you can quantify. Again, it is someone or public or something. Someone representative needs to identify or quantify what is tolerable risk. It could be 10 to the minus 10, but it has to be something - and you can then do a risk assessment based on what that is. Currently the Australian Geomechanics landslip guidelines indicate 10 to the minus 5 and that is the same as AMCOLD for dams and so on. There are things out there which specify levels of tolerable risk.

MS DOYLE: I asked Dr Haberfield and Dr McCullough over lunch to read a part of an exhibit in these proceedings. It is confidential annexure 4 to Mr Faithful's statement. I identify it that way because it behind a tab that says that. In fact, large parts of the document are not the subject of any confidentiality claim.

I asked Dr Haberfield and Dr McCullough to look at just a few pages within that document and I understand that copies of those pages have made their way around the room. Dr Haberfield and Dr McCullough have a copy there and I think some of these pages can be brought up on the screen to assist anyone who doesn't have it in front of them. This is part of the document known as the GDF Suez Hazelwood Mine risk assessment management plan dated November 2015 and Mr Faithful's statement explains it has been submitted and it is waiting for final approval.

Can I ask that page GDFS.0001.001.1043 be brought up on the screen. As that is coming up, I can just explain it is in part 3 of that document and it starts by

indicating that, "GDF Suez with respect to the Hazelwood Mine has undertaken a thorough risk identification analysis and evaluation of ground control risks."

First of all, Dr Haberfield and Dr McCullough, have you had the opportunity to read pages 1403 to 1412, which are part of that document, the larger document?

DR HABERFIELD: Yes.

DR McCULLOUGH: Yes, I did.

MS DOYLE: Can you see, if we go down that page, table 10 starts to set out a list of matters described as "aspect", then they are identified by a number and then "risk", and we see in the right-hand column things like bridge structures, the Strzelecki Highway, subsidence of road surfaces, et cetera. When looking at that table, did you understand that this indicated that what this part of the document does is undertake a risk assessment, so first of all the likelihood of a risk occurring and the consequences if it did occur, of impact on these physical aspects of areas close to the Hazelwood Mine?

DR HABERFIELD: That's correct, except the third column, "Risk", that's not the risk, that's the item of risk.

MS DOYLE: That's the item about which risk is to be assessed.

DR HABERFIELD: Yes.

MS DOYLE: If we go over to pages 1405 and 1406, there are aerial maps which highlight particular items again, which were in table form when we first looked at it. It comes up most clearly on page 1406 where there is shading which indicates that one is looking at things like ingress of the Morwell River, failure of a backwater levy, et cetera. Did you have the opportunity to look at those maps?

DR HABERFIELD: Yes.

DR McCULLOUGH: Yes.

MS DOYLE: Then if we move forward to page 1407, there then commences the assessment of risk which it says is done via the "bowtie" method. Having read that set of pages, can you comment on this risk assessment of the types of physical and public assets that were the topic of conversation this morning?

DR HABERFIELD: At a high level it addresses or looks at those, as far as I can tell from a quick reading. One shortcoming, I think, of the risk assessment is it is only considered within one feeder 3H from the crest of the mine, I believe, which a risk assessment would normally go further afield than that because it identifies, for instance, the failure of the northern batter may have implications further back than that and you need to assess that.

MS DOYLE: Can I take you to page 1410. There is a heading there "Batter failure" in the middle of page 1410, and just to look at the terminology. There are a couple of paragraphs and then it says, "Consequence rating: moderate. Likelihood rating: unlikely". Is that an example of a risk assessment tool being applied to work out the consequences if something occurs weighed against the likelihood of it ever occurring?

DR HABERFIELD: It is, at a high level.

MS DOYLE: Then if we go forward to page 1412, we then see those things collected into a table, consequence, likelihood, current risk, et cetera?

DR HABERFIELD: That's right.

MS DOYLE: Dr McCullough, do you have any experience of the application of this bowtie risk assessment method or any

other preferred terminology from your view?

DR McCULLOUGH: No, I've never heard of that term before.

MS DOYLE: Can I ask you to jump forward a number of pages. If we go to page 1552 and I think that was another one identified to be copied. You will see there is an appendix E, "Critical controls", just so you know the title of the section we are in. That's page 1552. Then I asked you to look at the extract from that that starts at 1562, "Batter failure".

Could you see in the pages that follow, 1562, 1563 and so on, that what is identified there then is a number of control measures. Obviously each of the control measures refers off to a suite of technical documents about how you actually implement them. But are these the types of control measures that the two of you have spoken of when you - you have used slightly different terminology - but either close out or minimise the initial risk?

DR HABERFIELD: These control measures here, my understanding is that this is for the operating mine?

MS DOYLE: Yes.

DR HABERFIELD: So, as we go through closure the risks will change because there will be - sorry, the hazards may change, but the probability of them occurring may change because you are affecting different water levels. So this type of high level assessment needs to done for the processes through closure. But, in addition, this high level risk assessment just identifies those areas which need further detailed assessment. So, if you have perhaps what's judged as a low risk, and I haven't seen what their risk matrix is so I don't know what low risk means, so low risk or very low risk, you might say, "Well, that's

something we may just put to the side." If you have medium risk or high or very high risk, that's something we need to deal with and do a much more detailed study of.

MS DOYLE: You just mentioned then, Dr Haberfield, and you are quite right to say so, that this identifies risks and methods of controlling them during the operational life of the mine. You would expect that as we get closer to closure or during a closure and post closure phase, that the look of this document might be quite different and the controls might be different?

DR HABERFIELD: Yes.

MS DOYLE: One of the controls mentioned in a couple of places relates to monitoring of stability. No doubt that's an appropriate mechanism, control mechanism to be adopted during the life of the mine as well as during the post closure phase, but the way in which you approach it might be different in each phase. Would the two of you, Dr Haberfield and Dr McCullough, agree with that?

DR HABERFIELD: Yes.

MS DOYLE: During the operational life of the mine, would you expect that there would be regular, if not constant, monitoring of stability undertaken by the operator?

DR HABERFIELD: Yes.

MS DOYLE: And that's physically something one does by having the right sort of machinery in place to do the monitoring and feed back the data to whoever is in charge of surveying that?

DR HABERFIELD: That's correct.

MS DOYLE: In that context I think there were a number of comments this morning about the need to do further work in relation to stability and in relation to the need to

monitor stability. Can I ask is there anyone on the panel who has had the opportunity or asked for the opportunity to look at the data collected by, for example, GDF Suez in relation to the monitoring it does do of stability of its batters? Has anyone either studied that data or been made aware of studies of that data?

PROFESSOR GALVIN: The TRB are well aware of it. The declared mines are required to submit a six monthly stability report to the regulator and we have been through some of those reports and we have made comment on them. We have visited the mines a number of times. We have assisted the mines, particularly Hazelwood, in bringing in some quite good survey technology and setting up a new survey system. So I think, Rae, we have fairly good oversight of what is happening and - - -

MS DOYLE: You would agree then, I take it, Professor Galvin, that that technology, it may improve over time, it may change over time, but it is presently in place at Hazelwood and is performing the role of monitoring stability and that one would, both the mine and the Technical Review Board, also seek to take a longitudinal view of that, assess it at intervals and monitor it regularly?

PROFESSOR GALVIN: Seeing I recommended to the mine the survey they should get involved to set up their survey system, I would like to think it is up there with the best. In terms of the outcomes of it, I haven't gone through them, but I have no reason to believe that it is not working quite well. And, yes, this will always change. Technology will change. The type of things we need to monitor will change. Based on what we monitor, the

monitoring outcomes themselves will cause us to change things.

MS DOYLE: Can I step back a bit from the assessment at the micro level in the nature of looking at monitoring of stability and hark back to some questions that were asked at a more general level this morning about the types of public assets or assets that could impact on public safety that are around at least two of the mines.

In that context I think it was you, Professor Sullivan, who expressed the view this morning that in light of works that are planned to be done or may still be done proximate to Yallourn Mine, you have expressed the view - and I took it in a formal and official capacity - to planners that placing a road so close to the Yallourn Mine would create a situation of risk unless one was able to have available a great deal of work that would suggest to one that risk was acceptable?

PROFESSOR SULLIVAN: I think you are referring to Loy Yang?

MS DOYLE: To Loy Yang Mine, sorry.

PROFESSOR SULLIVAN: That's correct.

MS DOYLE: Can I flip that around. That's a situation that has not yet crystallised, but with respect to the Hazelwood Mine it presently lives with, if I can put it that way, a situation where there is a freeway that's proximate. Of course, the freeway arrived after the mine, but now everyone has to live with whatever risk that throws up.

Can I ask perhaps you, first of all, Professor Sullivan, in those circumstances where one has to live with that risk, is it a risk that falls only on the head of the mine operator or one which in the future will need to also be assessed by, for example, VicRoads and local

government if not State Government?
PROFESSOR SULLIVAN: Primarily it resides at the mine level. If I was here with a VicRoads hat on, I would want to look at things more carefully. If I was here with a government hat on, I would want to look at things quite carefully.
MS DOYLE: I think Dr Haberfield said earlier in a slightly different context that VicRoads must have adjudged that risk or someone above their heads must have adjudged that risk to be tolerable at the time. It is hard to know. We don't have in front of us what risk assessment was done. But if we go back in time to when a decision was being made about the placement of that freeway, do you think that that is the case, that an assessment must have been undertaken that the risk was acceptable in some broad sense?
PROFESSOR SULLIVAN: I assume they did it.
MS DOYLE: If we can move forward and think about the situation that pertains now, the freeway is there, if monitoring of stability or if assessments of risk of any danger in terms of stability cause one to form the view that there is a risk to that asset, that public asset, the freeway, is it not the case that the authorities who are going to be impacted by that and the mine operator will then need to work together to close out or minimise the risk?
PROFESSOR SULLIVAN: There are a number of components to the question. Starting at the front, whether monitoring is of itself an adequate tool, the majority of the events, stability events, are related to critical loading events. You can monitor all you like for 356 days or 355 days of the year, but it is what happens in that critical loading event that's important. So, we don't understand well

enough how the critical loading events interact with the system, and that's the critical part. All of the ongoing monitoring can only alert you to whether there perhaps is a changing susceptibility or a changing circumstance which could alter the likelihood of something happening. Could you repeat the second part of the question?

MS DOYLE: The second part of the question moved really to the question of responsibility and control. If a risk is identified or an increase in risk level is identified, the owner of the mine is not the sole repository of the risk, is really what I was putting to you, and not the sole entity able to control or minimise the risk?

PROFESSOR SULLIVAN: I think my view is that probably at the base level it is in control of the risk because it can implement the remedial measures attached to minimising the risk or adequately controlling these load factors which could destabilise it. I think I'm feeling a bit uncomfortable in the area of what VicRoads should adopt and what the mine should adopt and what Latrobe City Council - - -

MS DOYLE: At a simple level in terms of one risk control measure, closing the road is a question for VicRoads. It is just one simple example.

PROFESSOR SULLIVAN: Since I was involved in that particular decision, VicRoads took my advice at the time and agreed with closing the road and also took my advice at the time and agreed with re-opening it. Since that period I haven't had any further involvement with that, apart from a further review about a year later of Hazelwood.

DR HABERFIELD: Perhaps I could elaborate a little bit on that. I have been involved in several movements with respect to

excavations in Melbourne which are next to VicRoads assets and tramway assets and so on. The process which I have experienced in those cases is that if you get a movement of that form, which is usually an instability - if it is a collapse it is a completely different thing - but a movement which can affect the road and assets in the road or the tramways or so on, the owners of the assets are notified, they come out and they assess their own risk and you are part of that process in that, but they assess their own risk for those, and that's what happens in Melbourne. I don't know whether that's applicable out here, but I know the people who are involved and I would imagine that would be the same.

PROFESSOR GALVIN: Could I comment on that, please?

MS DOYLE: Yes.

PROFESSOR GALVIN: It is a timely question because the TRB actually has just put in an advice to the minister on this issue, and it is building on what I said earlier about approval conditions today and the fact that Victoria is lagging. First of all, in the case of the Hazelwood situation, again we are dealing with a legacy issue and that wouldn't be expected to come about today.

MS DOYLE: Can I just pause there. You mean the decision that has the freeway put in place after an operative mine is in place?

PROFESSOR GALVIN: Yes, because one or two things would happen today. As part of your impact assessment in taking the project forward, the nature of these types of risks that the project can give rise to are identified and you would not, in brown coal situations today, you would not mine as close to the edge of your lease boundary as the mines have

in the past. We see that with Loy Yang. They are well back now. So, we would have a buffer zone around those mines and it would be quite clear that you wouldn't go and put freeways in that buffer zone or, if you did, you would have to put extra engineering into the structure to tolerate what you would be expecting to happen.

Now, we have a legacy issue. What do we do with that? In other states, and particularly in New South Wales, it is always the owner of the risk is responsible for the cost of managing it and having oversight of it. So in going forward, and our advice to the minister is very much that any mining induced impact becomes the responsibility of the mine. So, if it is a road that's impacted that's outside the mine lease, it doesn't matter. A forest, it doesn't matter.

My understanding at the moment in Victoria is that the legislation is structured that the owner of the land is responsible for dealing with the risk. We see a good case study at the moment of Latrobe Road which is only 160 metres from the edge of Yallourn open cut mine. The mine has worked to its work plan, all its approval conditions, but now the road has a crack in it and some of the drains beside the road are blocked up. We have this ridiculous situation that we have three agencies involved where one views that their responsibility stops at the fence that is the mine boundary, and the next one says, "Ours is just the tarmac and the shoulders," and the third one says, "We are the drains."

So here we are trying to deal with managing the impacts, mining induced impacts, and if we have a fourth agency involved which is the, from my language, the mining

inspectorate who is basically looking but not intervening too much. I understand the chief inspector of mines, for example, can only advise the owner of the road about the situation but can't dictate what needs to be done about it.

Now, that is an unacceptable way of trying to manage risk. As it currently is, if you own the Princes Highway - well, everyone has accountability for managing their own risks. So, in your situation with the Hazelwood, obviously VicRoads have to have some accountability for managing that risk. But, likewise, because the risk is a result of mining, the mine operator, the mine owner, also owns that risk.

In a nutshell, it is a legacy issue, it's not resolved, it's live as we speak. If you were putting new mines in, you would condition it out.

MS DOYLE: And can we turn that round the other way. You would also expect that if one were considering putting in a new road next to an existing mine, would you expect that, with modern eyes applying risk assessment procedures and protocols, one may well take a different view about the appropriate proximity of a new road to an extant mine?

PROFESSOR GALVIN: I would expect it, but I have to say with what we see happening at the moment with Loy Yang, that - - -

MS DOYLE: It may not bear fruit?

PROFESSOR GALVIN: I don't think others see it that way.

MS DOYLE: I'm going to move to a different topic entirely. Dr Haberfield, in your report, and just to orientate you it's paragraphs 96 to 104 - I'm not going to ask you to read out slabs of it, but just so you know where I'm

taking this from - you there address the particular question of a type of mitigation of fire risk. In context there you were asked to consider the question - I will put it in simple terms - of whether about one metre coverage of coal, exposed coal, would provide sufficient mitigation of fire risk as compared to two metres of coverage. There is no secret about it; the one versus two debate arises because in the Jacobs report Mr Hoxley, Mr Spiers and others have costed out some options based on an assumption about two metres coverage.

So, the question I'm going to pose will really call for a debate between the three of you gentlemen, but perhaps, Dr Haberfield, if you kick off. Can you explain in simple terms why it is that you conclude in that part of your report that one metre is probably enough coverage and that there is not support that you are aware of in the scientific literature for two metres. Can you just explain that in simple terms for us?

DR HABERFIELD: I would phrase it little differently. For a start, I'm not an expert in fire and I'm not an expert in ground cover or amount of overburden for fire. All I did was try and apply some soil mechanics, geotechnical principles, to calculate what would be a reasonable thickness. In doing so, I did research the literature through the technical search engines and I couldn't find anything which was readily applicable. I contacted CSIRO and they couldn't really lead me anywhere either. They said they had done some research, but - - -

MS DOYLE: I think the gentleman you spoke to, Justin Leonard, we can see his name up there, he does have expertise in fire mitigation and fire risk.

DR HABERFIELD: That is my understanding. He is head of the research group there. They had done some work to do with the insulation effects of soil and of course that depends on the soil type, the moisture content and various other things, but they hadn't really done anything in what was a minimum thickness you need to stop fire impacting or setting alight coal.

So, just using logic - and again I express that I'm not an expert in this, but I understand soil - the way that the fire can get down there is either through roots, tree roots, and it can burn down and go to the tree roots or a crack in the ground, some form of hole.

MS DOYLE: Just pausing there, so as far as you have been able to glean with all the caveats you have given, it has something to do with the exposure to the source of ignition, the exposure of the untreated coal below to the source of ignition?

DR HABERFIELD: Yes, that is my assumption, and someone else can tear that down if they like, but that is the assumption I have made, because the insulating effect of soil is quite strong and you probably only need a few hundred millimetres for insulating effect. Again, I'm not an expert in that, that's just what I have read. But with respect to tree roots, you can get tree roots growing quite deep, so you don't want the tree roots to go all the way through the cover because there's an opportunity for fire to go down through tree roots. So, you deal with that by having shallow-rooted plants.

Then you have the soil which can form cracks in it. Now, cracks can form by a number of ways. The most obvious is if you get some form of instability which will

open up in the coal, a joint in the coal will open up, you will get a crack forming up through the overburden and then that allows the fire to get in or it could form a hole or any other form of void. That type of process, I don't think it matters whether it is one metre, two metres or three metres, that hole is going to form if you get instability and therefore you have to deal with that through observation and repair.

So, the other way you can get cracks is through desiccation, just drying naturally through evaporation of moisture from the soil, and what happens is you get desiccation cracks. The depth of those desiccation cracks depends on the climate, how wet it is, how hot it is and so on. Applying just procedures which are set out for a completely different issue with respect to building foundations or footings for houses on clays, for this area here they recommend what's called a crack depth of just under one metre.

MS DOYLE: You mean "this area" being the Latrobe Valley?

DR HABERFIELD: This area being the Latrobe Valley. That one metre basically applies to soil which we call highly reactive, which means it is - I suppose a simple way of describing it is a sticky clay. If you have sand, you won't get cracks to anywhere near that depth. The less reactive to moisture the soil is, the smaller the crack depth. So, based on that information I estimate a maximum crack depth, which again is applicable to footings, but I would expect in the absence of any other information you could apply it to this situation, is about one metre.

That's for a highly plastic clay. If you have a less plastic clay or what's called a low plasticity clay

so it's not sticky, then that depth is lower. So, based on that, I think probably about a metre may be about right, but there needs to be research done. Like I said, I'm not an expert, it's just logic.

MS DOYLE: Perhaps, Mr Hoxley, Mr Spiers, if I can approach it this way. You have no doubt either read Dr Haberfield's report, but you have at least heard that summary. Insofar as your report goes to this question, it appears to me to go to it as an assumed mitigation approach and then, for various purposes we will go into next week, cost that out.

Perhaps it would be useful if you did have just one page of the report in front of you. It is 103 of the report, if you find it easier to use the numbers down the bottom. I'm going to ask you just about pages 102 and 103 and the Ringtail number is EXP.0011.001.0105.

If you have page 103, below the picture there's a blue heading "Fire risks" and you say, "Jacobs saw a need to cover exposed coal to reduce the fire risk." Accepting that, the last sentence on that page has the report saying, "The exact depth required is not clear from the material available to Jacobs and we have assumed the two metres of cover will provide appropriate long-term cover." I will just stop there. Dr Haberfield has talked about what research was available or not available to him. Did the Jacobs team draw on any other suite of research or data that suggested it needed to be one metre, two metres or any variation thereon?

MR SPIERS: Yes, would be the answer to that, and the data was experience in the mine.

MS DOYLE: In which mine, sorry?

MR SPIERS: I've worked two of the mines in the Valley over

30 years. It was stated yesterday that six inches of clay cover will protect against fire. I have no real argument with that. I've experienced that. One of the bases of fire protection in the mine is if you've got plant, park it on clay so it's clear of being ignited.

But in this situation we are talking about treatment of a batter that's got to last hundreds of years. So, having seen mine surface protection on levels put down, six inches, 12 inches, 15 inches, and achieve the purpose of initial rehabilitation, fire protection, access roads, et cetera, that's a successful form of treating it. But I have also seen with movements around mines that clay cover cracking, and one of the things you don't want is cracking to appear in a batter that you are trying to protect against fire.

The second issue was, and this is why we said further research, we didn't know how clay on a batter will behave in what thickness. I think it's come out several times in these hearings in the last 24 hours that it is an area that no one knows the answer. We chose two metres. I have no argument with the argument that's been put forward technically on the one metre. We certainly think it's more than six inches, so we adopted a comfortable buffer. And I might add, just for the benefit of those in the room, at one stage people in the group were talking about 20 metres, which we said was impractical and just wouldn't solve the problem, so we've come back to something realistic.

MS DOYLE: Would it be fair to say, Mr Spiers, it is an assumption and a conservative one?

MR SPIERS: Yes.

MS DOYLE: Would it also be fair to say it is based somewhat on the following proposition: if one metre of coverage is good, then two metres might be better?

MR SPIERS: No. No, I think that's a bit of an unfair statement. It is based on a proposition that we really didn't know the right answer, so we went for a conservative depth that we thought was safe to achieve the outcome and wouldn't be overly costly.

MS DOYLE: When you talk about further work that might be needed in order to answer some questions to which you don't presently know the answer, I take it that would include on re-profile batters and then over time what is the appropriate thickness. That's the question that we don't yet have a full answer to; is that what you're saying?

MR SPIERS: Exactly, some of the treatments that were talked about earlier this morning. Do some experimental trial sections and measure the performance of those over time so we get the right answers for batter slope, batter height, batter thickness cover, et cetera.

MS DOYLE: It goes without saying, and your own report acknowledges on the previous page and in a number of other places, that obviously depth and therefore volume of coverage will dramatically affect overall cost of any option. So, without going to the dollar figures, that's an obvious statement.

What about surface area, though? Can I just ask, in terms of the assumption that your costings are built on, what assumption was made about the area of a rehabilitated mine that will be covered in the mode in which you propose, the two metres? And if necessary, and

I think this is probably the only sensible way to do it, can you answer that by reference to how much of the mine below the lake and above the lake you envisaged being covered by the two metres?

MR SPIERS: Generally to the proposed water levels, which aren't fully defined, but there are assumptions made on the figures that were presented by Hazelwood, Yallourn and Loy Yang, and we used a slope of about one in three because that's where people were talking, and that gave us a length and a depth and we could measure the perimeter of the mines. So, essentially right round the mines.

MS DOYLE: So for each mine you worked off the potential end of life of mine water level. With respect to Hazelwood, do you recall whether or not you worked off the stability level minus 22 or the potential end of life plus 8?

MR SPIERS: I would have said we worked on the stability level.

MS DOYLE: Just to go back to the earlier question of depth of coverage, necessarily in order to cost it out you had to plug in an assumption and input and you said the assumption plugged in was two metres. You would accept, wouldn't you, that the further work of which you have spoken may end up throwing up the result that a very thin layer of coverage is acceptable in some parts of the mine, thicker required in others, and that may be a feature both of fire mitigation and stability concerns?

MR SPIERS: Yes, and if I could go back one step before that. It's only six years since I left Loy Yang and in that period of time we've moved from a position of, "In tall batters we'll hide them behind trees and so forth from a visual effect," to "We've had a couple of fires and we now know that we need to cover the coal to protect it from

fire." So this concept of covering the coal to protect it from fire is emerging and therefore we have taken a conservative approach in what thickness, but I would be delighted if you could do it with six inches.

MS DOYLE: I will open this question out to the - - -

MR HOXLEY: Sorry, can I just add a little bit to that around the two metres?

MS DOYLE: Yes.

MR HOXLEY: We were aware of the operational value in the thermal capacity of coal for buffering as Charlie said, that a relatively thin layer, when maintained and effective in an operating mine, can provide that control. We were also aware of the metre and the discussion that Chris said. I guess what was in our minds was around what is the long term. Given that it is many decades beyond an operating mine when you will have a lot of people working around there, that this cover needs to maintain its integrity.

This is a field where there is not a lot of information available, there is certainly not a lot presented in the plans, around what this long-term stage requirement is. We have to make some assumptions about public open access, the type of activities that will occur and the type of vegetation. While there's an intent of grasses or low-rooted vegetation going on, we could envisage a situation in 50 to 100 years where someone might wander around every year or two and just check that everything is under control, but something could happen in between.

So, we took a view that having some type of buffer between the minimum that you think might be

reasonable, say a metre, and some amount of soil that could wear off, without actually getting you down into your critical zone, was a prudent thing to do.

As Charlie said, it may well be with the due research that that actually proves to be some other figure. But for our purposes, for the purposes of the Inquiry, and thinking particularly in the long term beyond active operation of the mines, we felt that having that additional buffer was a prudent thing to include in our assumptions and we've tried to be quite transparent in the way in which we've done that.

MS DOYLE: All of the discussion we've just had about the two metre coverage has been seen through the prism of fire mitigation. I take it that others on the panel would agree that whatever view one lands on in terms of appropriate fire mitigation may need to be modified in light of the effect that laying down six inches, one metre or two metres of earth has on stability because it may have a negative effect or a positive effect. Professor Sullivan?

PROFESSOR SULLIVAN: I'd like to add something here to this discussion, if I may. Dr Haberfield is right theoretically in what he's talking about, about the availability for various materials to hold cracks, to form and then hold the crack open. I can understand that within the high level brief that Jacobs had that they might fix on a number, which might be two metres as an indicator. I do know that it is too early to talk about a layer thickness.

MS DOYLE: For the final re-profiled batters, is that what you mean?

PROFESSOR SULLIVAN: Yes, too early to talk about a layer thickness. I do know also from my general experience and understanding that earth is a very good insulator and you don't need a lot. But the issue is the majority of the materials that are in the soil profile are highly flaking, which means the individual mineral grains want to force each other apart because of the electrochemical bonds around those minerals. So, in the presence of any water they disperse, so they can't actually hold a crack for very long, and that's what you see when you walk around, that they disappear after a very short time.

The issue then comes back to what happens to the substrate under that soil. We heard from Professor Galvin this morning about the Morwell main drain and the sink holes that were discovered there in 2009. The soil cover thickness there was 15 metres, 20 metres. Those sink holes are material that's washing down into the coal joints at depth. So the basic fundamental is achieving stability in the substrate such there's no ongoing creep and movement that continues to open the joints to allow that material to potentially migrate into the coal underneath. Now, that's not to say - and I believe it's possible to engineer a simple layered system that mitigates against some of that, but I think it's too early to say the number is X.

MS DOYLE: Would you agree with the proposition I put earlier the number being X is probably oversimplifying. There is unlikely to be a uniform number for every mine, nor for every batter within each mine or domain within each mine?

PROFESSOR SULLIVAN: Correct.

MS DOYLE: Just one question again for the Jacobs team.

Without drilling down to the dollars, you obviously have undertaken, as you said, a suite of costings into which you had to inject some assumptions and then some inputs. One assumption I want to ask you about with respect to the Hazelwood Mine is that one feature that you cost out in your costings is the inclusion of a five metre wide, two metre deep drain around the lip of the ultimate lake. Can I just ask what risk was that aimed at controlling or minimising? What is it suggested or assumed that it will need to address?

MR HOXLEY: So, there's a couple of things that that is aimed at picking up, and again our focus was on the long term for these mines, not so much on what happens during operations. There are really a couple of key ones. The first one was mentioned earlier today in the panel discussion about the susceptibility of batters in upper areas to moisture and moisture ingress and a key thing was around diverting unwanted surface water, unintended surface water from getting in onto the upper batters onto those areas that might be particularly susceptible to water ingress.

So, again there will no doubt be argument and design that needs to be done about exactly what height of drain, what might be the return frequency of a particular event that would be required that would set the height and the width of that drain. Again, our mind set in doing that was to think of something that would have to last many decades or perhaps hundreds of years. So therefore in that period of time you may see a very significant or extreme event that may need to be shed from around that area. That's the first part.

The second part was around the water quality of the lake and the mixing of the lake and the concept of separating clean waters from not clean waters and the intention that we had was to allow for the management of the lake water quality and the water body within the lake from within that and not to unintentionally mix with runoff particularly from an extreme event that may come from elsewhere in the catchment.

Eventually this may become a design feature or it could be that a future plan chooses to bring in or inject in some of that surface water into the mine, but our assumption or principle to look at that was to say on the first principles we would seek to exclude that water from mixing with mine water that might be of a different quality, like a pit lake that was of a different quality, and therefore you would need a drain to keep that away.

MS DOYLE: So have I understood this correctly: it was assumed to be necessary, and only assumed to be so, in order to deal with the question of runoff?

MR HOXLEY: Yes.

MS DOYLE: And in terms of what the drain looks like, was it conceived of as an open drain or a covered drain?

MR HOXLEY: An open drain. I think it's a diversion drain.

MS DOYLE: Can I go to you, Dr Haberfield. In your report at paragraph 113 you express some doubt about what the control measure was directed towards and whether in light of the information you had it would be necessary. Can you comment on that?

DR HABERFIELD: From a stability perspective I think it's ill-advised, simply because - and the Morwell main drain is an example. If you are on a slope, the last thing you

want to do is concentrate water, because as you soon as you concentrate water that means you have to maintain that drain so it is free-flowing forever, because as soon as it blocks up, you are going to get a landslip. It's that simple.

With the Morwell main drain, it wasn't a blockage, it was a sink hole which developed which allowed water into the coal which then generated movement. So, by putting a drain at the top around the batter, all you do is concentrate water, get enough water into the area, which makes that a significant hazard.

With respect to water quality - or just going on from that, the process we tend to use, and I do a lot of landslip studies and that in various shires around the place, that what we advise the councils generally to do is to allow the water to shed off as sheet flow. Don't concentrate it, because as soon as you concentrate it that increases your maintenance a long, long way and the problem is that you would have to continue your maintenance all the time because things will back up and unless you clean them out, you are going to get a failure.

So it's much better from a stability point of view just to have sheet flow so you don't get that concentration. I can't comment with respect to water quality.

MS DOYLE: I was going to you, Dr McCullough. Dr Haberfield has responded to that potential risk control method particularly from a stability perspective. Can you comment from a water quality perspective?

DR McCULLOUGH: Yes, I certainly can. I have never seen an example of a drain like that around a pit lake enclosure

and I think this is a very good example of why we don't undertake definitive closure designs like this at this stage. They are ill-advised and they will come with poor outcomes.

We still don't know necessarily what the water quality of the pit lake is going to be like. We don't know necessarily how that water will present. Will it present into the groundwater? Will it present into surface waters? We are not sure of the runoff water qualities, so I can't see how an argument can be put for or against wanting to receive that water into the pit lake.

In addition to water quality, we need to think about water volume. There is an argument there, of course, that the larger the catchment of the lake, the more readily and rapidly the lake will fill, so it is actually to the advantage. There are also indicators there that the larger the catchment of the lake, then there is also potential for greater downstream flow which could be a good or bad thing.

So, it is certainly not just batter stability. It is not water quality alone. It is not just even the water balance of the pit lake. There are a number of different variables which we simply do not understand at the moment to be taking naive decisions like that from.

MS DOYLE: I have one final question which relates to a caveat put on the answer to question 5 by Dr Haberfield and Dr McCullough. Question 5 related to future research needs and everyone who participated in the panel generally agreed with a number of examples given there about future work to be done.

I notice, though, that Dr Haberfield and Dr McCullough both expressed a caveat which suggested that research findings may not so much be the key, but that also one needed to consider knowledge. What did you mean by that, first of all, Dr McCullough?

DR McCULLOUGH: I think what Professor Mackay was getting at, and we certainly note within the expert report as well that he agrees with the intended context of applied knowledge from elsewhere being transferred, so it is a much broader term than just research findings. But there are also a number of guidelines, standards, industry practices from elsewhere which are not necessarily site specific, they are fully broad principles. They haven't been captured in the Jacobs report. They haven't really been captured elsewhere. I perceive a danger within the Latrobe Valley and certainly in other areas such as Canada where I've worked, where the industry can become quite parochial, quite insular. The south is very different to other jurisdictions and certainly other areas.

There is a lot we can learn from other areas, be they Australia, be they Europe, Germany, for example. Before we start defining research needs, we need to make sure that we have synthesised and captured that knowledge and transferred it where possible. I certainly take the point that in regards to some of the site specific research it will need to be questioned in the context of this area, but by no means does it mean there is no research or knowledge otherwise that we can be bringing across.

MS DOYLE: Is that in part, Dr McCullough, a plea to people not to re-invent the wheel when it may be that if one

synthesises what is out there you might find that some of the holes are already plugged?

DR McCULLOUGH: Not to reinvent the wheel, not to ignore existing wheels and certainly, as I have seen in many reports so far today, not to misinterpret wheels that are already out there, mine work included.

MS DOYLE: Dr Haberfield, is there anything you wanted to add in terms of why you placed the caveat knowledge there as opposed to research in the broad?

DR HABERFIELD: No, not really. I think Clint has expressed it quite well. It is just that all research is built on knowledge of research which has come before, which I call knowledge, and so it is done in that context.

MS DOYLE: I have one further question that relates back to an analogy that was drawn this morning in relation to whether or not the area underpinning or sitting under the Hazelwood Mine needs further research on the basis that there is a regional fault line which was likened to a cracked dinner plate. If that be a situation that requires further research or study, is it the case then that the type of monitoring equipment that you and I were discussing, Professor Galvin, that type of monitoring equipment that's in place, will assessment of that monitoring work that's already under way, will that help to identify a suitable control measure with respect to that so-called regional issue, the cracked dinner plate issue?

PROFESSOR GALVIN: The Lewis anomaly is just one of the cracks in the dinner plate. We don't know. There still needs to be a lot more monitoring happening. It is showing that the ground is moving in blocks in strange directions, a

number of blocks in directions that you wouldn't normally expect. Professor Sullivan has done a more detailed assessment of that area in a consulting capacity to the department. So I have only read his reports.

But certainly at TRB level we don't understand yet what is happening there and, until we do, it is difficult to know what final controls you put in place. You certainly put controls in place simply for the very reason that you don't know what's happening. But at the end of the day what the final controls look like, I don't know.

MS DOYLE: Is there anything that you wanted add to that, Professor Sullivan or Professor Mackay?

PROFESSOR MACKAY: I think I would have to actually look in detail at the actual monitoring system that is in place. Monitoring systems particularly for ground movements will be able to isolate certain types of activity, but they may not be able to isolate others. Therefore I would be loath to say that the current monitoring system is fit for all purposes, but I would certainly be happy that it is fit for a significant number of them.

MS DOYLE: I have no further questions for the panel.

DR HABERFIELD: Can I just comment?

MS DOYLE: Yes.

DR HABERFIELD: I, like Tim, have looked at the data for Hazelwood Mine and the north batter. It is a very complex situation. As we have heard, there are unusual movements and there is actually different interpretations and understanding of those movements. Which is correct? We don't know. So, yes, it is a very complex issue. The problem is the movements which occur occur as incidences.

So how do we generate those incidences? There is a general movement which is continuing, subsidence and a little bit of horizontal movement, and then every now and then we get an episodal movement which is due to some type of loading event usually from water external. We can't predict when they are going to occur. So we need to understand what those loading events are and how they can affect the batter. So monitoring can only monitor what's happened if one of those events occurs.

MS DOYLE: Yes. But continuing to monitor will continue to increase and therefore improve the dataset that's available to be analysed at interval?

DR HABERFIELD: Yes.

MS DOYLE: If there is nothing else to be added to that, I now have no further questions for the panel.

MS FORSYTH: If the Board pleases, and I note for the benefit of the panel that I act for AGL Loy Yang. I have some questions for Professors Mackay, Galvin and Sullivan. So if I can turn first to Professor Mackay. Professor Mackay, you have referred at paragraph 18 of your witness statement to the significant research program focused on testing the batters and building artificial soils for use in covering the batters at AGL Loy Yang's mine. I want to ask you a question about those trials. One of the matters that will be examined in that research and through the trials is the relationship between water, including drainage, cover, stability and erosion issues. Is that the case?

PROFESSOR MACKAY: That is correct, yes.

MS FORSYTH: And one of the variables that will be looked at is the appropriate overall slope angle to apply to any one

batter; is that the case?
PROFESSOR MACKAY: That is correct.
MS FORSYTH: And another one of the variables that will be looked at includes the thickness of cover in relation to any one of the different batters; is that the case?
PROFESSOR MACKAY: Exactly, yes.
MS FORSYTH: You are working with AGL Loy Yang on developing the scope of that research at the moment; is that correct?
PROFESSOR MACKAY: That's right, yes. We are going through a planning process at the moment with a view to commencing the first trial either later this month or next month.
MS FORSYTH: It has been suggested to the Board that there may be some benefit in bringing forward progressive rehabilitation in order, for example, to mitigate short-term fire risks. Would you accept the proposition that one of the difficulties in mandating the bringing forward of progressive rehabilitation by the regulator, for example, may be to miss out on the benefits that could be obtained by having appropriate trials extending for a long enough time for you to fully understand what the final stable rehabilitation should look like?
PROFESSOR MACKAY: If the presumption is that whatever progressive rehabilitation is done equals the final rehabilitation, then that is absolutely the case.
MS FORSYTH: It is important, isn't it, that if you are to do progressive rehabilitation which matches in with your final rehabilitation that that progressive rehabilitation needs to progress in an orderly manner, having regard to such matters as those further studies that are needed in order to ensure an appropriate long-term outcome?
PROFESSOR MACKAY: I certainly believe that for some of the

batters that it is appropriate for those studies to move forward before actually moving to rehabilitation.

MS FORSYTH: I now turn to you, Professor Galvin. You were taken to - I do this somewhat reluctantly; this letter has received a lot of comment - a letter dated 12 October 2015, which is annexure 15 to Mr Wilson's statement. You said words to the effect that unfortunately the frustration you felt at that time came back to bear on AGL Loy Yang due to the production of that letter to this Inquiry. I hope I haven't misrepresented what I think you said. Can I ask you whether you are recognising the fact that AGL is subject to the regulatory system and it's the system that you are primarily directing your frustrations to rather than AGL Loy Yang?

PROFESSOR GALVIN: That's basically correct. It just blows me away, frankly, that a performance criteria which you don't have to think about much to realise doesn't give you a lot of long-term confidence can find its way out of the Valley and up to Melbourne and all the way to the TRB. There is something wrong with the approval system if something like that does not get picked up earlier. So I was venting my frustration on the approval process, that something like that could end up coming to the TRB.

MS FORSYTH: The comments you made in that letter about the northern batters have been the subject of questions. Can I ask you about that example. Is that an example of your criticism being directed to the regulator in the sense that in your letter you are not suggesting that what AGL Loy Yang says about the constraints on progressive rehabilitation is in fact wrong but what you are saying is that there should be a process to be able to critically

examine those types of assertions?

PROFESSOR GALVIN: That's correct. I'm not casting any aspersions on Loy Yang at all. What I'm saying, though, the process, those sorts of statements, commitments need to be tested if you are going to have confidence in the approval process.

MS FORSYTH: Thank you. Could I ask some questions of you, Professor Sullivan. I know it's the end of the day and I would ask you to just explain this in brief overview. Can you please explain what you mean when you talk about mine setting and why it's important, especially in the context of the AGL Loy Yang setting?

PROFESSOR SULLIVAN: AGL Loy Yang is largely a rural setting. There is no nearby significant natural or manmade infrastructure, apart from the planned bypass which we have heard a bit about. So we can't get away from the fact that these very large holes have been approved and excavated and these very large holes are in materials that are largely a bit above soil strength, not much above soil strength. So final rehabilitation to anything like a safe and stable condition in the context that people would think of is a challenge.

I know having gone through the process in a lot of detail in areas where stability and public safety were of much higher concerns, but if we start with a rural setting then you can look at the normal engineering processes, you can set criteria that would probably be lower than the criteria that you would set if you were, say, adjacent to a township or something else of significance, you could do the engineering studies that evaluate what the performance would be of that particular

slope under a whole range of conditions, and if you limit public access and you stay with a landform that addresses sustainability then you can arrive at criteria that I believe would get acceptance through stakeholders, despite the fact that some of the notional criteria that have been applied universally or elsewhere around the world might fall significantly below those standards. That's where setting comes into it. That approach I wouldn't use elsewhere necessarily.

MS FORSYTH: I wanted to ask you some questions about the bypass because it has come up this afternoon and I don't have a town planner to cross-examine about this. So if I'm going outside your area of knowledge, please feel free to pull me up. You are obviously aware that there is a public acquisition overlay over land to the north of the mine?

PROFESSOR SULLIVAN: Yes.

MS FORSYTH: Are you aware that that public acquisition overlay was put in place through a ministerial amendment in about 2009 and not through the recent panel hearing that you were involved in?

PROFESSOR SULLIVAN: No, I'm not aware of that.

MS FORSYTH: I won't take those questions any further. I will do that in submission. Can I ask you, Professor Sullivan, why is it important in understanding what should be in a work plan and in a rehabilitation plan to understand where a mine is in its lifecycle?

PROFESSOR SULLIVAN: If we deal with Loy Yang to start with, it is approximately halfway through its lifecycle. The previous mining period is about equal to the future mining period that's planned. So that's a little different to

the other two operations that are much more mature and significantly further down the path. So there is still quite a significant period in which to undertake research and develop some of the final criteria and to narrow those uncertainties that we face at the moment in terms of challenges.

In terms of what goes into the work plan in regards to rehabilitation at this stage, and you could always add in more, I have seen some previous work plan variations and they were very sparse, to my knowledge. I have seen this one from Loy Yang and it is significantly better. It is not all the way down the track, but I understand from what's within it that there is intent, and serious intent, from the organisation to address those challenges.

MS FORSYTH: In your view, is AGL Loy Yang now doing what it should do to progress its state of knowledge about mine stability issues?

PROFESSOR SULLIVAN: It has started on the journey.

MS FORSYTH: In your witness statement at paragraphs 166 to 171 - I don't need you to go to them - you talk about the constraints at AGL Loy Yang upon progressive rehabilitation. Should more progressive rehabilitation be mandated with specific timelines for that to be done over and above what is proposed in the 2015 work plan variation, notwithstanding those constraints that you have identified?

PROFESSOR SULLIVAN: I understand there might be a number of components to what you have just asked. I will try to deal with them. In terms of mandating at this stage I will give you a little anecdote from my own history in

the Valley. From my first involvement in late 2007 and through 2008 it was very clear to me then that rehabilitation was a big issue with these particular operations. I have turned my mind to it on and off throughout the period up to now.

We are not at a stage where we really should be mandating too much without the science to back it up. In 2010, when I was the Chairman of the Technical Review Board, I did discuss my concerns about the stability of one area - it doesn't matter where it is, but one area - with the technical services director of the mine and told him very clearly that I was concerned about this particular area from a stability viewpoint.

Then he advised me that he had to rehabilitate that area. So I told him it wasn't clear to me then that the rehabilitation was not going to make it better or worse in terms of stability. He said, "It's part of the bond. I have to keep going. I have to rehabilitate this." I even passed those concerns on to the department. Anyway, subsequently this area did develop a significant incident the next year, some seven months later. So I'm very wary about mandating things at this stage.

MS FORSYTH: I have no further questions, thank you.

MR ROZEN: I just have a handful of matters to raise. The first question is for Dr McCullough. The various additional studies that you have recommended in response to question 4 that you were asked, I think you agreed with me earlier that's a considerable body of work that is suggested?

DR McCULLOUGH: Yes, I consider it considerable but not unreasonable.

MR ROZEN: No, I understand that. Is the cost of doing that work properly to be considered as part of the cost of rehabilitation?

DR McCULLOUGH: That all depends which of those works can be related to operational. What you are asking is a closure cost question. There is an entire chapter that was written two years ago by Hugh Jones in the mine manager's handbook. It is a very complex issue.

MR ROZEN: I'm just reading your introductory sentence. I'm reading from page 15 of your report and the Ringtail reference ends in 0015. At 4.1 you say, "I recommend that the following further studies be undertaken in order to provide for practical rehabilitation of the Hazelwood Mine void in a timely manner with reasonable cost and with outcomes of significantly reduced risk and improved opportunity." In light of that, why wouldn't these be considered costs of rehabilitation?

DR McCULLOUGH: Because if they can be undertaken as operational costs then it will affect, for example, their net present value.

MR ROZEN: So there could be some apportionment as between current operating costs and future - - -

DR McCULLOUGH: There most certainly should be.

MR ROZEN: I understand. Dr Haberfield, both you and I think Dr McCullough have made reference to existing knowledge. I think at one point there was a discussion about underwater stability and the potential for instability under water and what is known. You made reference to work that has been done, for example, by oil companies in the context of underwater stability issues.

I note in the joint expert report that all of

you, Dr McCullough and Dr Haberfield included - and this is at point 5 in the joint expert report - I think I'm right in saying you all agreed with the following proposition that is drawn from Professor Mackay's report, that is that "the proximity of the Latrobe Valley mines to people and infrastructure, the specific geotechnical characteristics of the geological materials, the geological setting, climate, hydrology and the significant thickness of the coal seams are some of the factors that do not make it possible to rely on translating research" - and I would suggest "and knowledge", but perhaps he can correct me on that - "from elsewhere without first testing and tailoring the research findings to the specifics of the Latrobe Valley." Is the Board to make of your evidence and what appears in the joint expert report that, whilst there may be knowledge that can inform decisions made in the Valley, we need to approach the translation of that knowledge to the Valley with some caution?

DR HABERFIELD: I'm not sure "caution" is the right word. You need to consider it, think about it, compare outcomes with what's happened in the Valley and the knowledge we have in the Valley and see if it is applicable to the conditions which are in the Valley. Some of it will be useful, others won't. So "caution" is not the right word. It has to be tailored.

MR ROZEN: Yes. Dr McCullough?

DR McCULLOUGH: I think my answer to the counsel for Hazelwood probably touched on this. There are two views to take. I think that statement is probably a half glass empty view. It is more a half glass full view which is a lot of information that is out there can be transferred.

Whenever you take information from anywhere, even within the same setting, there has to be circumspection about that information. If you are translating from one mine to another mine there should be circumspection. If you are transferring information from one measure within that mine to another there should be. From one aspect to another there will always be circumspection. What it means is knowledge should not be transferred naively or in ignorance of the underpinning assumptions for that knowledge; that's all.

MR ROZEN: Equally I think you warn us against an overly parochial approach which just says, "Well, we're unique so we can't learn."

DR McCULLOUGH: Most certainly. I think anyone using that knowledge needs to be the person who understands where that knowledge came from and makes sure it is fit for purpose.

MR ROZEN: Professor Mackay, is there anything you would seek to add to that?

PROFESSOR MACKAY: Yes, I just want to add that research by definition in order to be truly called research has to be rigorous. The term "rigorous" means that it has to take advantage of all historical knowledge, and that includes away from the area that you are actually working in. So research is not just by picking up an idea and assuming that the world has never thought about it before. So I wholly agree that we bring as much knowledge in as we can, but I wholly agree that we need to test it thoroughly to make sure that it is actually fit for the purpose that we want it to be adopted for. If it is not fit, we throw it out. If we need other activities to actually

understand exactly what we need to do to actually make these things work, then we actually undertake that work. There will in many cases be additional work to be undertaken.

MR ROZEN: Professor Galvin, is there anything you would seek to add to that?

PROFESSOR GALVIN: No, I think knowledge underpins the research. To do decent research, you need the knowledge base to build on. Take it for granted that knowledge is included in the research.

MR ROZEN: Professor Sullivan?

PROFESSOR SULLIVAN: I think it has been adequately addressed.

MR ROZEN: Mr Hoxley, Mr Spiers, don't feel compelled?

MR HOXLEY: No.

MR ROZEN: Dr Haberfield, I wanted to raise with you another issue and this is in the context of tolerability of risk and as low as reasonably practical and the debate you were having, I think, in responses to some questions from counsel for GDF Suez. At one point you said I think by analogy with the road toll setting that it was a question of how much the public is prepared to pay for the level of risk that is present. I suggest to you that in the current setting it's not actually how much the public is prepared to pay, it is how much the mines are prepared to pay, isn't it, that determines the level of risk that the public is exposed to? Isn't that a better way of characterising the current situation?

DR HABERFIELD: For operational it is up to the mine to assess level of risk. But once you go beyond operation and if this becomes public land, it has to be the risk the public is willing to accept. The mine has gone. So that level

of risk has to be set some time now so that the mine closure can work towards that. It is not for the mine to decide that because the mine might say, "We are going to put up fences. No-one is allowed in. The level of risk? No-one is at risk. Therefore there is no risk." But that might not be acceptable to the final land use.

MR ROZEN: The community might say, "But we want to have access to that land."

DR HABERFIELD: Exactly.

MR ROZEN: Does that really point to the importance again of engagement and involving the community in these decisions?

DR HABERFIELD: It points to the importance of including all stakeholders, and the community is one of those.

MR ROZEN: Yes, which I think we are back to where we started and I don't want to go over that again. There is one final matter which arose in questioning yesterday and this is the use of something called rip rap, which as I understand it is an anti-erosion device, if I have that correct. Dr McCullough is nodding. I'm pleased about that.

It is part of the Jacobs costings, I think, is it not, the role of rip rap? Perhaps, Mr Hoxley, if you can just explain the thinking behind that and how it is envisaged rip rap would be used as part of the gradual filling of the lakes?

MR HOXLEY: Yes. Again we have needed to make some assumptions about what the final form would look like in order to be able to put some costs against them. Noting the extensive conversation we have had here that it is very early to be making such assessments and people may disagree with those assessments, nevertheless we have taken the view that in a

lake feature in these pits that has to survive in the long-term it needs to be low maintenance and it needs to be something which is protected from a range of weather events and weather extremes.

I think the comment was made earlier that a lot of these materials are soils, so they are fairly light and particularly in some of the coal areas. So we have made an allowance for a covering in what you might call the wave zone around the edge of these lakes. They will naturally in response to weather, warmer summers, wetter winters, they will move up and down a little bit over time, and in response to wind and other events may have waves and erosions. It would be typical in many areas for there to be a degree of protection of soft soils. So something like rip rap is used to provide that protection.

Again, prejudging a whole lot of studies that are not available to us and haven't been done, we have made an assessment that a level of rip rap may be required and we have put that into the costings.

MR ROZEN: Dr McCullough, the way you addressed this issue is you say that that's one of the things that needs to be studied, isn't it? An erosion study needs to be carried out, the outcome of which will determine whether anything is needed, whether if something is needed it is rip rap or something else and so on. It's an unknown that you have identified?

DR McCULLOUGH: Yes, but moreover I have never seen rip rap used in a pit lake before. I would never advise its use in a pit lake. My book has a chapter on riparian design, which is the amphibious layer around the outside. So there are design principles already published for pit

lakes. I would also question why a pit lake, a constructed lake, would need specific hard engineering when it should be designed along the low maintenance levels of a natural lake which does not receive the engineering. I have a number of photos within my library of pit lakes where the final water level has been misjudged. As the statement has been made, the level will go up and down as well. So you may need rip rap or armouring in those circumstances if you choose to go down that route of many metres up and down. That means that you will not establish vegetation. You will not establish amenity either. In short, I do not believe it is a very good idea.

MR ROZEN: But there may be other proposals that emerge from the study?

DR McCULLOUGH: There are various proposals, and I certainly take Jacobs' point that it is very early to be deciding this and, given their brief, they had to come up with something.

MR ROZEN: Dr Haberfield?

DR HABERFIELD: There are many reservoirs around which have slopes of 1 to 3 which have no rip rap on them. It depends on the slope, what the soil is, what the erosional features are, and so many things. If the public wants amenity to this type of thing you will have to flatten some areas out to less than 1 to 3 so they can get into the water and so on. They will not need rip rap. As soon as you put rip rap around - they are usually on slopes which are steeper - then, as Clint said, the aminity goes. You can't have people climbing over rip rap.

Does everyone understand what rip rap is? It is

large boulders. It could be big concrete blocks. It can be all types of things. But they are big features which sit there by gravity and are not eroded. But if you do get a major storm of course they can move or stuff like that. But there needs to be a whole study of wave action in these types of things, which I'm not an expert in. But I have seen plenty of reservoirs around which have absolutely no rip rap and they behave just fine.

MR ROZEN: Does anyone else have a view about that?

PROFESSOR SULLIVAN: Yes. Rip rap is generally a hard, durable high-density material. It has to have some sort of grading. The maximum sizing is usually a function of the calculation of the fetch of the wind and the wind speeds across the body of water and the prevailing wind directions that then give you an idea of the potential wave heights, which then tells you how you have to size and what sort of grain size distribution you have to develop in that rip rap layer.

If you start from what we know now about most of the covering materials, they are quite dispersive, which means water will take them away. As a first basis I hear what Dr McCullough and Dr Haberfield have said and I agree about those amenity aspects, that once you go down that route then you do preclude certain other things. But I could also see where Jacobs comes from at the moment and, based on that, these materials are liable to be erodible.

MR ROZEN: That concludes the questions that I have for the panel, unless there's anything the Board wishes to raise with them. No. I think it probably just remains for me - - -

CHAIRMAN: Perhaps I will take over, Mr Rozen, and express my great thanks. It is something like seven hours since we started on this and in so many respects of course it might be seen as an ordeal to have been where you are. But, compared with having you dealt with individually, it's been such a more beneficial process and I think that everyone in the room will be so much better informed as a result of the contribution that you have made, even though they may also now appreciate just how much more complex all the issues are than they might have thought before you got under way. I'm sure that will apply to not only the lawyers present but those who really hail from around these parts, and that will be a good thing. But I think there will also be enormous continuing value in the transcript of what has been recorded as to what you have done today.

There has been great interaction between the seven of you and for all those things I express my gratitude and now say that you are free to catch your flights, depending upon who you choose to fly with, depending on the acceptable or tolerable risks et cetera that are involved. Thank you very much indeed.

<(THE WITNESSES WITHDREW)

MR ROZEN: While the people are going to various airports around the place to catch those flights, if I can just bring everyone up to speed.

CHAIRMAN: Yes, please.

MR ROZEN: I think the advertised time for the link with Mr Von Bismarck in Germany was 4 o'clock, but it was decided because we were uncertain how long we would be that we would push that out to 4.30.

CHAIRMAN: Do we want to take a comfort break for, say, 10 minutes but it may extend beyond that if we can't get the witness - - -

MR ROZEN: I'm instructed he will be available at 4.15. If we take a comfort break until 10 past, then we will be ready to go.

CHAIRMAN: We will do that then.

(Short adjournment.)

MS SHANN: If I could call Dr Von Bismarck who is appearing by way of videolink from Berlin. I will just check, Doctor, are you able to hear me and see me?

DR VON BISMARCK: I am hearing you very clearly and see you all.

MS SHANN: If we can perhaps have Dr Von Bismarck sworn in.

<FRIEDRICH VON BISMARCK (via videolink), sworn and examined:

MS SHANN: Thank you, Doctor. If I could firstly just ask you a few questions about your professional background. And then I understand there's about a 10-minute Powerpoint presentation which you will take the Board through. Firstly, if you could please tell us about your background and your role in the joint governmental agency for coal mine rehabilitation based in Berlin?

DR VON BISMARCK: My academic background is economist as well as geologist. So (indistinct) - - -

MS SHANN: I'm sorry, Doctor. The sound is cutting out slightly. I do understand that if we lose the vision that the sound may improve. So we might ask you if you could just switch your camera off and we might just start again with your professional background?

DR VON BISMARCK: Okay, fine. The camera is now off. My professional background is economist and geologist and

(indistinct) - - -

MS SHANN: I'm sorry, we are losing the connection again. I might just ask you to pause there for a moment and we will just see if we can do anything technically at our end.

DR VON BISMARCK: Okay. Should I continue with my professional (indistinct) - - -

MS SHANN: It sounds like it might be an internet problem.

DR VON BISMARCK: I can hear you very clearly.

MS SHANN: All right. We might try one more time from our end, just in relation to your professional background and see if the sound quality improves?

DR VON BISMARCK: Yes. So, I'm a geologist as well as an economist and I have headed the joint governmental agency for coal mine - can you hear?

MS SHANN: It is cutting in and out. If you just hold on one moment.

DR VON BISMARCK: Let me know if I can do something at my end.

MS SHANN: Doctor, we might just try to cut the connection and then re-establish it. If I might just ask the Board whether the Board wants to retire, but it will take perhaps a few minutes.

CHAIRMAN: No, we will sit here and try to work out the technical side.

MS SHANN: Thank you.

DR VON BISMARCK: Should I hang on and we dial again?

MS SHANN: Yes, if you just sit tight for a few minutes, we will see if we can do something at our end. Thank you, Doctor. I'm told by technical people that there is currently a massive "surge", quote/unquote, of internet usage in this room at the moment and if that is able to be

switched off, then it would assist us.

CHAIRMAN: Does that mean that those who can turn off their iPhones, iPads and Surface Pros, et cetera, should to the maximum extent do so?

MS SHANN: That would be very helpful, I'm told.

(Short pause.)

MS SHANN: Doctor, can you see and hear me okay?

DR VON BISMARCK: Yes, I can see you and I can hear you okay.

MS SHANN: We can hear you much better than before, so I'm sorry to ask you again, but if you could outline your professional background, we might see how we go this time?

DR VON BISMARCK: Okay. I have academic background in economy and in geology and I have got a doctorate (indistinct) - - -

MS SHANN: No, I'm sorry, I think we are still having trouble. I think the plan now is that we might adjourn the court for today and see if we can rectify the problems or what options there are from this end. Doctor, I apologise. I know you have gotten up early this morning to assist us.

MS DOYLE: Can I suggest there is no party back here who would object to it being done simply by phone, if that helps.

CHAIRMAN: By landline. Is that possible?

MS DOYLE: An old-fashioned landline. We don't have any need to see the witness in these circumstances.

CHAIRMAN: I think the general mood is that what Ms Doyle is saying is if we can work out some way of having - - -

MS SHANN: We have a Powerpoint presentation issue, Mr Chairman.

CHAIRMAN: But can't we say what is on our Powerpoint presentation at any particular time, that we have slide such and such?

MS SHANN: We can do our best. It might be slightly awkward, but better than the current situation.
DR VON BISMARCK: I'm trying to establish a telephone contact.
MS SHANN: All right. I think an attempt is going to be done now, Doctor, to try to establish phone contact?
DR VON BISMARCK: Okay.
MS SHANN: We will just end the internet connection and then we will dial into you on the phone.
(Short adjournment.)
MS SHANN: Doctor, can you hear me clearly?
DR VON BISMARCK: Yes. It's dim, but I can hear you.
MS SHANN: All right, I will speak much louder. Is that better?
DR VON BISMARCK: Yes, that's better. Thank you very much.
MS SHANN: Thank you, Doctor, for your patience and also to the Board for their patience. Doctor, if I could ask you again to outline your professional experience for the Board, please?
DR VON BISMARCK: Yes. I have 35 years of professional experience in the field of mining and the impact of mining in the environment. By academic training I'm an economist and a geologist and I have a doctorate degree in economic geology concerning open pit mining. During the last 20 years I have been heading the Joint Governmental Agency in Germany for the coal mine rehabilitation. This is the place where the governmental finance rehabilitation program in East Germany is handled and we have so far carried out rehabilitation projects in the value of about 10 billion euros.
MS SHANN: Before I ask you a few more details about that agency, you have prepared a statement, a four-page

statement, for the Inquiry dated 1 December 2015?

DR VON BISMARCK: Yes.

MS SHANN: And have you read that recently?

DR VON BISMARCK: Yes, I have read it recently. I have it with me. So it is a recent statement of mine, yes.

MS SHANN: Are the contents of that document true and correct?

DR VON BISMARCK: Yes, those contents are true and correct.

MS SHANN: Would you like to change anything in that statement?

DR VON BISMARCK: No, I don't want to change anything.

MS SHANN: Thank you, Doctor. I tender that statement.

#EXHIBIT 25 - Statement of Dr Friedrich von Bismarck dated 1/12/2015.

MS SHANN: Doctor, the Joint Governmental Agency for Coal Mine Rehabilitation, could you please just tell the Board something about the staff, their background expertise and what kind of tasks and functions that agency has had over the years?

DR VON BISMARCK: Yes, we have a special situation in East Germany. Normally the government would not be involved with a lot of money in the rehabilitation work because this is the liability of the mining company. But because of the situation after reunification, the whole East German mining industry, which was state run by the socialistic government, was inherited by the West German State. The East German mining industry has not set aside money for the rehabilitation task. So this question was put up for the government and the government, the federal government as well as the four provincial state governments, took over responsibility and they are jointly carrying out this program.

This agency that I'm heading, it is a place where

a mining company, a project agency, is applying for the funds, for the governmental funds, and the agency is consisting between 18 and 34 people. They are evaluating the applications technically and financially and then they suggest a vote by the government. So, then the government decides on the project and then this agency is also responsible for the controlling of the rehabilitation process. So we look after whether the governmental funds are spent correctly and in the way they should have been implemented, the projects. So it's a financial and controlling agency in the name of the federal government as well as the provincial governments.

MS SHANN: So, if I'm understanding correctly, all of the mines now or when the reunification occurred, the mines were publicly owned by the federal government?

DR VON BISMARCK: Exactly. Exactly. Only 25 per cent of the East German governmental industry could be privatised because the other ones were uneconomic or they did not meet the environmental standard. So, 80 per cent or 75 per cent of the industry had to close down after reunification. This governmental program is only concerned about these closed down mines, 80 or 75 per cent, and the rest was privatised and are still mining actively and producing about 62 million tonnes per year, and they are of course responsible for their own rehabilitation. But the largest part is now controlled also by this agency, the largest part has been closed down and controlled by this rehabilitation agency.

MS SHANN: So when you say that the mines apply to the agency for funding to carry out projects and then that is overseen by the agency, can you explain what role the

agency has in terms of ensuring compliance with project design?

DR VON BISMARCK: So a project management agency or entity was set up and they hold responsibility according to the mining code. According to the work plans of the mining code it was this agency, but they don't have any money. So they have the responsibility, but no money, and so the money comes from the government. So, the controlling agency, like the department of mines, they ask for compliance with the work plans and all the works in this context are then applied to our agency and we check it, whether it's in line with what is supposed to be done, and then we suggest a vote by the government. The government has of course a final say, but we are suggesting a certain vote to approve the project. Once approved, then this kind of project management agency is tendering the work and our agency is doing the controlling of that.

MS SHANN: Thank you. Doctor, I understand there's a Powerpoint presentation which has been prepared. Everyone in this room should have a copy of the slides that have been prepared which would be attached to your statement behind tab 21. Are you able to, by reference to the slides that you have, just talk us through?

DR VON BISMARCK: Yes, of course. I can commence on the Powerpoint presentation.

MS SHANN: Thank you very much. Because you can't see what we have on the screen, if you could just indicate whenever you need to change slides and we will make sure that happens at our end?

DR VON BISMARCK: Okay.

MS SHANN: Thank you.

DR VON BISMARCK: So I should I go ahead?

MS SHANN: Yes, please, Doctor.

DR VON BISMARCK: So I have prepared a Powerpoint presentation for the Board of the Hazelwood Mine Fire Inquiry. The presentation is about the experience we have made in East Germany with the large scale lignite mine rehabilitation program. The situation of the open pit lignite mine in Germany could in many ways be of interest in the discussions to the situation in the Latrobe Valley.

Lignite is mined in East Germany in the Lusatian coal district and the Central German coal district. The mines are located about 120 to 180 kilometres south from the capital of Berlin that you see at the top of the map.

Next slide. Currently the annual lignite production in the Lusatia mining district of Germany is about 62 million tonnes per year. The coal is produced from four large scale open pit mines and delivered directly by band conveyer and trains to three power plants. The coal has a moisture content of about 55 per cent. The geological difference to the situation in the Latrobe Valley is that the coal seams in Germany are much thinner and are covered with more overburden.

Next slide. The mines are located in populated areas - some communities are directly adjacent to the mines - with mainly farmland and forestry surrounding them. Because of the specific situation with reunification in Germany, the government had to take up responsibility for the rehabilitation. It would normally be the legal obligation of the operator of the mining company.

Next slide. In about 20 years from now the

planned time of coal production from the three mines in the Latrobe Valley will come to an end and rehabilitation will be the main focus. In this context some of the German experience might be of specific interest to the situation in Victoria.

25 years ago, East Germany was with 300 million tonnes per year the largest producer of lignite coal in the world. In the early 1990s, about 80 per cent of the industry had to close down because the mines and plants became uneconomic or could not meet the rising environmental standards. At the beginning of the 1990s a unique program started in East Germany for the rehabilitation of the closed down coal industry covering an area of over 100,000 hectares of mine land, a total of 224 voids - on the picture you see void number 12 in the year 1992 - and 100 industrial sites, including power plants, processing plants and cookeries, and many partly toxic industrial waste dumps.

During the last 150 years, mining has had a major impact on the landscape of Lusatia. The production in the first coal mines, initially underground mines, started from 1875. The first map shows the pre-mining phase in Lusatia, and then particularly in the 70s and 80s of last century the mining increased intensively as GDR's socialistic economy depended heavily on the lignite coal as the sole source of energy.

Today after 25 years of an intensive rehabilitation program, a major change in the landscape and the regional development has been achieved. The landscape shows now a balanced mix of communities and infrastructure with agriculture, forestry and lakes that

previously had been mine voids.

Next slide. The development can be shown with "before" and "after" pictures. This shows the 1991 situation at the mine near Bitterfield. The only point for orientation is an old villa, the red arrow. Once the area was known as the dirtiest place of Germany. Now it is attractive for investors and is benefitting from tourism. The new lake has already been the location for a world championship for speed boats. Here is an aerial picture of the situation in 2012 at the same location from 1991. The red arrow shows the now restored villa.

The rehabilitation works create chances like the former mining areas provide opportunities for new value-added chains in agriculture, for example. At the Lake Geiseltal, a former mine void which became now the largest manmade lake in Germany, new forms of agriculture like growing wine becomes possible by using the dipping dump slopes to collect more sun for the plants. Wine can to my taste not compete with the Australian wine, but the demand is always higher than the offer and so the miner's wine is always sold out very early.

Next slide. The flooded voids offer now also new opportunities for different fishing activities for man and nature.

Next slide. Some of the former industrial sites were successful in attracting new industrial investments like a paper mill at the site of a pulled-down power plant and the production of rotor blades for wind power generators at the site of a former coal cookery.

Next slide. The work plans for mine closure - the work plans in Germany are a similar

construction to the work plans for the Victorian mines. The work plans demanded a hydrological link between adjacent mine voids. Then there was the idea to enlarge the canals to allow ships to pass through. The provincial governments, keen to support regional development, allocated the required funds. Now a lot of different forms of water sports are made possible, supporting tourism in the former mining region.

Next slide. The new lakes are attracting private investors, so for example in the fields of gastronomy and hotels. A hotel called "The Lighthouse" was, for example, opened up last year and it is now always fully booked in an area where there has never been a lake before.

Next slide. Another idea to enhance the attractiveness of the new lakes are floating homes that are manufactured locally. This is supporting the regional economy in two ways.

Next slide. The new post mining landscape with the voids had played in Germany an important role in the regional flood water prevention. During the last 14 years the negative effects of several stormwater and high flood events could be reduced as the mining lakes could take large quantities of water from the river system, saving communities downstream from the water masses. At the "White Magpie" River a new flood protection structure helped in June 2013 capping the floodwaters and thus avoiding potential financial damage on the inundated buildings in the downstream city of Leipzig in the order of 50 million euros.

Next slide. The regional population has, on one side, benefited from the job opportunities of the mining

activities, but for most of the people the mines were "off limits" for decades. After the active coal mining comes to an end, the public will take "possession" again of the post mining land as this is going to be part of their home landscape again. They will have to build up identification with the new post mining landscape. In Lusatia several projects were carried out to integrate the interested people into the rehabilitation process. So, many regional choirs formed a united choir of the post mining landscapes with about 500 singers singing jointly their own new anthem.

Next slide. Following an announcement in the newspaper, over 4,500 regional people gathered around a flooded void and became part of a light performance - everyone bringing his private torchlight - to welcome the creation of the new lake. Now a majority of the regional population is seeing the result of the rehabilitation process as a very positive development.

But besides many successes in the process of rehabilitation, some drawbacks in the field of geotechnical stability and water quality had to be witnessed too, indicating some remaining risks with the rehabilitation works.

Our applied standard technology to stabilise the pit walls and dump slopes has not been questioned, but in the last years some ground breaks on dump surfaces happened in areas that previously had been deemed stable.

Next slide. Another drawback was a rising content of iron hydroxide in the groundwater. Although generally expected, it occurred earlier and more intensely than the hydrogeological model calculations had predicted

and is entering the river system in some areas.

Next slide. The German governmental rehabilitation program is now running since 1991. One year later a study calculated the costs of the operator's obligations from the work plans for all mines to be closed and came up with a figure of 16 billion euros. Meanwhile, the German federal government, together with the governments of the four affected provincial states, have allocated - always within a framework of joint governmental financial treaties in five-year step - allocated about 10 billion euros. The program is now in its final phase and today it becomes clear that less expenditure will be required for completion and the initial planned amount will most probably never be reached.

Next slide. The individual cost parameters of the rehabilitation works changed, of course, over the years. So, for example, the cost for the creation of forest areas stayed during the same period between 3,200 and 5,100 euros per hectare.

Next slide. The cost of mass movements with bulldozers stayed since the year 1999 between 0.5 and 0.81 euros per cubic metre. In total, the costs of the rehabilitation program showed a development comparable to the cost developments in other industries.

Next slide. Mining is typical for a very steady long-term business. In Germany we have witnessed that the future prospects of the active coal mining industry in Germany have changed largely over the last 30 years. So in GDR times one could not imagine that the excessive coal production would be drastically reduced, but it just so

happened after reunification. And 10 years ago no one would have realistically foreseen the development of the rising share of renewable energy, like photo-voltaic, power generation and - next slide - wind power generation, here shown on former mining land.

The changing prospects of coal mining were in Germany largely affected by governmental decisions. So it was decided after the Fukushima accident in 2011 to phase out nuclear power plants and subsidise heavily the generation of renewable energy. Currently the political discussions about the future of coal mining are getting again more intense.

Next slide. Finally, I will sum up some points of our experience in Germany that might be of interest to the discussions in the Hazelwood Mine Fire Inquiry.

First, the situation of the open pit lignite mining in Germany is in many ways comparable to the situation in the Latrobe Valley. Second, it was possible to create with the mine rehabilitation work a major change in the landscape and the regional development. Third, the rehabilitation works create chances like the former mining areas provide opportunities for new value-added chains, for example in agriculture, industry, renewable energies, tourism and real estate. Fourth, the new post mining landscape with the flooded voids can play an important role in the regional flood prevention.

Next slide. In Germany we have experienced some remaining risks with the rehabilitation works in the field of geotechnical stability and water quality. The mine rehabilitation cost stayed within the planned framework and showed over the last 20 years a development comparable

to the cost development in other industries. The future prospects of the active coal mining industry have changed over the last 25 years and were in Germany largely affected by governmental decisions. Finally, the regional population is building up identification with the new post mining landscape and seeing it as a very positive development.

So that's the end of my Powerpoint presentation. I hope you could hear my comments on it.

MS SHANN: Yes. Thank you so much, Doctor. I have a few questions for you, and then there may be some additional questions from some other parties. Can I ask firstly how many mines were you dealing with in the area that was being rehabilitated?

DR VON BISMARCK: The exact number, it's a little bit difficult because mining went on for over 100 years, so some mine was moving over another coal seam 50 years after. But generally one can say it's 52 large scale mines that are in the rehabilitation; about that.

MS SHANN: Thank you. You referred to the standard technology that was used to stabilise the pit walls and the dump slopes. Could you explain what that standard technology is that was used in Germany?

DR VON BISMARCK: Yes. We have certain techniques to reduce the slope angle. So if this is possible we do it by dozing and just reducing the slope angle to stabilise the slope. Another technology is blast compaction, so we insert explosives just at the border from the groundwater, where the rising groundwater, the rebound of the groundwater comes up to the slope material and we create blasts that are compacting the slope and are creating a

kind of hidden underground dam, a hidden dam in the slope. Another technology is the vibro-compaction. So when the slope is too sensitive for blasting, then vibro-compaction is carried out, which is a long vibrating device inserting in the slope and by moving it it will compact the grain package and create a hidden dam to stabilise the slope. Then of course after the soil is compacted and stabilised, then there are certain techniques with vegetation to cover it up and protect it from the normal rainfall. So this is the standard technology and whenever we have applied technology there, we had no failure there. Does this answer your question?

MS SHANN: It does, thank you. Nevertheless, you found that there was over time some unexpected stability and water quality issues; is that right?

DR VON BISMARCK: Yes, that's right.

MS SHANN: Were those discovered as a result of ongoing maintenance and monitoring of those pit lakes?

DR VON BISMARCK: Yes. Of course, we knew that there would be an effect on the groundwater quality when the dumps, the overburden dumps are penetrated with rebound of the groundwater because of the chemical composition of the overburden that would have an effect on the groundwater. So, for each mine we have a hydrogeological model trying to predict the amount of outflow from the mine area into the river system. So, with the water quality, those models were not precise enough, so they had to be improved and we had strong and early effect, but it happened also that we had very unexpected heavy rainfall. So we had also a kind of high flood in the groundwater and that has added to the special situation. But now we are applying

different measures to reduce the iron-hydroxide content in the groundwater as well as in the river system.

MS SHANN: Doctor, going into the future, what do you predict or how long do you predict there will be a requirement to monitor stability and water quality issues with the lakes?

DR VON BISMARCK: We are expecting that monitoring will go on for a very long time. Of course, the active rehabilitation will be phased out probably in the next 10 to 15 years where there's really a lot of active rehabilitation works, but the monitoring will continue, particularly in the mine voids, to ensure that the water quality is in the target range and there will be also several technical means in place, so in case there have to be adjustments made for the water quality, that this will be possible also in the future. So we are talking about decades in the future that the monitoring will go on.

MS SHANN: Decades in the future; is that correct?

DR VON BISMARCK: Excuse me?

MS SHANN: The monitoring will need to go on decades after the active rehabilitation phase?

DR VON BISMARCK: Yes.

MS SHANN: In terms of the costs, is it accurate to say that it was difficult to predict the exact cost that these rehabilitation works would ultimately come to?

DR VON BISMARCK: Of course it was quite difficult. When you are thinking of the mine lifetime of 10, 20, 30 years, so when you are look at other prices, they will change in 30 years, so it is definitely difficult to predict the cost precisely. But in our case we were lucky that the cost frame that we had was still valid and if I might add that normally at governmental spending it is very rare

that you keep governmental spending within the initial limit, and in this case we were successful in doing so.

MS SHANN: The $10 billion which has been spent so far, does that factor in the requirement to have ongoing maintenance and monitoring in the future?

DR VON BISMARCK: Well, we are not expecting very high monitoring costs in the future compared to what we have done in the rehabilitation so far. So, as I mentioned in the presentation, we initially had thought we would need 16 billion euros and we have now spent 10. So, even if adding some more possible risks in the future, we still are quite sure that we will never reach that 16 billion figure. The monitoring is rather cheap compared to the actual rehabilitation work, so it will be a question of several million, but not a question of billions in the future of the monitoring.

MS SHANN: Can I ask in terms of the mines that you have been dealing with, how big and deep they are on average, if you are able to say in those terms, or do they differ from each other too much to say?

DR VON BISMARCK: They differ, of course, but generally as I mentioned, I don't know exactly the production in the Latrobe Valley for the three mines, but we have four mines producing 62 million now in the active mine and during GDR times about 30 active mines produced 300 million tonnes. So, larger and smaller ones.

MS SHANN: In terms of the larger ones, how wide and deep were the pits prior to filling them with water?

DR VON BISMARCK: Well, the water availability was the critical question because we have many mines that want to be filled as quick as possible, but the area in Lusatia is a

relatively dry area where there's not enough rainfall, not enough precipitation. So we had to have a list of priority which voids should be filled at first. So, some mine voids will wait for quite a long time, but I think in the year 2020 all voids will be filled with water and the final level of water will be achieved. So it took about 30 years in total to fill all the lakes.

MS SHANN: In terms of the average size of the pits prior to the water being filled, are you able to say something about on average how wide and deep those pits were?

DR VON BISMARCK: Well, some of them are, let's say, up to two, three, four, five kilometres long and I think I showed in the picture the Geiseltal Lake and it's a marathon, the distance, if you are running around the lake. So it is always several kilometres, some of them are maybe six kilometres wide, but they are moving and the actual work face is changing. The German mines are moving much faster than the ones in Victoria because the coal seams are thinner, so to get the same amount of coal out, the mine has to move faster. So your mines are relatively slow moving compared to the amount of coal that is taken out.

MS SHANN: Are you able to say in comparison to the Latrobe Valley mines anything about the depth compared to the German mines?

DR VON BISMARCK: Well, the depths, the second Lusatian coal seam is normally in the depths of about 60 to 100 metres and the mine lakes, now also there is very often internal dumps so the water depth is up to 100 metres or 70 metres. Those are the deeper ones and the other ones are shallower.

MS SHANN: Thank you.

DR VON BISMARCK: But they are not as deep as the Australian ones, but nearly.

MS SHANN: Thank you. Just finally, Doctor, can I ask how important was it in Germany, in your opinion, to involve the community in the rehabilitation process of the mines?

DR VON BISMARCK: It became more and more important. So initially when we started in 1991 there was 120,000 jobs were lost in the coal industry and the majority was just to give the people jobs. So this was a strong motivation for the government to take over responsibility and to bring the former mine workers into the rehabilitation program. There the communities were happy with getting jobs in the rehabilitation work, but then the planning started and more and more the communities also got more interested about what's going on in the mine area and then there is a democratic procedure in Germany where also the communities have a say in the mine closure plan and the goals for the mine closure plan.

So this is a very active process in all the rehabilitation area that the communities are incorporated. So it started very early, but apart from the legal and democratic instruments to incorporate the community, it is also for the standard community member who may not be sitting in committees and so on, for them to be invited into the mining area. That became very important in the last, let's say, 15 years, 10 to 15 years.

So, apart from the normal democratic procedures, just for everyone to be invited and to look at it and to comment on it and see whether this is what they are seeing in their homeland, this is just a more recent development.

MS SHANN: Thank you, Doctor. They are the end of my

questions, but there may be some from someone else.

DR COLLINS: Dr Von Bismarck, my name is Matthew Collins. I represent Energy Australia, which is the operator of the Yallourn Mine in the Latrobe Valley?

DR VON BISMARCK: Yes. Hello.

DR COLLINS: I understand you had the opportunity to inspect the Yallourn Mine on your recent trip to the Latrobe Valley?

DR VON BISMARCK: Yes, I saw it, yes.

DR COLLINS: I assume it was explained to you that the approved rehabilitation solution for the Yallourn Mine is a fully flooded lake that would have interconnections to existing water courses, being the Latrobe and Morwell Rivers?

DR VON BISMARCK: Yes.

DR COLLINS: Has your experience in Germany demonstrated that it is possible to interconnect safely with existing water courses with appropriate hydrogeological modelling and water treatment?

DR VON BISMARCK: Yes, I hope I have understood your question right. So you asked whether we think in Germany it would be possible for a hydrogeological model linked to connect the mine water situation with the river and groundwater system?

DR COLLINS: Yes, subject of course to appropriate modelling and treatment.

DR VON BISMARCK: Yes, yes. So it was relatively precise in the modelling in terms of the quantity and also in terms of the quality for the river system, but we had to improve the models step by step when it comes to groundwater quality. But also now it gets quite good without those modelling and also the regulating departments are happy

with what is done there.

DR COLLINS: In those cases where interconnection of pit lakes with existing water courses has been successfully achieved, are there advantages in terms of amenity, water quality and so on?

DR VON BISMARCK: I'm sorry, I didn't catch that totally. Could you please ask the question again?

DR COLLINS: Yes, I will try again. The question was: in those cases where you have successfully achieved interconnection of pit lakes with existing water courses, have you observed benefits in terms of water quality, amenity or other issues?

DR VON BISMARCK: Yes, yes. We have observed large benefits from that, so the mine void system functions like a sponge. So, when there are high floods, because there's a lot of space in the voids, they can take a lot of water from the river and in times of drought then the mines can easily give up some of their water to guarantee the minimum flow in the river system. So we work very closely with the water department and regulating offices and so we say every cubic metre of water in the Lusatian area is controlled by a mouse click that steered the water from the mine, when are they feeding the river system and when are they taking from the river system, and that has helped largely for the river system, particularly guaranteeing the minimum flow during drought times.

DR COLLINS: You were asked some questions before about the relative sizes of lakes in the German experience. The Yallourn lake, if its approved solution is fully implemented, would be about eight kilometres wide at its widest point, about 95 metres deep and would carry about

750 gigalitres of water. How would that compare with the larger of the lakes in the German experience?

DR VON BISMARCK: Well, that would of course be one of the largest ones we have, what would compare to those. Ours are not as deep, but in terms of the size that would be comparable to our larger mines.

MS SHANN: Do you have a view, Dr Von Bismarck, about the potential benefits for the community of the Latrobe Valley of a lake of that size at the Yallourn Mine interconnected with the existing water courses?

DR VON BISMARCK: No, I don't - it's not very clear to me now. I don't know whether I have understood the question properly but I don't really answer. Could you put it again, please?

DR COLLINS: Yes. I was asking whether you had formed a view about the potential benefits of a Yallourn lake to the community of the size and dimensions that I have described?

DR VON BISMARCK: I have seen the mine in the Latrobe Valley, but it was just one day, so I can't exactly comment on the situation there. But what I have seen is in scale similar to what we have, although maybe we have more and maybe not as big as your mine, but the benefits for the communities are clear because they are eager to get the mine voids filled for the rehabilitation because they have a lot of ideas on what could be done with the new situation with the new landscape in terms of tourism or industry or other economic activities.

DR COLLINS: Thank you. Just one final question. In the German experience are there advantages in terms of stability or other matters of filling pit lakes as quickly

as possible?

DR VON BISMARCK: Definitely a filled void is easier to stabilise. It is the benefit of the water pressure on the slopes supporting stability, so there's a benefit of that. But in Germany we have the question of availability of water. So, we always wanted to flood as quick as possible, but we had limit in the availability of water, and as quick as possible, particularly also because of the stability effect. Another effect is that if the slope is there for a long time, then erosion problems occur and the shorter they are open and not covered with water, then there are different cost factors that occur then.

DR COLLINS: Thank you, Dr Von Bismarck. No further questions.

MS SHANN: Thank you, Doctor. It is Ms Shann back again. Just one final question in relation to what you were just asked. You were asked about whether you could say anything about the potential community benefits in flooding the Yallourn Mine. Is it the case that you would support the idea of asking the actual community of the Latrobe Valley about what they think the potential community benefits are as opposed to other people deciding that for them?

DR VON BISMARCK: Well, we had experienced that the direct communal benefit came in mainly in terms of selling the property surrounding the lake and the community wanted to have of course a say to whom the area is sold and what kind of after use is then built on, so we give priority to the community when it comes to selling the mine land to private investors. So this is always done in close connection to the community so that they still are getting hold of the development that is happening. This is very

important for - - -

MS SHANN: And in terms of decision making about rehabilitation, it is important to ask the communities affected by those decisions?

DR VON BISMARCK: Yes, we have this standard democratic procedure to set out a mine closure plan and in that procedure the communities bring in their ideas and goals and this has then to be discussed with all the other stakeholders and finally when there is agreement on what should be done, then this becomes a legal document and it is binding for the mining company and then it is going into the work plans for the mine operation. So this procedure is first, but this procedure is about 15, 20 years before the actual mine void is filled up and the large changes come. So in between - after of course the mining company needs planning security - and so they have to arrange for the rehabilitation works long-time, they need security for that. But sometimes we see that communities have new ideas long after the legal part for the mine closure plan is gone and is implemented for many years and then one sees what one can do to also to somehow accommodate the community wishes with the work plan. So we have seen several cases of that, that in the final stage some goals of the mine closure plan were adapted according to new upcoming ideas in the region and the affected communities.

MS SHANN: Thank you, Doctor. Doctor, if I could thank you on behalf of the Inquiry for your assistance attending at various sites, providing the statement - - -

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MS SHANN. I will not take that personally. Thank you, Mr Chairman.

MR ROZEN: I think it is appropriate to adjourn proceedings. Before we do that, if I could just indicate we only have two witnesses left for tomorrow, Carolyn Cameron from Jacobs and Corinne Unger, who is the recently appointed rehabilitation member of the Technical Review Board. I think I can confidently say that will be well and truly finished by lunchtime if we have a 9.30 start.

CHAIRMAN: Okay. We will just adjourn now until 9.30.

ADJOURNED UNTIL FRIDAY, 11 DECEMBER 2015 AT 9.30 AM