

**QUEENSLAND COAL MINING BOARD OF INQUIRY**

*Coal Mining Safety and Health Act 1999*

*Establishment of a Board of Inquiry Notice (No 01) 2020*

Before:

Mr Terry Martin SC,  
Chairperson and Board Member

Mr Andrew Clough,  
Board Member

At Court 17, Brisbane Magistrates Court  
363 George Street, Brisbane QLD

On Monday, 22 March 2021 at 10am  
(Day 20)

1 THE CHAIRPERSON: Yes, Mr Rice?  
2  
3 MR RICE: Mr Martin, I call Dr Ray Williams.  
4  
5 <RAYMOND JAMES WILLIAMS, affirmed: [10.03am]  
6  
7 <EXAMINATION BY MR RICE:  
8  
9 MR RICE: Q. Dr Williams, would you just give us your  
10 full name, please?  
11 A. Raymond James Williams.  
12  
13 Q. Just a few things about your background. You were  
14 tertiary educated at the University of Newcastle?  
15 A. Correct.  
16  
17 Q. You gained a doctorate in geology in 1980?  
18 A. Correct.  
19  
20 Q. You have spent most of your career, I think, working  
21 in the areas of coal seam gas related work, including gas  
22 reservoir definition, gas drainage and modelling of gas  
23 emission and gas production?  
24 A. Correct.  
25  
26 Q. You were the founder, I think, of a business called  
27 GeoGAS in 1990?  
28 A. Yes.  
29  
30 Q. You were its managing director for a good number of  
31 years, were you not?  
32 A. Yes.  
33  
34 Q. More recently, you are retired, but you still do some  
35 consulting work?  
36 A. Yes, a small amount. Not much.  
37  
38 Q. Of relevance, the coal mines inspectorate asked you to  
39 do some consulting work, did they not?  
40 A. They did, yes.  
41  
42 Q. You were asked to review documents and data which you  
43 understood to have been sourced from Grosvenor mine, which  
44 the inspectorate provided to you?  
45 A. Yes.  
46  
47 Q. And that resulted in your preparation of, firstly,

- 1 a report dated 29 October 2020 - that's the longer one?  
2 A. Mmm-hmm.  
3  
4 Q. Correct?  
5 A. Yes.  
6  
7 Q. And then there were some features which you were asked  
8 to elaborate on that resulted in an addendum report I think  
9 dated 24 November?  
10 A. Correct.  
11  
12 Q. You have also prepared a PowerPoint presentation to  
13 assist with explanation of some aspects of the work you  
14 did; correct?  
15 A. Correct, yes.  
16  
17 Q. I'm going to go directly to the PowerPoint,  
18 Dr Williams, and it may be necessary from time to time just  
19 to revert back to the text of your report for a bit of  
20 elaboration. So that's the process. Okay?  
21 A. Okay.  
22  
23 Q. Your PowerPoint - I will just give the number of it.  
24 It's RSH.019.001.0471. I have control of the slides,  
25 Dr Williams, and you have a pointer also, which you can use  
26 from time to time if you need to do so. Okay?  
27 A. Okay.  
28  
29 Q. Slide 2 contains a short-form depiction of the areas  
30 that you were asked to review. Would you like to use that  
31 to explain the task that you carried out?  
32 A. Yes. I will start with the gas reservoir. That  
33 involved defining the gas reservoir above, including the  
34 GM seam, the mined seam, and in the floor strata below it.  
35 And by "gas reservoir", I mean certain properties such as  
36 gas content, gas desorption pressure, gas saturation, and  
37 I think we'll get the opportunity to explain these a bit  
38 later. But also important in this are the thickness of  
39 these sources and their distance from the mined seam.  
40  
41 Q. As we will see, I think, you have spent some time on  
42 making some comparisons between circumstances of mining on  
43 longwalls 103 and 104?  
44 A. That's correct, yes. Yes, I needed a base to proceed  
45 from, to judge longwall 104 by, so it made sense.  
46  
47 Q. The first of those topics listed is gas pre-drainage

1 of the GM seam. You reviewed that and formed some  
2 conclusions about it, as I think we will find?

3 A. Yes.

4

5 Q. Moving forward to the next slide, you have titled that  
6 "Longwall 104 seam stratigraphy", and you have referenced  
7 a borehole numbered as DDG295. I think we will see  
8 reference to that borehole on a number of occasions as we  
9 go through.

10 A. Mmm-hmm, yes.

11

12 Q. That is located within the mined area of longwall 104;  
13 correct?

14 A. Correct. It's pretty well in the centre of the area,  
15 yes.

16

17 Q. We will see a diagram of it shortly.

18 A. Yes.

19

20 Q. Would you just like to explain what is depicted?

21 A. It shows the stratigraphy from the working seam, which  
22 is the Goonyella Middle, and I'll see if this pointer can  
23 work. Okay, it highlights it. The Goonyella Middle seam -  
24 maybe without the pointer. Overlying that is the P seam,  
25 which is something like 50 to 60 metres above the Goonyella  
26 Middle seam and one of the most important seams as far as  
27 the gas source is. It is, I recall, about 5.5 metres  
28 thick.

29

30 Then there are further seams above that, the QB and  
31 the QA. I think they are around about 3 metres thick and  
32 much more inferior coal; and then a very thick seam, the  
33 Fair Hill seam, albeit at a long distance from the  
34 Goonyella Middle seam, but it's around 44.5, 45 metres  
35 thick, of quite inferior coal. That's the sequence above  
36 the GM seam.

37

38 Below the GM seam, we've got the Goonyella Lower, and  
39 there is an expanded view from the P seam down through the  
40 Goonyella Middle to the Dysart seams below. We can see  
41 this better now. Yes, the P seam here we see, and we have  
42 covered that.

43

44 Q. Interestingly, the P seam, as it is commonly called,  
45 appears to be a confluence of a number of seams?

46 A. Yes. The Goonyella Rider, the PL1 and the PL2, but,  
47 yes, together they are the P seam, yes.

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Q. No particular significance attaching to that for present purposes?

A. Not for present purposes, no, no. The Goonyella Middle seam itself is around 5.5 or 6 metres thick, and they mine a section of about 4.2 metres or more out of it. In the floor of the Goonyella Middle seam quite close to it, we have the Goonyella Middle Lower seam, it is quite thin, about 30cm thick.

Q. And not far below the GM seam?

A. Not far below. It's just a metre or two or three - I'm not sure exactly at this point, but it's quite close. It contains quite inferior coal, but unlike the Goonyella Middle seam, which has been pre-drained quite thoroughly, the Goonyella Middle Lower hasn't been pre-drained, mainly because it is an exceedingly difficult proposition to pre-drain it.

Below the Goonyella Middle Lower, we have the Harrow Creek seams, Lower 1, 2, 3, 4, and then the Dysart Upper seam, and that's the end of the sequence in this borehole. Now, there are more seams further down, but in terms of their influence on the longwall mine, from the work I've done, they are not important. So I'm not including those in the study.

Q. Your assessment of gas reservoir, then, applies to that stratigraphy that we have just observed?

A. Yes, it does.

Q. We will move to slide number 4. The first task was to review the Goonyella Middle seam pre-drainage. One of the features I think was that there had been pre-drainage by Arrow Energy over a number of years. Would you explain what you observed about that?

A. Yes. Arrow Energy undertook pre-drainage for commercial gas reasons some 10 to 15 years ahead of mining, and that was done without any regard to mining at all. They drilled in a manner that was the most efficient and least costly from their point of view.

Q. That was just for commercial purposes?

A. That's correct, yes.

Q. But it had some benefit to Grosvenor mine in terms of pre-drainage of the areas that it drained?

- 1 A. It did. It did. But the result was that it had  
2 a non-uniform drainage pattern.  
3
- 4 Q. Is that to do with the nature of the chevron wells  
5 that were used?  
6 A. Yes, it is completely to do with that, yes.  
7
- 8 Q. Can you give us an idea of the functionality of those?  
9 A. The chevron wells are indicated here. This is one of  
10 them, GM038V. It has two laterals. These laterals are  
11 drilled from the surface, enter the GM seam at this point  
12 and travel in seam quite a long distance, over a kilometre,  
13 and intersect a vertical well, which is the gas and water  
14 production well. This lateral here does the same. So they  
15 have drilled two laterals into the single production well,  
16 which is less costly than drilling a single production well  
17 for a single lateral.  
18
- 19 Q. What you have just highlighted is an example of  
20 a number of such wells?  
21 A. Yes. Yes, that's the general scheme of things. Here  
22 is a trilateral down here, GM039V, where they tried to get  
23 a bit more gas out in between the wells. Looking at the  
24 modelling here, they succeeded. But, yes, the thing with  
25 the Arrow wells is that where the chevrons are close, they  
26 have reduced the gas content to lower levels, and we'll  
27 talk a bit later, maybe, about what I mean by gas content.  
28 And where they are far apart, the gas drainage has been  
29 less effective.  
30
- 31 Q. Leading to what you have described on the slide as  
32 non-uniform drainage overall?  
33 A. Yes.  
34
- 35 Q. Resulting in a need to achieve some greater uniformity  
36 and to reduce gas content; am I right?  
37 A. Very much so, yes. In mining, you have to get the gas  
38 content down to - well, I think the mine aim at less than 4  
39 in the development and around 2 in the longwall, so there's  
40 usually supplementary pre-drainage needed.  
41
- 42 Q. If we move to the next slide, we see a graphical  
43 depiction. The first note you make is that there was  
44 supplementary pre-drainage required. I think your report  
45 makes mention of 10 main boreholes being drilled from  
46 38 cut-through, maingate 103. Is that depicted on the  
47 slide there?

1 A. It is.

2

3 Q. Just point that out for us?

4 A. There is 38 cut-through there, and these are the  
5 10 boreholes. They are branched, they go in seam, and  
6 these ones here look like they are drilled to pre-drain  
7 ahead of maingate 104 development, but these ones up here  
8 are to pre-drain the longwall block itself.

9

10 Q. As the legend indicates, there are some holes depicted  
11 in blue and a number in red. The red ones depict, do they  
12 not, the reduced gas content arising from the further  
13 drainage of that area of the mine?

14 A. Yes, the green ones are the state of drainage before  
15 these underground in-seam, or UIS, holes were drilled, and  
16 that reflects what is left over after Arrow finished.  
17 I think quite a decent period of time elapsed before - on  
18 drainage for these UIS holes, so that the gas content was  
19 further reduced down to around 2 cubic metres a tonne in  
20 this longwall block.

21

22 Q. That was a level of gas content I think as referred to  
23 in the secondary extraction SOP?

24 A. Yes.

25

26 Q. Insofar as that was the target, you reached  
27 a conclusion about whether that was achieved or not?

28 A. Yes, I thought it was achieved. I looked at the flows  
29 and material balance analysis, which is a method the mine  
30 used as well, and came up with a similar result. It was  
31 argued they could have drilled more of these test  
32 boreholes, but I'm fairly happy with - you know, I think  
33 even getting the gas content down to 2, for reasons we may  
34 go into, is not necessary. It is good to get it down as  
35 low as you can, but it is very hard for the gas to come out  
36 in the GM seam much below 4, so - anyway.

37

38 Q. So that was a good result?

39 A. Yes, yes.

40

41 Q. This is to do with drainage of the Goonyella Middle  
42 seam, but I'd just like to go to a couple of passages of  
43 your report that touch on the subject of drainage of the  
44 P seam by Arrow.

45 A. Yes.

46

47 Q. Mr Operator, if we could have Dr Williams' report,

1 WRA.001.001.0001, and we will be alternating between those  
2 two documents. Could we go to .0025, please. If we could  
3 highlight the third paragraph down, commencing "The P seam  
4 tests". You have given an indication there for the  
5 purposes of hole numbered DDH295, which I think is also one  
6 in longwall 104?

7 A. Correct.

8

9 Q. You were able to identify the extent of the Arrow  
10 pre-drainage of the P seam at that point?

11 A. Yes.

12

13 Q. It appears as though there was a reduction of gas  
14 content by 28 per cent, from 10.4 down to 7.4; is that the  
15 point?

16 A. Yes.

17

18 Q. Could we go to the final paragraph on the page that  
19 appears under the heading "DDH268", which is located in  
20 longwall 103, is it not?

21 A. Yes.

22

23 Q. There is a reference there to the extent of  
24 pre-drainage by Arrow of the P seam at that location?

25 A. Yes, there is, yes.

26

27 Q. Particularly in the second line, do I read that  
28 correctly that there was a reduction of between 62 to  
29 77 per cent from 9.8 cubic metres per tonne down to 2.3?

30 A. Yes, but the line below says that the Arrow well  
31 residual modelling shows a gas content of about 4.5 cubic  
32 metres a tonne, and I think the extra bit of gas came out  
33 because, fortuitously, what appears on the map as an  
34 underground in seam - in seam into the P seam, that is - gas  
35 drainage hole was drilled quite close to DDH268. So  
36 I think it is somewhat a localised effect.

37

38 Q. You make reference to that in the last sentence of  
39 that paragraph, that that 2.3 figure may have been  
40 influenced by the effect of its location close to the  
41 P seam UIS borehole?

42 A. Yes.

43

44 Q. Is the figure of 4.5 more likely to be more generally  
45 applicable, or can't you say?

46 A. Yes, possibly, yes. I mean, the Arrow modelling  
47 turned out to be fairly reasonable, quite - with the work



1 Anglo did subsequently, it more or less confirmed it.

2

3 Q. Does that give us an idea, then, of the results of the  
4 P seam pre-drainage by Arrow for those two boreholes?

5 A. Yes. But you raise a good question. I mean, if one  
6 is a localised effect, more typically it is probably  
7 4.5 cubic metres in the general area.

8

9 Q. Let's go back to the PowerPoint, and at slide number 6  
10 you have moved to another assessment of gas reservoir  
11 properties, and I think you explain that by the "gas  
12 reservoir" you are talking about each of the seams above  
13 and below the GM seam?

14 A. Yes.

15

16 Q. What was the nature of the exercise?

17 A. The first assumption you make is that the gas is  
18 confined in the coaly material, in the carbonaceous and  
19 coaly material, within the stratigraphic sequence above and  
20 below the Goonyella Middle seam. It can also be contained  
21 in sandstones and stuff like that, but we've ignored that  
22 for this exercise, and I think in this part of the world  
23 it's a fairly trivial amount, anyway.

24

25 Q. So you are looking at the gas content of the coal  
26 seams?

27 A. Not just the coal seams. Anything with carbonaceous  
28 material in it has the ability to adsorb gas. So, yes,  
29 looking at the gas reservoir above and below, we looked at  
30 everything that had carbon in it that had a lower density  
31 than rock and was low enough to adsorb gas.

32

33 Q. You've got three minor dot points, commencing with gas  
34 content. Could you perhaps explain each of those?

35 A. Yes, I did mention that gas is - coal - we will talk  
36 about "coal" rather than "carbonaceous material", but it's  
37 much the same thing. It has a huge capacity to adsorb gas.  
38 So, for example, the Goonyella Middle seam in its raw  
39 condition at this location, before Arrow pre-drained it, is  
40 around, say, 12 cubic metres a tonne. That's a lot of gas  
41 in a piece of coal.

42

43 The thing about gas content, though, is that it is  
44 quite misleading to use the number on its own. You've  
45 always got to qualify it by saying the gas content is, say,  
46 12 at a density of 1.44, for example, because the mineral  
47 matter in the coal reduces the gas content.

1  
2 A good example is the Goonyella Middle Lower seam.  
3 It's only a metre or two away and it's got a gas content of  
4 probably 3 or 4 cubic metres a tonne, and on the face of  
5 it, you would say, "Well, that's not much", but because  
6 it's so high in mineral matter, it's a different kettle of  
7 fish. This is where gas saturation and gas desorption  
8 pressure come in to complete the picture. So gas content  
9 on its own can be misleading.

10  
11 Q. The concept of gas saturation and desorption pressure  
12 features in various ways in your assessment, and you have  
13 a tab there to explain.

14 A. Yes.

15  
16 Q. Perhaps we might go to that. This is slide 42. Have  
17 you set out there to explain the functioning of the gas  
18 saturation and desorption pressure isotherm; is that what  
19 it is?

20 A. No, well, it's just the isotherm, yes. Yes, I will  
21 endeavour to explain it, if I can. The red line is called  
22 a gas sorption isotherm. It is a laboratory test that's  
23 done. The X axis is the pressure. In this case, it is  
24 absolute pressure; that's how it is done. And the Y axis  
25 is gas content - or gas sorption capacity, more correctly.

26  
27 Like I said, it's a laboratory test where in the  
28 laboratory you crush coal samples up, you do the whole  
29 thing at a constant temperature, hence the word "isotherm",  
30 and at different pressure steps you let the gas sorb into  
31 the coal until it is in equilibrium. The coal has to be  
32 crushed quite fine for it to reach equilibrium, but you do  
33 that, and you get maybe five points on the graph and you  
34 put a line of best fit through. There is a particular  
35 equation to do that. The line of best fit describes this  
36 thing called the gas sorption isotherm. Like I said, it's  
37 a laboratory thing. On its own, it doesn't mean too much,  
38 but when you combine it with depth of mining and measured  
39 gas content, it starts to become very important.

40  
41 For example, if we look at the pressure that the thing  
42 is adsorbed in the laboratory, you can use that as an  
43 analogy for depth. Instead of, say - we'll look at Qa, for  
44 example. That's an unfortunate choice of terms. It's not  
45 the QA seam and the QB seam. But the first example is Qa.  
46 At a depth of around - not a "depth". At a pressure of  
47 about 1800 kPa and approximately a depth of 180 metres,

1 that's what that means. In the case of Qa, we have  
2 a desorption pressure of 1800 kPa, and if we measured the  
3 gas content in the coal and it plotted there, the coal  
4 would be described as being fully saturated. So A over B,  
5 in this case, equals 100 per cent fully saturated.  
6

7 In the case of situation Qb, the gas content is  
8 exactly the same, but it's deeper, or at higher pressure,  
9 but we'll call it deeper. It's at about 360 metres depth,  
10 thereabouts. Here the pressure is 3600 kPa. That's what  
11 you call the pore pressure or the head of water lying on  
12 top of it. But to get the gas to desorb, you have to  
13 reduce that pressure a long, long way, in this case all the  
14 way from 3600 down to 1800 kPa, and when it reaches that  
15 gas sorption point there, it's called, in coal bed methane,  
16 the critical desorption pressure. But that's described as  
17 the desorption pressure, and from then on, with gas  
18 drainage or gas emission, the gas content and the pressure  
19 will track this curve all the way down the bottom. Okay?  
20

21 Q. Yes, okay. The mechanics of the operation of the  
22 isotherm are highly technical to at least one not as expert  
23 as you, but in terms of the practical implications of high  
24 gas saturation and high desorption pressure, you have said  
25 in your report at page 22 - I will just read you a sentence  
26 and ask you to comment on it:  
27

28 *Gas desorption pressure magnitude is*  
29 *a driving force behind gas ignition and if*  
30 *the gas saturation is high, it will be*  
31 *enacted more quickly.*  
32

33 A. Yes.  
34

35 Q. Could you explain what you are getting at there?

36 A. Yes. One thing - I didn't really mention it in the  
37 report much, because it amounts to the same thing, but gas  
38 desorption pressure is what drives desorption rate. We see  
39 some peculiar things here.  
40

41 For example, if I can just diverge momentarily, this  
42 isotherm here looks, let's say, somewhat typical for the  
43 Fair Hill seam. I don't think it is the Fair Hill seam,  
44 but if I were to draw the Goonyella Middle seam isotherm on  
45 here, it would look very different. It would come up here  
46 and be a lot steeper. The Goonyella Middle seam, because  
47 it is a lower ash coal, has a much higher capacity to

1 adsorb gas. So you say, wow, that's a lot of gas content.  
2 So for the same pressure, it can hold a lot more gas. But  
3 the other side is true as well. For example, the Goonyella  
4 Middle seam at 4 cubic metres a tonne, let's use this  
5 example here, would have a gas desorption pressure of  
6 500 kPa, whereas this seam at 4 cubic metres per tonne has  
7 a gas desorption pressure three times that amount.

8  
9 So this desorption pressure is very important, and we  
10 see some peculiar things have occurred. I didn't mention  
11 this in the report, but in the Goonyella Middle Lower, for  
12 example, the desorption rate of that coal, for the same gas  
13 content as the Goonyella Middle seam, is way higher, maybe  
14 five or six times higher. The exact number I won't quote.

15  
16 Q. Just to come back to that quote that I read to you,  
17 you have said that if the gas saturation is high, it will  
18 be enacted more quickly.

19 A. Yes.

20  
21 Q. Is the level of gas saturation and its desorption  
22 pressure a material consideration in the extent to which  
23 the seam will emit gas once it is relieved of pressure?

24 A. Yes.

25  
26 Q. Is that the way it works?

27 A. It especially works that way in the floor strata. In  
28 the roof strata above a longwall, the pore pressure, which  
29 might be at 2000 kPa, or 1800 where the Fair Hill seam is,  
30 when the longwall goes under, from what we know from rock  
31 mechanics, FLAC modelling of pore pressure, it drops to  
32 about 200 kPa virtually instantly.

33  
34 Q. What's the significance of that?

35 A. You have this big pressure difference between the  
36 desorption pressure and the ambient pore pressure, and this  
37 is what drives desorption rate, which is gas emission, in  
38 other words, in a longwall sense. The gas has to desorb  
39 from the coal before it's a problem. If the surrounding  
40 pore pressure is quite high in relation to the gas  
41 desorption pressure, the desorption rate is quite low,  
42 regardless. But if you drop the pore pressure a long way,  
43 which is what happens in the strata above a longwall, then  
44 what is very important up there is the gas desorption  
45 pressure.

46  
47 I did make the point that the Fair Hill seam was gas

1 saturated, and that makes the process happen more quickly,  
2 but I think in a longwall that process would happen pretty  
3 quickly, anyway.  
4

5 Q. Just so that we understand, you mentioned the  
6 Fair Hill seam, with high gas saturation and higher  
7 desorption pressure?

8 A. Yes.  
9

10 Q. Once longwall mining commences underneath it, albeit  
11 some distance away, what is the effect of the mining  
12 activity at the GM seam on gas liberation at the Fair Hill  
13 seam?

14 A. Well, when the goaf forms in the GM seam, lateral  
15 fractures form around the margins of the goaf where the  
16 chain pillars are, and they project up into the strata  
17 a long, long way and at an angle. The strata movements are  
18 most obvious around the margins of these chain pillars.  
19 The material between the chain pillars is more or less like  
20 a layer cake, but the whole lot goes from having low  
21 permeability to having very high permeability. So the  
22 process is the pore pressure is nonetheless dropped; the  
23 gas desorbs from, let's say, the Fair Hill seam; it can  
24 migrate along bedding planes laterally into these lateral  
25 fractures surrounding the goaf and, from there, can find  
26 its way down into the mine workings.  
27

28 Now, that process only occurs for a relatively short  
29 period of time, because you've got a front abutment zone  
30 and a rear abutment zone. The rear - when you take the  
31 coal out, you create a void. The stresses have to be  
32 redirected around the void, and when the void is large  
33 enough, you get what is called a rear abutment occurring,  
34 and that recompacts the material above the goaf and  
35 probably the goaf itself. That process shuts things down.  
36 So everything is happening within this - between the front  
37 abutment and, say, the 300 to 400 metres to the rear  
38 abutment. That's where the action occurs. Higher up, that  
39 effect gets less and less, but nonetheless if the gas  
40 desorption pressure is high enough, in the case of the  
41 Fair Hill seam, it can happen there.  
42

43 Q. We will come back to the Fair Hill seam and talk about  
44 it some more a little bit later.  
45

46 Just getting back to slide 6, if we can, which is at  
47 page 0476, the assessment that you made involved gas

1 content testing of the boreholes that are depicted there?  
2 A. Yes.  
3  
4 Q. Being nine in all across a number of longwalls?  
5 A. Correct.  
6  
7 Q. There were gas content testing results available from  
8 those boreholes; is that the idea?  
9 A. Yes.  
10  
11 Q. Which you had regard to?  
12 A. Yes.  
13  
14 Q. Were you able to cover the whole stratigraphic  
15 sequence from those boreholes?  
16 A. To differing degrees, but yes, yes. They were  
17 selected because they did mostly cover the whole  
18 stratigraphic sequence.  
19  
20 Q. We will go forward to the next slide, number 7. This  
21 represents one of the features that you found, that across  
22 those boreholes as a whole you found that gas content -  
23 there was no discernible difference between the Fair Hill  
24 seam down to the DYU seams?  
25 A. That's right, no discernible difference in inherent  
26 gas content.  
27  
28 Q. Is that the same thing as virgin gas content?  
29 A. Yes, it is. It is. But because the seams have  
30 varying mineral matter, they have different densities. The  
31 gas content would appear to be all over the place, mainly  
32 reflecting the densities. But if you take the density out  
33 of it, which you can by plotting the gas content against  
34 density, you get, as indicated here, this relatively  
35 consistent picture here (indicating) of gas content against  
36 density for all the seams and all of those boreholes shown  
37 before.  
38  
39 Q. Was it surprising to find that?  
40 A. Yes, it's not totally surprising to me, because I'm  
41 familiar with this area, but it is surprising to see it  
42 compared to most other areas, nearly all other areas.  
43 Normally, as you go deeper, the gas content increases, and  
44 normally the gas content at distances such as the Fair Hill  
45 seam above the Goonyella Middle, 180-odd metres above,  
46 isn't such an issue.  
47

1 Q. This process that you went through, do we take it,  
2 shows that that general rule that gas content increases  
3 with depth is not necessarily universally applicable?

4 A. That's correct. In fact, as you go deeper than the  
5 seams I've shown in this report, the gas content actually  
6 reduces. It's quite a strange phenomenon, but it's quite  
7 widespread in parts of the Bowen Basin.

8  
9 Q. Apart from being perhaps a curious feature that you  
10 discovered, what are the practical implications of this  
11 conclusion that you identified?

12 A. One practical application is that - and I have only  
13 looked at those boreholes you showed on the previous  
14 slide - it makes defining the gas reservoir a whole lot  
15 simpler than having gas content vary all over the place.  
16 Gas content normally doesn't vary all over the place. You  
17 can normally define zones, or I call them gas domains,  
18 where it behaves in a sensible manner either with depth or,  
19 in this case, with density and being constant with depth.

20  
21 Q. Does it make identification of properties of the  
22 different seams easier because of the relatively uniform  
23 gas content?

24 A. Yes, absolutely.

25  
26 Q. Does it enable, then, comparisons to be made more  
27 readily?

28 A. Correct. It's one of the reasons why I guess we can  
29 look at how the Fair Hill seam fared after the longwall  
30 goaf went through. But that also gets down to how well the  
31 gas content testing was done, and in this case it was done  
32 very well.

33  
34 Q. In the next couple of slides, you have made mention of  
35 conclusions by others which were I think different to  
36 yours. Starting with slide 8, you mention Dr Moreby's  
37 assessment?

38 A. Yes, it shows the same overall thing, in that he has -  
39 the Goonyella Lower seam, which is maybe 150 metres or so  
40 further below, or a bit less than that - the Goonyella  
41 Lower seam is quite a low gas content in comparison, and  
42 Roy Moreby has calculated the ash out of the coal, which is  
43 the correct thing to do, using a method that's dry ash  
44 free, which is a typical coal bed methane method applied,  
45 but if you are correcting high ash coal, it's really,  
46 really inaccurate in the end, so you just don't discern  
47 things quite that well.

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Q. Why is there inherent inaccuracy in that method?

A. Well, there are a couple of reasons. You assume that the gas content at 100 per cent ash plus moisture is zero, and oddly enough, in this part of the world, the gas content is zero at about 96 per cent ash plus moisture. So if you are correcting a sample from, say, 70 per cent, that has an ash of 70 per cent, ash plus moisture, you generate a large amount of error. The lower the ash, the less the error, in this sort of transformation. Yes, so there is a fair bit of error in that, but that's the way it is.

Q. I take it you prefer the results of your assessment as shown on slide number 7?

A. Yes, I do. The other thing I would say, though, is that Roy Moreby has used a much larger area. I mean, I'm focusing on a smaller area. So if I extend my reach a lot further, I may go into a different gas domain or some such thing, but - yes.

Q. You are making the point, I think, that your assessment of gas content was over the boreholes that you noted?

A. Yes.

Q. Being spread across perhaps four longwalls?

A. Yes.

Q. As opposed to whole of mine, for example?

A. Yes, yes.

Q. Another assessment that you looked at was one by GeoGAS in 2011. What comparison did you observe between your assessment and theirs?

A. Well, see, they've done a correction again. This time - this is a different one again. They've corrected everything to 15 per cent ash, which is better than dry ash free. Again, it runs into problems for very high ash coal, but here it shows nonetheless the sort of thing we've been saying, and that is that the gas content, albeit depth going this way it seems to reduce, but stratigraphically, the shallower seams have the highest gas content for the same depth. The Goonyella Lower seam at 300 metres is down as having only 6 cubic metres a tonne, whereas the Q seam is double that at 12. So they're sort of seeing something there, but there's a hell of a temptation to want to make the gas content increase with depth.



- 1  
2 Q. Because that's the normal thing?  
3 A. That's the normal thing, yes.  
4  
5 Q. What is the final comment that you have made on that  
6 slide?  
7 A. The increase in gas content with depth on a seam basis  
8 is not as clear for borehole coverage. Yes, I mean, on  
9 a seam basis, the analysis I did, there is no difference.  
10 All the seams look the same.  
11  
12 Q. To that extent, does your assessment differ from some  
13 observations made in Dr Moreby's report and also the GeoGAS  
14 report of 2011?  
15 A. Yes, yes. It's quite different to the GeoGAS one,  
16 where their gas content is varying by seam, whereas mine is  
17 not. But, again, the GeoGAS one is whole of mine, and mine  
18 is a portion of it.  
19  
20 Q. Is it a bit unsafe to compare apples with oranges in  
21 that respect?  
22 A. Yes, yes. But the problem is that you see graphs like  
23 this, and you just don't know where the data are from.  
24 That's the problem. There is not a whole lot of data  
25 points on there, either.  
26  
27 Q. Moving forward to slide 10, you have done an overall  
28 assessment of gas content between the two longwalls; is  
29 that what that is?  
30 A. That's what this is. It's sort of splitting things  
31 pretty closely, but all the other boreholes are indicated  
32 by the orange circles here, and longwall 104 is indicated  
33 by the crosses. This slide shows that there would appear  
34 to be some increase in inherent gas content in  
35 longwall 104, and I've sort of indicated it's around  
36 15 per cent at probably 1.5 grams/cc density.  
37  
38 Q. What are the implications of that in a practical  
39 sense?  
40 A. Well, it just indicates that there is a bit more gas  
41 in longwall 104, but 15 per cent is not a huge amount more.  
42 But it does seem to be - there is a measurable difference.  
43 That's what it is.  
44  
45 Q. Is that gas content that is released by the activity  
46 of mining?  
47 A. No, no. This is all virgin, pre-mining,

1 pre-pre-drainage gas content that's shown here. How much  
2 is released in mining gets down to things like the  
3 desorption pressure and all the rest of it. But here we  
4 are just defining the gas reservoir, which is a static  
5 comparison. We're not talking about mining at this point.  
6 We're just trying to see what's there to begin with.  
7

8 Q. We've returned, at slide 11, to the subject of gas  
9 saturation and desorption pressure. Can I take you back to  
10 a part of your report near to the passage that I quoted to  
11 you earlier. If we could go to page 0023, Mr Operator, it  
12 is the third paragraph on that page. Is the comment that  
13 is highlighted there relevant to that slide number 11 to do  
14 with gas saturation and desorption pressure?

15 A. Yes, it is.  
16

17 Q. The comment you make is:

18 *Seams with high gas desorption pressure and*  
19 *high gas saturation in close proximity to*  
20 *the working seam will more readily give up*  
21 *their gas.*  
22  
23

24 Your slide is directed towards the Fair Hill seam, and it  
25 does have high gas saturation and desorption pressure, but  
26 is it correct to say that it is one within close proximity  
27 to the working seam?

28 A. No, it's not, no. The first sentence was a general  
29 statement. The second one looks more specifically at the  
30 Fair Hill seam, and it is clearly not close to the working  
31 seam. In the wash-up, it turns out that only 19 per cent  
32 of the gas has been emitted from the Fair Hill seam, at  
33 least over longwall 103, from testing Anglo has done.  
34

35 Q. Could we go, Mr Operator, to page 0029 of that report  
36 and highlight the paragraphs in the middle of the page. In  
37 the second of those highlighted paragraphs, you have made  
38 a comment about the importance of a number of factors,  
39 proximity to the working seam being one of them. I think  
40 you are probably aware there is a - perhaps it is a rule of  
41 thumb that seams more than 150 metres distant from the  
42 worked seam are not particularly relevant from a gas  
43 emission point of view?

44 A. Yes.  
45

46 Q. Is that a general rule of thumb? Have I been accurate  
47 in describing it as such?

1 A. Yes, it's probably general, yes. Yes, I - it's not  
2 one I'd subscribe to, but it's generally believed.

3

4 Q. Why do you not subscribe to that?

5 A. Well, this is the exact case in point: it's further  
6 than that, and it can emit gas. It's a peculiar set of  
7 circumstances here at Grosvenor, where not only do we have  
8 a high gas desorption pressure in the Fair Hill seam, but  
9 the gas reservoir size is massive. It's a huge gas  
10 reservoir.

11

12 Q. So is the size of the gas reservoir of the Fair Hill  
13 seam, in conjunction with its high gas saturation and  
14 desorption pressure, sufficient to outweigh that general  
15 rule of thumb?

16 A. Yes, it is.

17

18 Q. That's your opinion?

19 A. Yes.

20

21 Q. Just to be clear about that, is it your opinion that  
22 the gas desorption from the Fair Hill seam was emitting to  
23 the Goonyella Middle seam?

24 A. Yes. I mean, there is the thought it could have  
25 disappeared up to the surface. The Fair Hill seam sits  
26 equidistant, virtually, between the surface and the working  
27 seam, but the cracks migrate up from below, and I think the  
28 greater likelihood is that the gas migrated down into the  
29 workings.

30

31 Q. Because of cracks between the Fair Hill seam and the  
32 GM seam?

33 A. Yes.

34

35 Q. As opposed to from the Fair Hill seam to the surface?

36 A. Yes. I think the gas is going to go down the path of  
37 least resistance. I mean, there are things like  
38 ventilation pressures that might induce the gas one way,  
39 there is the buoyancy of methane that might induce it  
40 another way, but those things are small compared to the gas  
41 desorption pressure and the fractures that are in the  
42 coal - in the strata. The fractures will be greatest below  
43 the Fair Hill seam into the workings. And the whole effect  
44 is transient. I mentioned the front abutment and the rear  
45 abutment. It all happens within that zone, and then it's  
46 shut off. I mean, the Fair Hill seam lost, as maybe we'll  
47 see later, 19 per cent of its gas, and the rest of it is

1 still there. So it comes and it goes, but the gas  
2 reservoir size is so high that 19 per cent ends up being  
3 a pretty sizeable number.  
4

5 Q. You have made the point I think in your report that  
6 insofar as others, perhaps, Palaris, for example, may have  
7 adhered to that 150 metre rule of thumb, there appears to  
8 be no reference to the influence of gas saturation and gas  
9 desorption in that kind of assessment?

10 A. Yes, that's right. I think if you look at the  
11 literature, maybe with the exception of Klaus Noack, who  
12 produced a pore pressure model in Germany, there is never  
13 much - I haven't seen any reference to gas saturation or  
14 gas desorption pressure in longwall mining at all. I mean,  
15 there is the ACARP work done by CSIRO in 2019 that  
16 Roy Moreby was a part of, and a huge amount of work was  
17 done there, but unless I missed it, that's not mentioned in  
18 there at all.  
19

20 Q. Can we go back to the PowerPoint, Mr Operator. You  
21 have made your observations then about the significance of  
22 gas saturation and desorption pressure for the Fair Hill  
23 seam. If we move on to slide 12, there is apparently  
24 lesser gas saturation and desorption pressure at the  
25 HL seams. Is that simply for the point of comparison?

26 A. It is. The calculation to derive these graphs is  
27 fairly intensive, so I didn't want to do the whole  
28 sequence, although I have a bit of a short summary in  
29 another graph, but it is by way of comparison.  
30

31 The HL seam - I think it's got a higher gas content  
32 than the Fair Hill seam. The isotherm is a little bit  
33 higher. But you can see, because it is deeper, I mean, it  
34 is down around - you can read off that, it is about  
35 420-odd metres deep. To get the gas to desorb - it's got  
36 a gas saturation of 65 per cent, meaning that value there  
37 over the total value at that pressure is 65 per cent  
38 (indicating). But 65 per cent, oddly enough, is a very low  
39 gas saturation because of the implication it has on the  
40 amount of pressure you have got to reduce to get the gas to  
41 come out, and here you see you've got to reduce the  
42 pressure a long, long, long way, all the way from 4200 down  
43 to around 1600 kPa, to get gas desorption.  
44

45 Q. For those various reasons, the HL seams are less  
46 likely to give up their gas to the GM seam?

47 A. Yes, but there is one other important reason in it.

1 They are in the floor of the GM seam, and the reduction in  
2 pore pressure in the floor is a whole lot less marked than  
3 it is in the roof. I've grabbed a - I don't have access to  
4 pore pressure models from FLAC modelling from Strata  
5 Control Technology for this situation, but I have used the  
6 general one from Noack, yes, and the pore pressure is not  
7 reduced that much at that depth.

8  
9 And remember what I said, that it is the difference  
10 between pore pressure. You might get to gas desorption  
11 pressure, but if it is only desorbing from 1800 down to  
12 1600, it's not going to come out very fast. All in all,  
13 the stuff in the floor is not that important from that  
14 point of view.

15  
16 Also, I mean, the HL, I think it is the HL3 and HL4 -  
17 it's a fair thickness, I don't know, I may have it wrong,  
18 but maybe 4 or 5 metres, but it's very ashy coal and it has  
19 this characteristic of desorption pressure and saturation  
20 in an environment where the desorption pressure - where the  
21 pore pressure hasn't been lowered very much. Sorry to make  
22 that a bit hard.

23  
24 Q. If we go to slide 13, this is the last of the slides  
25 dealing with this subject. Perhaps you might just explain  
26 for us the features of note that emerge from the graph that  
27 is depicted there?

28 A. Yes. Beginning with the BA and CA seams, they are  
29 above the Fair Hill seam and they are simply affected by  
30 proximity to the surface, so their gas content is reduced  
31 in that way.

32  
33 Q. Are those seams then of relevance to --

34 A. Below that? Yes, the Fair Hill we have talked about -  
35 gas saturation is up around the 100 per cent. This is  
36 a pretty broad-brush way of looking at it. It needs to be  
37 done in a lot more detail, but it gives a reasonable  
38 picture, I think, of what's going on. So we've got the  
39 Fair Hill seam.

40  
41 The various other seams - not written on there is the  
42 QA and QB seam, for some reason. Down here (indicating),  
43 we've got the P seam, which has low saturation and  
44 desorption pressure, but that's because it has been  
45 partially pre-drained, in the example I used.

46  
47 Then you get down, these seams here have higher

1 desorption pressures (indicating), so that gas would expect  
2 to migrate very quickly, especially as it is close to the  
3 GM seam. Here, the GM seam has been pre-drained to a low  
4 level, so it has a very low desorption pressure, and  
5 compared to the original gas sorption isotherm it has a low  
6 gas saturation.

7  
8 The notable thing here is the GML seam - it's come off  
9 the boil a bit because it's deeper, but it's still got  
10 a fairly high gas saturation and a fairly high pore  
11 pressure. So there is some potential for the GML, the thin  
12 seam close to the floor of the GM seam, to create gas and  
13 cause problems. Indeed, we know it has caused problems in  
14 development.

15  
16 Below it are these HL seams, where the gas saturation  
17 is pretty low - 65 per cent, that's low - and gas  
18 desorption pressures are low similarly.

19  
20 Q. As we go a bit further into your PowerPoint, we will  
21 see some estimate made of the degree of emission from these  
22 various seams?

23 A. Yes, yes.

24  
25 Q. You have attempted, have you not, to identify the gas  
26 reservoir size for relevant seams above and below the  
27 GM seam? The first thing you have done is offer an  
28 explanation of the method. That formula or equation is  
29 a fairly standard one, is it not?

30 A. Yes, it is. Yes, it's quite common in the industry.  
31 The gas reservoir size, GRS, is the product of gas content  
32 in cubic metres of gas per tonne of material, multiplied by  
33 the density, which is tonnes per cubic metre of that same  
34 material. So then you have a result of cubic metres of gas  
35 per cubic metre of material. Multiply that by the  
36 thickness to get the gas reservoir size in cubic metres of  
37 gas per unit area, per square metre.

38  
39 Q. The third and fourth dot points there, are they  
40 indications of the kind of material you have had regard to  
41 in making this calculation?

42 A. Correct. The thing is that the gas content testing is  
43 only carried out on discrete samples, but we need to assign  
44 gas content to the entire stratigraphic sequence, and this  
45 is where you asked about the utility of the gas content  
46 relationship. We found with density earlier that the  
47 consistency of it - well, it makes something like the gas

1 reservoir assessment quite easy, because all we need to  
2 know is the density of everything and we can assign a gas  
3 content to it. So that's what we've done using geophysical  
4 logs for density.

5

6 Q. For the purpose of this exercise, you have selected,  
7 have you, the data from two boreholes, DDG268 and DDG295?

8 A. Yes.

9

10 Q. Is there some reason you chose those two?

11 A. Well, 295 is obvious. It's the best borehole to look  
12 at in longwall 104. Longwall 103 - you could argue I could  
13 have looked at a lot more boreholes. This gas reservoir  
14 size calculation is quite onerous, to be honest, and  
15 I didn't want to bog down and I just wanted to get a feel  
16 for what the whole thing was, and that's what I got. It's  
17 in the middle of longwall 103.

18

19 Q. From side to side?

20 A. Yes - no, middle of the longwall block from end to  
21 end, longwall 103.

22

23 Q. It looks like both?

24 A. It's both.

25

26 Q. In terms of outcomes, then, if we go to the next  
27 slide, we see first of all a table. We see some indication  
28 there in the table of the size of the Fair Hill seam  
29 reservoir, although somewhat different from the borehole in  
30 longwall 103 to that in longwall 104.

31 A. Yes, but it's still huge. That was the main point.  
32 Yes, I think there is plenty of scope to look at the  
33 Fair Hill in a lot more detail for every borehole  
34 intersection you can get, but the bottom line is that the  
35 gas reservoir is huge. In 268, it's kind of interesting  
36 that it is quite large and even closer to the GM seam.

37

38 The distances between the working seam and these  
39 overlying seams obviously varies, and this is part of what  
40 needs to be tracked down in the course of the geological  
41 assessment. The Fair Hill seam has the highest gas  
42 reservoir. The QA and QB seams are fairly reasonable. The  
43 GU seam is smaller again. But the interesting one,  
44 I guess, is the P seam, which has been partially  
45 pre-drained, and the figures in red indicate my estimate of  
46 what, based on density, the gas reservoir size was  
47 originally compared to what it is now. We see in

1 longwall 103 - bear in mind that that data point is  
2 affected by maybe localised pre-drainage, but it's  
3 relatively low, 18, whereas in longwall 104 it's quite  
4 sizeable and it's relatively in closer proximity to the  
5 GM seam.  
6

7 Q. Is it a reflection of the figures we looked at earlier  
8 when we extracted details of the extent of pre-drainage of  
9 the P seam from your report?

10 A. Yes, yes. The other points of note are in DDG295, the  
11 gas reservoir size for the GML seam, and 268, it's really  
12 quite low. It's around 3 metres below the GM seam, in  
13 longwall 104. Very low gas reservoir size, so ordinarily  
14 you would just dismiss it and not worry, but it has a high  
15 desorption pressure and it's very close to the working  
16 seam, so it has the potential to cause some problems. Yes.  
17 The HL seam - yes, the gas reservoir size just isn't that  
18 great below the working seam, anyway.  
19

20 Q. The graph on the right, is that a graphical  
21 representation of the detail in the table, or is it  
22 different?

23 A. No, it is the same. Yes, it's gas reservoir size here  
24 on the X axis and distance above and below the working seam  
25 on the Y axis, yes.  
26

27 Q. We will go forward to slide 16, entitled "Longwall Gas  
28 Emission". Would you mind explaining what was the task  
29 that you undertook from this point?

30 A. Well, longwall 103 is important to give you a base of  
31 empirical data and to look at what the nature of emission  
32 is. I could have looked back at previous longwalls, but  
33 103 is the most important. As I've said here, the approach  
34 utilises gas content, gas saturation, all of those things,  
35 desorption pressure, gas reservoir size, but it also  
36 utilised - and this was fantastic data to have - two gas  
37 content test boreholes in the goafs of longwall 101 and  
38 longwall 103. These were boreholes drilled after the goaf  
39 had passed to see what gas remained in the coal seams above  
40 the GM seam, and that's, yes, really good data.  
41

42 Q. Just to be clear on the scope, having regard to the  
43 title of the slide of "Longwall Gas Emission", are you  
44 looking at emissions from all sources in the stratigraphic  
45 sequence?

46 A. Yes.  
47



- 1 Q. Having regard to the concepts that we've already  
2 discussed, including gas content, saturation, desorption  
3 pressure and gas reservoir size?
- 4 A. That's right, yes, and here you are looking at how it  
5 all relates to mine production. Hence the third point  
6 there. Gas make is the relationship between gas emission  
7 and production. So that's an important one. I go on to  
8 map gas make into gas domains.
- 9
- 10 Q. Why is it important for a mine to know from where gas  
11 is emitting and to where?
- 12 A. You have to make an initial assessment as to what you  
13 think will happen and design a solution from it.
- 14
- 15 Q. Does it feed in to gas drainage requirements?
- 16 A. Yes, yes, if you --
- 17
- 18 Q. Is that the most direct relevance?
- 19 A. And ventilation and - yes, but gas drainage and your  
20 strategy --
- 21
- 22 Q. They are two of the most important control features,  
23 are they not, the ventilation and the gas drainage?
- 24 A. Yes, yes.
- 25
- 26 Q. Both of those would be informed by this kind of  
27 assessment; is that correct?
- 28 A. Yes. I mean, you could make an assessment without any  
29 gas drainage, and you would be quite alarmed at what would  
30 be going down the tailgate in your model. So then you've  
31 got to - you know, you can pre-drain the P seam and do  
32 various other things to see what might happen, change your  
33 ventilation and do all sorts of things.
- 34
- 35 Q. All right. You have explained why you have done  
36 a degree of analysis on longwall 103. If we go slide  
37 number 17, first of all, to the map, you make a note there  
38 that - is it a P seam Arrow map?
- 39 A. Yes.
- 40
- 41 Q. You've drawn on that longwall 103; is that correct?
- 42 A. Yes.
- 43
- 44 Q. It is divided into domains. Why is that?
- 45 A. If you look at - and Anglo do this; it's pretty  
46 commonly done - you look at gas make versus production and  
47 you average it over a week to take the variations out of

1 it. If you just look at the data holus bolus, you end up  
2 with a pretty blurry pile of points. You can put a line of  
3 best fit through it, but it doesn't help a whole lot, and  
4 that's usually as far as things go.

5  
6 What I've done here, though, is break the area up -  
7 and this is something I've found quite commonly, that  
8 longwalls can vary in the way their gas make occurs, either  
9 due to natural reasons, the geology changes, the gas  
10 content increases or something, or due to some remedial  
11 action the mine takes. Nonetheless, you can identify large  
12 areas in a longwall where the gas behaves quite  
13 predictably.

14  
15 Q. Did you find then that the gas make was not uniform  
16 across these different domains that you have drawn?

17 A. It was uniform within each domain but quite different  
18 between the domains, yes.

19  
20 Q. There is a very technical-looking graph and associated  
21 data on the left-hand side. Could you perhaps interpret  
22 that for us?

23 A. Yes. That shows tonnes per week versus gas make. Gas  
24 make is cubic metres generated from all the sources - goaf  
25 wells, ventilation, the lot - and averaged over a week,  
26 plotted against tonnes per week. What you can see there -  
27 and this is the standard picture you see - is that the  
28 faster you mine, the lower the gas make. You still get  
29 more gas per se, if you multiply the two numbers together,  
30 you will get more gas, but the gas make does vary. It  
31 decreases the faster you mine.

32  
33 Q. Do those various boxes illustrate different gas make  
34 per domain?

35 A. That's right. It's just a mathematical relationship  
36 for each one, which I've gone on to use to calculate return  
37 gas emission against what they actually saw.

38  
39 Q. I think we might find on the next slide, number 18,  
40 this looks very busy, but if we take a bit of information  
41 at a time, it's actually very useful. Just dealing with  
42 the subject of the domains and their gas content, have you  
43 identified the five domains just below the top of the  
44 graph?

45 A. Yes. I use the term gas make at 150 tonnes per week.  
46 It's sort of an average value. Gas domain A, I'm not  
47 quoting a figure, because that's early in the retreat of

1 the longwall before the goaf is properly formed. But once  
2 the goaf has probably established itself, we get a period  
3 of consistent gas emission - total emission, that is - and  
4 that's characterised by a number there, you can say  
5 19.8 cubic metres per tonne at this 150 tonnes per week.  
6

7 Domain C, it's a ramp-up in gas for some reason, and  
8 these are the things we need to sort out why. The total  
9 gas has increased, but it is consistent all the way through  
10 there, even though a lot of things have been happening in  
11 the meantime (indicating).  
12

13 Domains D and E are where the seam is reducing in  
14 depth and mother nature is helping quite a bit. The  
15 longwall starts at around 390 metres and it finishes at  
16 about 200, I think, so there is a fair change as you  
17 retreat.  
18

19 Q. It reaches its peak gas content, or gas make, at  
20 domain C and then tapers off through the balance of the  
21 panel?

22 A. Yes.  
23

24 Q. Just to look at some of the features of this  
25 presentation, on the X axis you have chosen to use chainage  
26 rather than date, but we can get an idea of the sequence of  
27 events from some events that we can fix in time, one of  
28 which is the major ventilation change, which I think we  
29 know to have occurred on 15 July 2019?

30 A. Yes.  
31

32 Q. You have also drawn there an indication of the time  
33 period of what you have described as the maximum goaf rate  
34 trial, which we know to have occurred in the first half of  
35 August.

36 A. Yes, I can't recall the exact date, but --  
37

38 Q. I think other information will tell us that that is  
39 so.

40 A. Okay.  
41

42 Q. You have made mention there at the top of the slide of  
43 the P seam SIS borehole. One of your later slides deals  
44 with this in a bit more detail, but for present purposes,  
45 so we can make sense of this, could you just explain to us  
46 what the P seam SIS borehole was?

47 A. Yes, the P seam SIS borehole was an attempt at

1 primarily goaf drainage by drilling a surface to in-seam  
2 borehole that went into the P seam and then tracked along  
3 the P seam for maybe 1300 metres or so. In this case, then  
4 they retracted from the borehole. They didn't intersect  
5 a vertical riser for production. They retracted from the  
6 borehole and did floor touches on the way out. The  
7 borehole was very large diameter, 311mm, as I recall, and  
8 they got a lot of equipment stuck in the borehole, in the  
9 end.

10  
11 Q. In terms of its functionality, just to be clear, it  
12 was not an aspect of pre-drainage of the P seam; am  
13 I right?

14 A. You are right. Correct.

15  
16 Q. Rather, it was an attempt to capture gas from the  
17 P seam once the activity of mining affected the stress and  
18 allowed gas to be liberated from the P seam; does that  
19 summarise it correctly?

20 A. Yes, and also, I mean, if it worked properly, it could  
21 have caught gas coming from above the P seam as well. But,  
22 yes, unfortunately the borehole didn't do much. I mean, it  
23 did flow really well when it finally flowed, but as I've  
24 indicated here, if you look at where my cursor is going,  
25 they mined over the end of the borehole and not much  
26 happened.

27  
28 Q. Can you just explain what you mean by "mined over" it?

29 A. Yes, the borehole, there is probably a plan somewhere  
30 with it, but - mined under the borehole, I should say.  
31 They extracted under the borehole, and at that point you  
32 would have expected the gas to be released and the borehole  
33 to start functioning.

34  
35 Q. That's what it was intended for, I presume?

36 A. Designed, yes, yes, but essentially nothing much  
37 happened.

38  
39 Q. Is there some reason that you are able to deduce for  
40 that?

41 A. Not really, other than it was blocked and then  
42 suddenly became unblocked. I mean, it's a very  
43 large-diameter borehole and they did a lot of branching in  
44 it for floor touches, which is a bit of a strange thing to  
45 do, I think. In the process, they would have left a lot of  
46 rubbish in the hole and - yes, I think it was a difficult  
47 proposition. Nonetheless, they mined under the borehole.

1  
2           Nothing much happened until they got to this point -  
3 we are in domain C - and then while they were still mining  
4 under the borehole, for about 140-odd metres, it started  
5 producing, and it produced quite well and stayed that way  
6 until it was finally turned off. But the interesting thing  
7 from the sort of analysis I've done in domain C is that the  
8 production of the P seam borehole seemed to have no effect  
9 on gas make - well, on what was happening in the return,  
10 anyway. Maybe that was masked by other things. But it's  
11 a strange borehole.

12  
13 Q.   Let's talk about the gas capture, represented by the  
14 line at the top. You have drawn a note with an arrow in  
15 domain C, which is proximate to the maximum goaf rate  
16 trial. The note is "Higher goaf gas capture from here".  
17 Were you able to attribute some reason to increased gas  
18 capture from the point you have drawn at domain C?

19 A.   Yes, it's starting to rise a bit early, but they were  
20 having, by the look of it, a lot of problems with  
21 exceedances - these red dots. Production is not shown on  
22 here, but the gas actually started tracking down because  
23 they slowed production down a fair bit, and that's probably  
24 why the gas capture has gone up a bit ahead of the maximum  
25 goaf rate trial.

26  
27 Q.   You note that it was on the rise before that goaf rate  
28 trial commenced?

29 A.   Yes, I think it was. Yes.

30  
31 Q.   The other lines drawn below that deal with tailgate  
32 CH<sub>4</sub> and calculated tailgate CH<sub>4</sub>. Can you tell us what the  
33 difference is between the two?

34 A.   These are weekly average numbers. One is calculated  
35 using the gas make curve for the particular domain. The  
36 gas make curves are sort of gold, because once you've got  
37 it, you can produce relationships like this, which are  
38 pretty tight. This one here is kind of cock-eyed, but  
39 I think what happened here is that the ventilation was  
40 different to what I put in the calculation. The calculated  
41 number - and it's in the back of the report - uses  
42 ventilation as well to arrive at what the gas concentration  
43 is going to be. Anyway, it's sort of a reality check,  
44 I guess, to see that everything is making sense.

45  
46 Q.   There is a peak drawn on the blue line, actual  
47 tailgate CH<sub>4</sub>, and it's towards the end of that cluster of

1 exceedances that we know to have occurred in July 2019.  
2 Then it starts to tail away - by that, I mean it starts to  
3 drop - somewhat in advance of the maximum goaf rate trial.  
4 Were you able to attribute a reason for what you have  
5 described as significant improvement in tailgate emission  
6 from the point drawn?

7 A. Yes, prior to the goaf rate trial, I think it's just  
8 simply related to a reduction in production. They just  
9 didn't produce much coal because they were having that  
10 many - those sorts of troubles, yes.

11  
12 Q. The trend was down, and it stayed down, certainly by  
13 comparison with the first more than half of the longwall.  
14 Were you able to attribute any potential reasons for the  
15 generalised reduction of both tailgate and calculated CH<sub>4</sub>?

16 A. For this part, in domain C, this improved trend here  
17 (indicating) - and I'm not looking at production, but  
18 I don't think there were probably too many hiccups in  
19 production at this point, but this trend here reflects the  
20 better goaf gas capture generally, along here (indicating).

21  
22 Q. Is the decreasing gas make also relevant?

23 A. Oh, yes. I'm just talking about domain C. Domain C,  
24 the gas make is the same all the way along, and then right  
25 here it suddenly drops. So in here (indicating),  
26 everything is constant and total gas, so if it is not in  
27 the return, it must be going into the goaf wells. In here  
28 (indicating), the gas make is reducing, and here it is  
29 really quite low, 13. So this is reflecting the more  
30 favourable gas/geology --

31  
32 Q. That's domains D and E?

33 A. Yes.

34  
35 Q. All right, let's go forward to number 19. You have  
36 given a depiction of a typical goaf well there. What is  
37 the significance of the features that you have drawn there?

38 A. The typical well is drilled around 20 metres - there  
39 it is (indicating) - above the GM seam. Ultimately that's  
40 where it finds itself, but it is drilled in a couple of  
41 stages. Initially, a 17.5 inch hole is drilled. Then it  
42 is cased with 13 and 3/8 inch steel casing and then  
43 cemented, I think. And then between there a further hole  
44 is drilled, and I think it is about 11.5 inches, through  
45 which slotted steel liner is emplaced.

46  
47 Q. How does the slotted steel liner function?

1 A. Well, I guess it is slotted so that it can - it  
2 actually ends up being probably just into the goaf, and its  
3 function is to allow gas to migrate through the slots and  
4 accommodate strata movement, because while there is no  
5 cementing, it is just sitting there; it can move around as  
6 the rocks move around a bit.

7  
8 Q. Is there a normal depth to which the well is cemented?  
9 A. It is not so much the depth as distance above the  
10 GM seam. But - yes. And there are variations. Some wells  
11 are drilled shorter, as I've indicated here, to 5 metres  
12 below the P seam, or, in the same sentence, 45 to 50 metres  
13 above the GM seam, with a short slotted liner. So there  
14 are some variations, but the general generic well is the  
15 one I have described.

16  
17 Q. The steel slotted liner - you have drawn it there as  
18 approximately 40 metres. Is that a standard length for  
19 that, for the liner?

20 A. I believe so - for the standard well, yes. Yes, the  
21 variation would come in the length of the 17.5 inch hole to  
22 get to the point where you want to put the slotted liner  
23 in.

24  
25 Q. In the establishment of the goaf well, is it a case of  
26 drilling and cementing to a point 40 metres above where the  
27 slotted liner is designed to fit?

28 A. Yes. Yes.

29  
30 Q. And that in turn is likely to be 20 metres above the  
31 seam and comes online once the action of goafing collapses  
32 that strata to allow the well to draw gas; is that the  
33 functionality?

34 A. Yes.

35  
36 MR RICE: Mr Martin, I was going to turn to something  
37 different. I wonder if that would be a convenient time to  
38 stop.

39  
40 THE CHAIRPERSON: Yes, all right. We will adjourn until  
41 11.45.

42  
43 **SHORT ADJOURNMENT**

44  
45 THE CHAIRPERSON: Yes, Mr Rice.

46  
47 MR RICE: Q. Can we move to slide 20. This commences

1 a series of slides dealing in some detail with aspects of  
2 goaf drainage at longwall 103. I'm going to pass over some  
3 of that, the reason being that there is perhaps more  
4 interest in the first 400 metres of the experience of  
5 longwall 103 to make it a comparator with longwall 104. If  
6 we look at this slide and the next one, we see what is  
7 drawn there is what you have described as "type 1" goaf  
8 wells in the graph, and there are both face start line  
9 wells and tailgate wells. It looks like there are four  
10 face start line wells; correct?

11 A. Correct.

12

13 Q. And we commence with the tailgate wells. You make the  
14 point on the next slide, having regard to the type 1 wells,  
15 that they were applicable for the first 1000 metres or so  
16 of retreat. Do I read that correctly?

17 A. Well, that's where they were. They were for the first  
18 1000 metres of retreat. Then they had to change the well  
19 type after that.

20

21 Q. But those wells for that first 1000 metres or so  
22 were - you have "normal" in inverted commas. Do we take  
23 that to mean wells of the kind that were depicted in the  
24 earlier slide that was shown?

25 A. Correct, that's, yes, typically 40 metres or 20 metres  
26 above the GM, that sort of thing.

27

28 Q. And that they were at a spacing of 50 metres?

29 A. Correct.

30

31 Q. Now, we have seen from one of the earlier slides the  
32 point at which exceedances were experienced in  
33 longwall 103. It is correct to say, isn't it, that there  
34 weren't any exceedances with that goaf well configuration  
35 for the first 400 metres of retreat of longwall 103?

36 A. As far as I'm aware, yes.

37

38 Q. You go on in slides 22, 23 and perhaps 24 to consider  
39 the performance of those wells. I just want to pass over  
40 that and go to slide 25 just to note some of the type 2  
41 wells that you identified. They are referenced by their  
42 number in the top right-hand corner, and they featured, did  
43 they not, in the operation of the maximum goaf rate trial?

44 A. They did.

45

46 Q. We can get something of the history of their use, can  
47 we, from the timing or the dates on the X axis?



- 1 A. Correct.
- 2
- 3 Q. We note, do we, that they were turned off at dates  
4 between perhaps the end of May through to towards the end  
5 of July progressively?
- 6 A. Correct.
- 7
- 8 Q. Were they performing satisfactorily to that point?
- 9 A. They were performing very well. Those were the three  
10 best-performing tailgate wells. They had high purity and  
11 no trigger action - no TARPs were invoked.
- 12
- 13 Q. Were you able to discern any reason why they were shut  
14 off at the intervals shown on that graph?
- 15 A. I can only assume it was because they were getting  
16 back from the face a bit and they needed the equipment on  
17 the surface to be deployed elsewhere.
- 18
- 19 Q. Probably a case of distance from the face?
- 20 A. Yes, probably, yes, I guess so. I really don't know  
21 why they particularly did it, but they did.
- 22
- 23 Q. At slide 26 we come again to the P seam SIS well, and  
24 we've probably touched on the main features of that. In  
25 terms of the graphical representation, do we see on the red  
26 line what was depicted in a different form on one of the  
27 earlier slides where we drew attention to the portion of  
28 the slide where the P seam was mined under?
- 29 A. Mmm-hmm.
- 30
- 31 Q. And you might have anticipated gas flow from the  
32 P seam SIS well, but there was none?
- 33 A. Correct.
- 34
- 35 Q. Is this a date depiction of that scenario?
- 36 A. It is.
- 37
- 38 Q. So no gas production from that well until some time in  
39 May 2019?
- 40 A. Correct.
- 41
- 42 Q. From that point, are you able to comment on the  
43 performance of that well from the time at which it  
44 commenced to produce?
- 45 A. I can't comment much. It performed very well, for  
46 whatever reason. I don't know where the gas came from.  
47 I think it was shut off artificially at the end, not for

1 any problem with purity or CO or anything of that type.

2

3 Q. It came from the P seam, presumably?

4 A. Yes, yes.

5

6 Q. I'd like to go to the report, Mr Operator, if I could,  
7 at page 0046. It is the paragraph underneath the table, if  
8 you wouldn't mind highlighting that. You see what is  
9 depicted there. The paragraph has now been highlighted,  
10 but it appears under a table in which you have listed goaf  
11 well geometry. Just have a look at that paragraph,  
12 Dr Williams.

13 A. Yes, we're talking longwall 104 here, though, not the  
14 other one.

15

16 Q. Yes, correct. I understand that.

17 A. Yes.

18

19 Q. Is the point of that that there was a similar SIS  
20 P seam borehole drilled for the purpose of longwall 104 in  
21 the same fashion as we saw for longwall 103?

22 A. I can only presume so. I haven't seen any reasoning  
23 other than the P seam well in longwall 103 flowed well.  
24 But as I've said before, to what effect?

25

26 Q. Just in terms of its existence, though - we will turn  
27 to its performance at some other point - was it a well of  
28 the same kind as the P seam SIS well for longwall 103?

29 A. It appears to be, yes. Yes.

30

31 Q. That is to say, a well drilled from the surface, down  
32 to the P seam and then lateral across the P seam?

33 A. Yes, and large diameter.

34

35 Q. Well, the same diameter, is it not, as the one for  
36 longwall 103?

37 A. Yes.

38

39 Q. Perhaps the point is the one in the last sentence of  
40 that paragraph, that it produced no gas for the relatively  
41 brief lifetime of that longwall?

42 A. I've seen no records of gas flow. That's all I can  
43 say.

44

45 Q. Is there any reason that you could advance why it  
46 would not have produced gas for the first 400 metres of  
47 retreat?

1 A. Well, presumably - it could well be blocked. I think  
2 it was another hole that used floor touches on the way  
3 out - I'm not sure. I'm not sure I've even got a lot of  
4 records on that particular hole.

5  
6 But I think these horizontal holes in goafs are pretty  
7 much hit and miss. You could be lucky and get one that  
8 flies and a whole lot more don't fly so well.  
9 A large-diameter hole is - I think it is probably  
10 problematic getting the return velocities up, when you are  
11 drilling it, to get all the muck out of the hole, and  
12 especially when you go and do branches of floor touches, so  
13 you can easily get bogged and things go wrong.

14  
15 Q. From what you say, there could be a range of possible  
16 reasons why it didn't produce?

17 A. Yes.

18  
19 Q. We can go back to the PowerPoint, Mr Operator, please.  
20 We're looking now at slide 27. On the right-hand side is  
21 a depiction of the goaf wells that were brought into  
22 operation for the purpose of that trial?

23 A. Yes.

24  
25 Q. The ones starred in yellow - are they the wells that  
26 were connected for the purpose of that exercise?

27 A. Correct.

28  
29 Q. Being some at or near to the face line - there are  
30 certainly six highlighted there between the two face lines  
31 that you have drawn; and then there were several others, at  
32 least five, further inbye?

33 A. Correct.

34  
35 Q. You have referred to those as the distal wells; am  
36 I right?

37 A. Yes.

38  
39 Q. You have graphed the performance of the various wells  
40 on the left-hand side. Now, are the distal wells the ones  
41 that I've highlighted, being the five towards the top of  
42 the slide?

43 A. Yes, essentially those, yes.

44  
45 Q. What point are you making there, by observing that the  
46 distal wells had greater effect? Is that just an  
47 observation of fact? Does it have some significance?

1 A. I think it has a lot of significance. A few slides  
2 ago, you showed wells GR3L002, 3 and 4, and they were  
3 turned off abruptly. I could have produced graphs of L005  
4 and 006, which were similarly turned off. They weren't as  
5 high producing as those other three wells. But the wells  
6 were turned off abruptly, and what is not shown on the  
7 graph in my report is what was happening at the time with  
8 regard to gas exceedances. As those wells were being  
9 turned off, that coincides with a good run of gas  
10 exceedances.

11  
12 Q. Does that suggest to you they shouldn't have been  
13 turned off?

14 A. Yes, it does. And then they turned them back on, and,  
15 lo and behold, gas exceedances no more.

16  
17 Q. So you would attribute the turning off of those  
18 particular wells, the distal wells, to the cluster of  
19 exceedances around July 2019?

20 A. Yes, I think it had a lot to do with it, yes. There  
21 are other reasons given in the report directly, things like  
22 vague things such as SGE higher than anticipated and stuff  
23 like this, because I think no-one had thought that if you  
24 turned a well off, the gas would do anything other than  
25 just stay in place. But if you turn a well off, the gas  
26 pressure is still there, and we will cover that a bit  
27 later, but it can migrate.

28  
29 Q. Slide 28 is another representation of features  
30 associated with the goaf rate trial. If we start, perhaps,  
31 with the number of wells, we see the key on the right-hand  
32 side on the Y axis. It looks as though, leading up to the  
33 goaf rate trial, there were 10, perhaps 12 or 13,  
34 increasing to approximately 20 for the purpose of that  
35 trial?

36 A. Yes.

37  
38 Q. Looking at the illustration of goaf well gas quantity,  
39 it does appear to pick up quite a bit from the commencement  
40 of the goaf rate trial; am I right?

41 A. Yes.

42  
43 Q. Is it correct to say that that would be the reason for  
44 the increase in goaf well gas quantity?

45 A. Yes, yes.

46  
47 Q. And is that connected to the number of wells?

- 1 A. Yes, those ones were the reconnected wells that were  
2 turned off previously, where the ramp-up has occurred.  
3
- 4 Q. In the bottom half of that slide, if we take the date  
5 4 August - we know the trial commenced perhaps a couple of  
6 days before that. We have seen total gas quantity trending  
7 down from towards the end of July, the 25th or thereabouts,  
8 prior to commencement of the goaf rate trial in early  
9 August, and it looks as though production has dropped as  
10 well around the same time; is that correct?  
11 A. Correct.  
12
- 13 Q. Have I read that correctly?  
14 A. Yes.  
15
- 16 Q. Would that be the reason why tailgate gas quantity had  
17 reduced over that period of the dip from, say, 25 July  
18 onwards - that it is related to production?  
19 A. I think it is reasonable, yes.  
20
- 21 Q. But then even if we take 4 August as an indicator and  
22 look ahead in time, it appears as though production  
23 increased somewhat significantly; is that correct?  
24 A. Yes.  
25
- 26 Q. But the tailgate gas quantity didn't get back to the  
27 same levels as prior to the goaf rate trial?  
28 A. Correct.  
29
- 30 Q. Does that make the goaf rate trial a success in terms  
31 of tailgate gas quantity?  
32 A. Yes.  
33
- 34 Q. It does?  
35 A. Yes.  
36
- 37 Q. If we go to the next slide, number 29, we see some  
38 data selected by way of comparison between the two  
39 longwalls, the important parameter being the distance of  
40 retreat, being 390 metres in each case. Looking at that,  
41 we see production for both longwalls, 814,000 and 866,000  
42 respectively. That's not materially different; would you  
43 agree?  
44 A. Agree, yes.  
45
- 46 Q. So that any differences in the right-hand columns,  
47 which we will turn to, are not really attributable to

1 differentials in production?

2 A. Correct.

3

4 Q. Moving across to the right, to the column headed  
5 "Return CH4", would you, first of all, indicate what those  
6 figures represent and how they compare one with another?

7 A. Yes, in longwall 103, the return CH4 - it is a higher  
8 number than in longwall 104, but the ventilation data I've  
9 got indicates that there was about 10 cubic metres a second  
10 more air flowing down, so I presume that's why they didn't  
11 get such an issue in longwall 103 from that extra return  
12 gas.

13

14 Q. Is that a measure at the tailgate return?

15 A. Yes, at 3-4 cut-through, yes.

16

17 Q. Then moving across to the right, we come to quite  
18 a big difference in the comparison, the comparison here  
19 being CH4 production. Is CH4 production the measure of  
20 what is derived from the productivity of the goaf wells.

21 A. Yes, it's just pure methane devoid of any air they  
22 were pulling up, yes.

23

24 Q. We see there more than double for longwall 104. You  
25 have made the point in the next column across that there  
26 were a total of 20 wells across the 390 metres or so of  
27 retreat of longwall 104, but of course the number never  
28 actually rose above 12 in operation, according to your  
29 plotting of a previous graph; correct?

30 A. We will assume so, yes.

31

32 Q. I don't think we need to assume so.

33 A. I'm not sure what it rose above in longwall 104, to be  
34 honest. There were 20 wells drilled in total.

35

36 Q. I beg your pardon?

37 A. There were 20 wells drilled in total. At the time of  
38 the incident, there were 10 of them switched off.

39

40 Q. Did you turn your mind to explanations for the  
41 difference in goaf well production across the two longwalls  
42 as indicated by that parameter?

43 A. Yes. Yes, I found it quite hard to work out how you  
44 could get so much extra gas. Your implication is you've  
45 got the actual similar number of wells connected, but  
46 that's a lot of extra gas, and I thought if the wells were  
47 shut in, the ones that were shut in, the gas should have

1 come from, say, the P seam, but it wouldn't have accounted  
2 for that amount of gas.

3  
4 So in coming up with an explanation of why that was,  
5 it was a case of invoking this idea that the shut-off wells  
6 actually build up sufficient - the coal surrounding the  
7 wells builds up sufficient pressure that it can migrate  
8 down the cement lining, which is fractured because of its  
9 being only 20 metres from the goaf edge, and finds its way  
10 into the workings, and all that is a product of things like  
11 the Fair Hill seam having this high gas desorption  
12 pressure, and the QA and QB as well.

13  
14 Q. Just getting back to that question of the number of  
15 wells, your slide 30 depicts the circumstances at  
16 longwall 104; am I right?

17 A. Correct.

18  
19 Q. You have actually plotted the number of wells online?

20 A. Yes.

21  
22 Q. And it appears not to rise above 12 at any point; do  
23 you accept that?

24 A. Yes.

25  
26 Q. Would it be correct to say, then, that this difference  
27 in the CH<sub>4</sub> production is not the product of a greater  
28 number of available wells for longwall 104, since the  
29 number of wells online never rose above 12?

30 A. Correct.

31  
32 Q. And there had in fact been 12 at longwall 103 for  
33 a similar distance of retreat; correct?

34 A. Correct.

35  
36 Q. I think you note that one of those had been turned  
37 off?

38 A. Yes.

39  
40 Q. Is it correct to say, then, that the number of wells  
41 in operation across longwalls 103 and 104 were comparable?

42 A. Yes, it is, yes.

43  
44 Q. In the final column on the right-hand side, you have  
45 a substantial difference also in gas make. Did you  
46 identify to what that may have been attributable?

47 A. It's directly attributable to the extra goaf wells,

1 and it gets down to --

2

3 Q. How so?

4 A. The gas make is the total of all the gas that you get  
5 in the goaf wells and in the tailgate return. So, I mean,  
6 if they've turned off a number of wells in longwall 104, it  
7 means the other wells are picking up added gas from, in my  
8 belief, the wells that were turned off, which are producing  
9 gas and it's being drawn into the adjacent wells.

10

11 Q. Is the rate of vacuum applied to the wells a factor in  
12 their production? You make the point that:

13

14 *Extra wells should have meant you could*  
15 *suck with less vacuum and a bit more total*  
16 *quantity.*

17

18 A. Yes.

19

20 Q. Is that what happened?

21 A. No. I mean, if all 20 wells were kept open and  
22 throttled back so that limits on CO and oxygen weren't  
23 exceeded, the picture might have looked a fair bit  
24 different, I think.

25

26 Q. How so?

27 A. Well, because you haven't turned any wells off. If  
28 wells are turned off, then the gas that was originally  
29 flowing out of those wells has to flow somewhere. If you  
30 turn them off, because the cement casing, in my judgment,  
31 isn't going to remain intact on the longwall goaf edge,  
32 then the gas flows down that casing and into the goaf and  
33 into other goaf wells.

34

35 Q. They actually act as conduits to the goaf and not away  
36 from the goaf?

37 A. That's right, yes, and it's a case of - I mean, you  
38 can create a problem thinking you're fixing it. "We will  
39 drill more wells" - that's good, but you create more  
40 conduits for gas to flow down, if you are not careful.

41

42 Q. Is that what occurred, in your opinion?

43 A. I think so, yes.

44

45 Q. If we go forward to slide 30, we see something of the  
46 history of longwall 104 according to certain criteria.

47 We've noted already that you have depicted the number of



1 wells increasing, unsurprisingly, from commencement  
2 generally upwards with progressive retreat, but you have  
3 drawn what you have described as a number of troughs?

4 A. Yes.

5

6 Q. And you have attributed what you have noted as L2 and  
7 L3 to the turning off of wells according to TARP triggers?

8 A. Yes.

9

10 Q. Is that your assessment?

11 A. Yes.

12

13 Q. All right. On the next slide, number 31, you have put  
14 in table form the performance of the wells, and I just want  
15 to ask you about some of the columns of information here.  
16 Is what is listed in the "Goaf Well" column all of the goaf  
17 wells for which you could find records of production?

18 A. Yes.

19

20 Q. As you noted earlier, we don't see represented there  
21 the SIS P seam well, because you saw no records of gas  
22 production from it?

23 A. Correct.

24

25 Q. Now, in the first column, it is "Average CH4". What  
26 do you mean by average CH4; can you explain?

27 A. It's the average CH4 concentration for the life of the  
28 well.

29

30 Q. Well, a feature, is it down to well number V003, which  
31 appears highlighted, and you have noted in your legend  
32 below that the highlights have above-average values. Does  
33 that convey anything other than an objective fact that they  
34 were above average? Is there some significance to that?

35 A. Taken with the next two columns on CO, I think the two  
36 go hand in hand.

37

38 Q. To reveal what?

39 A. The early ones had higher purity gas. The ones more  
40 recently were affected by oxygen, primarily oxygen, and  
41 corresponding CO.

42

43 Q. So the more outbye wells, commencing with V004, with  
44 one exception, being V006.5, drew less methane and, you  
45 would suggest, more oxygen?

46 A. Yes, I will also point out that the last well,  
47 GR04V010, I've left out - that's not part of the 20. That

1 well came on the day before, and it sucked pretty well air,  
2 so I didn't give it a guernsey.

3

4 Q. I understand that. To sum it up, above average CH<sub>4</sub>  
5 for the more inbye wells, reducing to a degree, which we  
6 can observe, which you would attribute to drawing more  
7 oxygen and less methane; is that correct?

8 A. Yes.

9

10 Q. What about the next column, "Average CO ppm"- we see  
11 almost directly the converse. How do those two columns  
12 interact?

13 A. Well, I mean, Martin Watkinson or Andy Self are  
14 probably better placed to answer the significance of it,  
15 but with added oxygen you always seem to see more CO.

16

17 Q. Column 2 then fits with column 1, in your estimation?

18 A. Yes.

19

20 Q. What about the third column, CO parts per million -  
21 that's just the maximum figure as against the average in  
22 the second column?

23 A. Yes.

24

25 Q. In the other highlighted column, which is headed  
26 "Average CH<sub>4</sub> Flow", is that an average for each well?

27 A. Yes.

28

29 Q. Over its lifetime?

30 A. Yes.

31

32 Q. Expressed in litres per second?

33 A. Yes.

34

35 Q. You have highlighted the inbye wells up to V004 as  
36 having above average values but then, with three  
37 exceptions, reducing flow. Accepting that reduced average  
38 flow is a question of fact, is there some significance or  
39 some interpretation that you would put on that?

40 A. Well, only that they - well, what we're not seeing  
41 here is - well, no, we're seeing it well by well. They  
42 were just drawing in more air, I think would be the logical  
43 thing. It looks like they were having quite a hard time  
44 with the TARPs over the last two-thirds of that 400 metres  
45 of retreat. It's sort of just a factual sheet, to my way  
46 of thinking, that largely sort of speaks to itself.  
47 Previously we saw more and more gas delays as they -

- 1 I mean, I'm not close to the operations remotely even, but  
2 they must have been working really hard to try and contain  
3 the gas, and it seems to be getting on top of them, yes.  
4
- 5 Q. The wells affected, as you plotted on a previous slide  
6 by reference to TARP triggers, are those numbered L2 and  
7 L3?  
8 A. Yes.  
9
- 10 Q. We see that in tabular form in that column; correct?  
11 A. Yes, in the last column, yes.  
12
- 13 Q. The next slide, number 32, is perhaps a simple one.  
14 It just illustrates which wells were producing as at 6 May,  
15 being those with the yellow star; correct?  
16 A. Correct, yes.  
17
- 18 Q. On slide 33, we return to the subject of looking to  
19 make a calculation of the degree of emission from other  
20 seams in the stratigraphic sequence; is that correct?  
21 A. Correct.  
22
- 23 Q. For that purpose, you have analysed data from the two  
24 boreholes listed on that slide?  
25 A. Correct.  
26
- 27 Q. They being boreholes from longwalls 101 and 103 that  
28 have been mined?  
29 A. Yes.  
30
- 31 Q. That's the significance?  
32 A. Yes, yes.  
33
- 34 Q. The fact that they have been mined enables, through  
35 gas content testing, to make an assessment of the degree of  
36 emission from surrounding seams; is that the method?  
37 A. Yes, yes, from the seams above the worked seam down to  
38 the point where you can't drill any further or you lose  
39 circulation.  
40
- 41 Q. We see those two selected boreholes depicted in the  
42 diagram in red. The ones in blue, are they for comparison?  
43 A. Correct.  
44
- 45 Q. If we go, then, to slide 34, do we see a tabular  
46 representation of your findings for those two boreholes?  
47 A. Correct.

- 1  
2 Q. We did spend some time speaking about the Fair Hill  
3 seam. So far as hole DDG267 is concerned, is it the case  
4 that you have assessed there was a gas content reduction in  
5 the course of mining of 20 per cent?  
6 A. Correct.  
7  
8 Q. Which has to go somewhere?  
9 A. Yes.  
10  
11 Q. The other figures for different seams we can see. For  
12 DDG321, the figure for the Fair Hill seam was almost the  
13 same, at 19?  
14 A. Yes, you can see the individual readings "% Reduction  
15 in Gas Content", though, there is a fair range, especially  
16 in DDG267. So that 20 per cent average would have a pretty  
17 decent standard deviation attached to it, but, yes,  
18 nonetheless, we're looking at that ballpark. I think it's  
19 not a problem so much as we're dealing with a 45 metre  
20 thick coal seam here, and we're trying to characterise what  
21 happened with half a dozen gas content tests. One of the  
22 recommendations is, when you do this again, take a lot, lot  
23 more tests.  
24  
25 Q. You have made a note of that on the slide. Perhaps  
26 you might explain that. Were there a limited number of gas  
27 content tests from those boreholes from which you could  
28 extrapolate?  
29 A. Yes, there is opportunity to take a lot of samples.  
30 You have got to drill the hole. The other thing that seems  
31 to be occurring is that where the coal has a lower density,  
32 it seems to result in a higher percentage drop in gas  
33 content. So things like that you could evaluate better if  
34 you took more samples, but - yes.  
35  
36 Q. You have included slide 34. Is that for comparison  
37 with seams below the GM?  
38 A. Can we go back one slide?  
39  
40 Q. Yes.  
41 A. Yes, the slide - yes, that one there. No, forward  
42 one, sorry. Oh, I'm sorry, I thought we were somewhere  
43 different. It's all right.  
44  
45 Q. Just to orientate you, we had looked at that table.  
46 A. Yes.  
47

1 Q. And we have moved forward. You have indicated "For  
2 the Floor", suggesting that that has relevance to the lower  
3 seams?

4 A. Yes, yes. The blue line is a complete guess of what  
5 the post-mining pore pressure would be. The orange line is  
6 the gas desorption pressure. So where it crosses the line  
7 here, there is no degree of emission at all and it gets  
8 more and more - the greater the difference between the pore  
9 pressure and the desorption pressure --

10  
11 Q. You would accept, Dr Williams, that your graphical  
12 representation is difficult to follow for the uninitiated.  
13 Could you tell us what features emerge from that?

14 A. Okay. We're looking at distance below the GM seam  
15 floor, for a start, on the X axis. There are two Y axes.  
16 One deals with pressure. The other deals with degree of  
17 emission.

18  
19 So if we look at pressure, we've got two things - pore  
20 pressure and desorption pressure. This is showing the pore  
21 pressure on the blue line and the desorption pressure on  
22 this line here (indicating). Where the pore pressure  
23 exceeds the desorption pressure, the gas can't flow, as is  
24 the case here with HL3 and 4. Where the desorption  
25 pressure is higher than the pore pressure, it can flow, but  
26 only in relation to the difference between the two.  
27

28 So there is not a lot of gas - not a lot of energy  
29 driving the gas out here. Here we have the degree of  
30 emission shown (indicating), which summarises the effect of  
31 both these lines here. The degree of emission here is  
32 zero, up to 20 per cent and creeps up. The GML degree of  
33 emission is quite high, up around 85 per cent.

34  
35 Q. All right. Perhaps we might go forward to number 36  
36 and might see some of the content of what you have been  
37 describing represented in tabular form. Is it the case  
38 that once the gas reservoir size has been calculated, which  
39 you had done in an earlier slide --

40 A. Yes.

41  
42 Q. -- and you know the degree of emission, calculated by  
43 reference to the exercise we've already looked at - does  
44 that then enable you to identify a quantity of gas emitted  
45 in cubic metres per square metre?

46 A. Correct.

47

1 Q. You can go further than that, and you can distribute  
2 it to the various seams, including not only the upper seams  
3 but also the lower ones?

4 A. Correct.

5

6 Q. Is it a feature of this estimate of gas emissions that  
7 the lower seams are actually contributing, really, very  
8 little?

9 A. That's correct. If we used a different pore pressure  
10 reduction, it would increase that, but I did some  
11 sensitivity studies, and it didn't make huge differences.  
12 But, yes, I think it is pretty clear there is not a lot  
13 coming from the floor.

14

15 Q. What appears in the column "Seam Basis Proportion of  
16 Gas Emitted" is your calculation, is it, of the proportion  
17 of gas emissions to DDG295 on the basis of the proportion  
18 of gas emitted as assessed by the two previously mined  
19 boreholes?

20 A. Correct, but I think I would have taken notice of the  
21 one in longwall 103. It amounts to something similar  
22 anyway, but yes.

23

24 Q. So that although you have said on a number of  
25 occasions that the degree of emission from the Fair Hill  
26 seam is relatively low at, say, 19 or perhaps 20 per cent,  
27 because it is such a large reservoir to begin with, it  
28 translates to 29 per cent of gas emissions, potentially, to  
29 longwall 104?

30 A. Correct.

31

32 Q. And so on, that same method applies to all the figures  
33 we see in that column; correct?

34 A. Correct, yes. I just make the point at the bottom  
35 there, Mr Rice, the degree of emission, nonetheless, is  
36 based on longwall 103 post mining gas content tests.  
37 I would think that given the extra goaf gas that we saw in  
38 longwall 104, we might see higher degree of emissions in  
39 longwall 104 when and if the time comes to take cores and  
40 see what really happened.

41

42 Q. I will just draw attention once again to that figure  
43 of gas emitted, being 172 cubic metres per square metre.  
44 You have taken that figure and done some further  
45 calculation with it and other data. Could we go,  
46 Mr Operator, to the report at page 0050, and highlight the  
47 paragraph commencing "The 172 cubic metres per square

1 metre". We've already noted from slide 36 that that was  
2 the figure of gas emitted that you came up with.

3 A. Mmm-hmm.

4  
5 Q. We see there that you have represented that at that  
6 part of your report and done some further calculations.  
7 Could you talk us through the exercise and the results as  
8 depicted there?

9 A. Yes, it's sort of a reality check to see that the  
10 numbers add up, the gas emitted --

11  
12 Q. A reality check for whom - for you?

13 A. For me.

14  
15 Q. Yes?

16 A. Yes. The gas emitted is 172 cubic metres per square  
17 metre, as you have said. I have used a mined length that's  
18 a bit shorter than what they actually mined, because I've  
19 discounted the initial bit of mining because of the lack of  
20 the goaf forming all that well. The speed of retreat - so,  
21 in any case, you come up with the area mined, the average  
22 tonnes mined, and knowing the area and you've got the gas  
23 emitted in cubic metres per air, you know the total amount  
24 of gas that was emitted over that area, and you divide it  
25 by the tonnes mined and come up with a number, in this case  
26 22.8. I've tried to make some allowance for intake gas as  
27 well, which is fairly minor. But around 23 cubic metres  
28 a tonne, which is sort of ballpark for what we saw in  
29 longwall 103.

30  
31 Q. You mentioned it was a reality check for you?

32 A. Yes.

33  
34 Q. What did it reveal?

35 A. I think the next little bit, the next few lines down  
36 the page here.

37  
38 Q. Can we zoom out, Mr Operator. Perhaps if you would  
39 highlight that paragraph again, including all above the  
40 next heading. Is that the part that you want to draw  
41 attention to?

42 A. Yes. The actual gas make over the period was a lot  
43 higher, at 30 cubic metres a tonne.

44  
45 Q. How would that be so?

46 A. Well, it literally was. That was the measurement of  
47 the gas they received, they made, and we're attributing

1 that to all these extra goaf well - the goaf well  
2 production produced it, yes. The thing is, well, what  
3 caused this difference, and that's what the following  
4 section seeks to assess.

5

6 Q. If we go back to your slides, then, the first bit you  
7 have already noted. By itself, you didn't give it  
8 particular significance?

9 A. Well, it adds to it, but --

10

11 Q. Yes.

12 A. Yes, at 15 per cent, yes. That's the P seam, partial  
13 pre-drainage of the P seam. I thought that accounted for  
14 about 4 cubic metres a tonne of the 23.7.

15

16 Q. You return in your third dot point to the shut-in  
17 wells potentially acting as conduits. Your postulation is  
18 that the wells - the cement exterior became fractured with  
19 strata movement; is that correct?

20 A. Yes, yes.

21

22 Q. You have a diagram on the right-hand side. It is not  
23 actually from longwall 104. It is from an earlier  
24 depiction. It's just used for the purpose of illustration;  
25 am I right?

26 A. Correct, yes.

27

28 Q. Could you explain what it is and what it depicts? It  
29 looks like some modern art, but I assume there is some more  
30 significance to it than that.

31 A. Yes, well, all the - lots of the little dots - I can't  
32 tell you all of them, but along here, this here  
33 (indicating) is the edge of the goaf. It's  
34 a cross-section, and the fractures occur - the fracturing  
35 occurs at an angle as you go up. What it is depicting is  
36 that is the level of fracturing occurring in the Fair Hill  
37 seam and elsewhere over the length of the cemented casing.  
38 The cemented casing is this black section.

39

40 The blue dotted line - I will just talk it through.  
41 The blue dotted line below the black vertical line is the  
42 slotted liner. But the point is the potential for -  
43 I would imagine there is quite a lot of strata movement,  
44 that differential movement between the rocks and the  
45 borehole steel itself, and the cement is the thing in the  
46 middle that's got to try to withstand all that, and it's -  
47 I'm just using imagination here, but I can't imagine that



1           happening.

2

3           But the next point, then, is that those fractures, the  
4 last couple of dot points - the Fair Hill seam, by virtue  
5 of its high desorption pressure, the gas can find its way  
6 down to the goaf. That also applies to the QA and QB.

7

8           Q. Is the theory of cracked cement casing necessary for  
9 the conclusion that the Fair Hill seam is contributing gas  
10 to the GM seam?

11          A. Not entirely, no. If you never had goaf wells at all,  
12 the Fair Hill seam would, because of its high desorption  
13 pressure, desorb gas when the pore pressure is lowered and  
14 it would find its way down the lateral fractures as well.  
15 But it's a case of path of least resistance and conduits,  
16 and the implication here is that these goaf wells provide  
17 a lot of extra conduits that would seem to be quite  
18 significant.

19

20          Q. You have made some suggestions for means of  
21 verification of this postulation that you have made.  
22 Perhaps rather than make it a memory test for you, we might  
23 go to your report and you might speak to that?

24          A. Okay.

25

26          Q. Could we go, Mr Operator, to the report at page 0007.  
27 In the top half of that page, there are three bullet points  
28 with horizontal bullets. Could you highlight those,  
29 please. The first of your suggestions, if anyone wanted to  
30 verify, would be to drill further boreholes over the mined  
31 area of longwall 104; correct?

32          A. Correct.

33

34          Q. And do gas content testing?

35          A. Correct.

36

37          Q. With a sufficient number of samples, presumably?

38          A. Correct.

39

40          Q. In doing so, if your theory is correct, what would you  
41 expect that to reveal?

42          A. If it's correct, I would expect to see a greater  
43 reduction in Fair Hill seamgas content than we saw for  
44 longwall 103, and --

45

46          Q. Greater than, say, 19 or 20 per cent?

47          A. Yes, yes. It wouldn't necessarily have to be very

1 much higher, but it might be 25, it might even be 30, but  
2 probably not that high - maybe 25. But we'd have a lot  
3 more samples, so we can be a lot clearer in what's really  
4 happening. I mean, the fact that you can do this at all is  
5 because of, as I mentioned at the beginning, the  
6 consistency in gas content within the seams; it has made  
7 this sort of analysis possible.

8  
9 Q. The second point relates to making an assessment of  
10 strata movement; does that sum it up?

11 A. Yes, it does.

12  
13 Q. Potential to fracture, and so forth?

14 A. Yes. Yes, and I think, yes, people with materials  
15 knowledge could use that to assess whether the cement is  
16 likely to withstand the movements or not.

17  
18 Q. The third point is related to that, is it, being the  
19 properties of the cement and its susceptibility to  
20 fracturing?

21 A. It is, and whether you undertake bond logs is another  
22 thing. That's a petroleum industry standard procedure. It  
23 is very important to cement wells in and be sure they are  
24 cemented. I see no reason why you couldn't apply it here,  
25 but maybe you don't need to go that far.

26  
27 Q. If we could zoom out, Mr Operator, I just want to take  
28 in the next paragraph, commencing "Goaf wells". You  
29 commence that by saying, "Goaf wells should not be turned  
30 off", as you have assessed that they were, for various  
31 reasons, in longwall 104. Is that any sort of  
32 controversial view?

33 A. I don't know. I haven't discussed this. I think it's  
34 industry --

35  
36 Q. I just wondered, from your experience in the industry?

37 A. No, I - if turning goaf wells off is a controversial  
38 view, or if my view is controversial?

39  
40 Q. Your view that goaf wells shouldn't be turned off.

41 A. Yes, it probably is controversial, because they  
42 require the equipment on the surface to keep up with where  
43 the face is.

44  
45 Q. Equipment on the surface has to be moved, do you mean?

46 A. Yes, yes. If a new well is put on line, you need the  
47 skids and pipework, and that, to hook it up and keep up

1 with the face, so the older wells drop behind and --

2

3 Q. That's what we saw previously with the type 2 wells  
4 from longwall 103?

5 A. Yes.

6

7 Q. Probably turned off for that reason?

8 A. Yes, I'd say so. The bottom line is if they are  
9 flowing, you shouldn't turn them off. If you have  
10 retreated the longwall quite some distance, say  
11 1000 metres, and the wells at the beginning of the longwall  
12 aren't doing much, you probably can turn those ones off,  
13 but --

14

15 Q. But not for 400 metres of retreat?

16 A. No, no.

17

18 Q. What do you mean by "valves regulated to control  
19 oxygen and carbon monoxide"?

20 A. If you keep the wells turned on, you can't have them  
21 sucking too much oxygen and CO, so you would throttle the  
22 valves back so that you are only producing reasonable  
23 purity gas. I think that should be possible. You mightn't  
24 be producing much gas, and if you get to a point where  
25 you're not producing much to warrant a single skid, then  
26 you can manifold some of these really low-flowing holes up  
27 and maybe do it that way. But these are things down the  
28 track for people to consider.

29

30 Q. Would that scenario of keeping the wells operating but  
31 regulated to a low level prevent them from acting as  
32 conduits of gas to the GM seam from the likes of the  
33 Fair Hill seam?

34 A. Yes, yes, it should. It should.

35

36 Q. Could we go back to the PowerPoint and go then to  
37 "Conclusions", some of which we have had a look at.

38 I think we have in fact discussed all of those except  
39 perhaps the last one. When you have included there,  
40 "Inadequate P seam pre-drainage", are you speaking there  
41 about inadequacies of the level of drainage by Arrow, or  
42 what content would you give it?

43 A. You want to reduce it down to as low a level as you  
44 reasonably can. I mean, Arrow pre-drained it - well, they  
45 didn't pre-drain it; they just produced out of it, and it  
46 is what it is. Over longwall 104, there is still a lot of  
47 gas there. So, yes, not desirable to have that much gas in

1 the P seam.

2

3 Q. Are you recommending then, in hindsight perhaps, that  
4 there ought to have been some further pre-drainage of the  
5 P seam?

6 A. Yes, but it is easy to recommend. Pre-drainage takes  
7 time. Of all the targets outside the Goonyella Middle  
8 seam, it's the P seam that's got the lowest density and a  
9 reasonable thickness, so it's the only seam there that's  
10 really a pre-drainage target. But it is banded, it is  
11 a difficult seam to drill in. So, you know, I think they  
12 could do the job okay longwalls ahead. I mean, you could  
13 drill surface to inseam holes - not 310mm diameter, but  
14 like what Arrow did, about 96mm diameter - line the holes,  
15 put them to a vertical riser for production of gas, and do  
16 that years in advance and get it down that way. So that  
17 would work. Otherwise, you have to do it by underground  
18 inseam drilling, and, you know, there are some problems  
19 potentially with that.

20

21 Q. We will go to slide 39. You have made some  
22 recommendations. What do you mean by "Future design  
23 /assessment" - for this longwall or for future longwalls or  
24 what?

25 A. For future longwalls in general. That's for Grosvenor  
26 especially, but for most mines you can nut out what the gas  
27 content is doing and produce a reasonable model of it,  
28 tied in with the geological model. I mentioned in the  
29 report you could produce slices showing the gas reservoir  
30 size above and below the seam at different intervals. It  
31 does nothing to help you calculate what ventilation you  
32 need, but because you have already mined out a few  
33 longwalls it gives you some brilliant empirical data to  
34 look on and say, well, this is looking better, or this is  
35 looking worse, and by how much, so that's the first point.

36

37 The second point is building on empirical evidence -  
38 assess past emissions along the lines that I did in  
39 longwall 103. I think at the end of each longwall, that's  
40 not a hard thing to do.

41

42 Q. You mean look at the degree of emission?

43 A. I mean look at the gas make curves and divide them up  
44 and try and nut out what's going on. In what the mine has  
45 done in the past, and it's probably similar to a lot of  
46 mines, they will produce an overall gas make curve just to  
47 get a gas make number for the longwall, but it is a pretty

1 crude comparison. If you divide it up into recognisable  
2 domains as you go longwall to longwall, you will probably  
3 see patterns emerge and it helps. If you introduce some  
4 quite different method of gas capture, such as what we're  
5 moving on to, these relaxed strata wells, you can assess  
6 the effectiveness quite well in that regard.

7  
8 And, yes, combine that with (a) for future designs.

9  
10 The third point is longwall emission pore pressure  
11 modelling. I'm not at all a fan of using European  
12 modelling.

13  
14 Q. The Flugge method?

15 A. Flugge and others. There is a whole pile of them.  
16 I noted it was stated in one of the documents that Anglo  
17 had that "the Flugge method shall be used", and stuff like  
18 that. Well, it is very, very coarse. It doesn't take into  
19 account too much of the local geology.

20  
21 Q. To be specific, what geology are you speaking about?

22 A. Well, it's, sorry, not just local geology but mining.  
23 The Flugge method goes back into the 1970s in Germany  
24 mining greater depths, thinner seams, advancing longwall,  
25 lower production rates. Here we find ourselves at  
26 Grosvenor with a thick seam, fast mining, yes, gas contents  
27 with all the pore pressure and all the rest of it, so it  
28 was fine in the past when you knew nothing else, but  
29 I think we can do better. That's where I get to saying SGE  
30 assessments aren't recommended.

31  
32 Point (d) about probability modelling, I'm pretty  
33 keen. All these things have an element of uncertainty  
34 about them which needs to be explored more. Before  
35 Dartbrook started mining, I came up with this giant  
36 longwall emission model that had thousands of elements and  
37 all the rest of it. It was a scary thing. The person in  
38 charge of tech services said to me, "Well, how sure are  
39 you?" I said, "I haven't got a clue, there's so much going  
40 into this." He threw me in the direction of some of these  
41 probability modelling packages, and it was a great help,  
42 I think. But that's not used much, either. I would  
43 recommend that to my consulting buddies as well.

44  
45 Q. I beg your pardon?

46 A. To my consulting friends as well, yes.

47

1 Q. On the next slide, you have referred to one  
2 suggestion, or recommendation, actually, that you make,  
3 which is to drill a row of relaxed strata wells. You've  
4 mentioned a little more about them in your report. You  
5 suggest at page 6 that you drill a row of relaxed strata  
6 wells ahead of mining, near the panel centre, 50 metres  
7 apart. Can you perhaps just elaborate on what you see as  
8 being the functionality of this kind of well?

9 A. I think the whole key to controlling - it is all about  
10 controlling the gas when you are mining, and pre-drainage  
11 is a fantastic way of doing it. You get rid of it that  
12 way.

13  
14 Q. You're not relying so much on your goaf wells in  
15 production?

16 A. Exactly. Goaf drainage. It's all --

17  
18 Q. Or your ventilation?

19 A. Yes. It's all hands to the pump. With relaxed strata  
20 wells, you've got the opportunity to get the gas out before  
21 it gets into the mine workings.

22  
23 Q. How would it do that? How would such wells do that?

24 A. In this instance, we would drill boreholes down to the  
25 base of the QB seam, a slotted liner to the top of the  
26 Fair Hill seam. When you mine under the boreholes, they  
27 should relax and produce, and produce high-purity gas.  
28 Potentially - I know in times past, the Queensland  
29 Government wants to see you use your resources better.  
30 Well, this is a gigantic gas resource, this Fair Hill seam.

31  
32 Q. Commercially useful?

33 A. Yes, pipeline quality, it could be. It's a lot better  
34 than sticking it in a power plant. But that's all by and  
35 by. The thing is, the Fair Hill, QA and QB, in my emission  
36 estimate, accounted for just over 50 per cent of the gas.  
37 So if you can take that out before it gets downstairs, it's  
38 a big advantage. You know, you are not relying on  
39 horizontal goaf wells and stuff. That's tricky stuff.  
40 It's expensive. Technically, it is brilliant to be able to  
41 do it, that they did it at all, but hell's bells, vertical  
42 holes are the way to go. And then with goaf wells, it puts  
43 less pressure on your goaf wells. You may need to just go  
44 back to 50 metre spacing. I mean, I'm talking about Utopia  
45 a bit here, but it may be possible.

46  
47 Q. In terms of the way in which these so-called relaxed

1 strata wells would operate, you have been somewhat critical  
2 of the difficulties and so forth associated with the  
3 lateral type in-seam - the horizontal ones, the horizontal  
4 P seam wells?

5 A. Yes.

6

7 Q. But the concept is similar, is it not, that once  
8 mining commences, the seam will liberate its gas and can be  
9 captured as a form of post-drainage; is that correct?

10 A. Yes, yes.

11

12 Q. But you favour the vertical wells for the reasons you  
13 have described?

14 A. I have to - years ago at Appin Colliery, I drilled a  
15 borehole down into the Balgownie seam, which is just below  
16 the Bulli seam, and instead of doing all these down holes  
17 they used to do - which is for post-drainage, it is  
18 a similar function to a goaf well, but only it is drilled  
19 down because that's where the gas is - this hole produced  
20 really well and we drilled more and more and got nothing.  
21 They are just hit and miss, unfortunately.

22

23 But here in Queensland, you have that opportunity for  
24 vertical wells. I mean, you have rivers and things in the  
25 way, that doesn't help, up there, but - and just how many  
26 you need I don't know. There's all these sums to do. But  
27 there is a path to follow to validate what I'm saying or  
28 otherwise, and then get on and design it and hopefully it  
29 will all work.

30

31 I go on to mention these gas sorption isotherms.  
32 I made an awful lot of just three isotherms on the  
33 Goonyella Middle seam and adjusting them to the vagaries of  
34 the Fair Hill and the other seams. One of the  
35 peculiarities at Grosvenor is not just that the gas content  
36 is pretty much the same all the way down, but the coal rank  
37 gradient - that's the degree of maturation of the coal -  
38 it's very high. I think I mentioned in the report the  
39 numbers for vitrinite reflectance, but it goes from  
40 something like medium-volatile bituminous to low-volatile  
41 bituminous. Coal rank has a big effect on isotherms as  
42 well. So there is a room to do a lot more of that sort of  
43 testing and fine-tune desorption pressures and things for  
44 the seams below as well as above.

45

46 Q. Just one point I don't think we've made clear: you  
47 have mentioned the likely significance, in your view, of

1 the Fair Hill seam to the emissions to the mined seam. You  
2 are not suggesting, are you, that the Fair Hill seam is  
3 a candidate for pre-drainage?

4 A. No.

5  
6 Q. It is not, is it?

7 A. It isn't. I was involved with CH<sub>4</sub>, which became Arrow  
8 Energy, so that's one reason why I know this area pretty  
9 well, and we knew the Fair Hill seam had a lot of gas. But  
10 as a target for getting it out of the ground, permeability  
11 tests showed it was just as tight as could be, so we never  
12 went down that route. No, it is not. In fact, as the coal  
13 seams get more and more ash in them, it attracts stress,  
14 and the stress reduces permeability and they become harder  
15 to drain.

16  
17 So that's why it's only the GM seam. The P seam has  
18 higher - the P seam for other conditions equal would have  
19 lower permeability, a bit harder target, but the others are  
20 out of question for pre-drainage.

21  
22 Q. Just one thing I will take you to and invite you to  
23 comment on if you can, that's not actually to do with your  
24 PowerPoint. It concerns one of your working spreadsheets,  
25 LW104 Gas Make.XLSX. Mr Operator, could we have that if we  
26 can? It's document RSH.038.002.0001.

27  
28 Now, I don't know what you'd call the X axis, but on  
29 the various tabs, some are presently hidden, I think. Is  
30 it possible to scroll across? Yes, that's sufficient. You  
31 see there the tab "Vac"? Are you able to tell us,  
32 Dr Williams, what data is represented in that tab?

33 A. Yes. This data came from manual goaf flow  
34 measurements. There were usually two measurements a day  
35 done, sometimes more. What you see here is a pivot table  
36 condensing those to one measurement a day.

37  
38 Q. All those inscriptions across the top are the labels  
39 of wells for longwall 104 that we've already looked at,  
40 commencing with GR04L001?

41 A. Yes. I'm looking at the highlighted wells. I'm not  
42 sure why I've highlighted them. There are comments there,  
43 too, which you would have to put the cursor on the comments  
44 to see what some of them are.

45  
46 Q. It is a list of data per well of longwall 104;  
47 correct?



1 A. Yes, it is, yes. Yes.

2

3 Q. I only wanted to draw attention to the final column.  
4 You've got "Avg Vac". If we go across the various rows we  
5 see different figures. What is it an average of in that  
6 final column?

7 A. Well, if you just clicked on one of the cells over  
8 there you would see what the formula is. It is just  
9 the simple average of those boreholes. All I'm trying to  
10 do here is to get a picture of what the wells are doing  
11 without necessarily attaching great significance to it.

12

13 I've mentioned in the report the vacuum seems pretty  
14 high. That comes from my point of view of not having  
15 direct operational experience in goaf wells. I've had  
16 a lot of experience in inseam boreholes and post-drainage  
17 holes on the South Coast - a lot of hands-on experience.  
18 But I would have thought with a goaf well, you would have  
19 a situation - and I can understand why the vacuum is that  
20 high. If the wells are producing so much gas and you've  
21 got to handle it, you've got to just keep sucking it up and  
22 up. But if you have enough goaf wells, keep them online,  
23 or you've got wells of large enough diameter that you can  
24 handle the gas without a huge vacuum, I'm thinking that -  
25 all you are overcoming is ventilation pressure down the  
26 bottom, you shouldn't need to suck the daylights out of  
27 things. But because you are sucking so hard, in my  
28 uneducated way - not uneducated, but inexperienced way, because  
29 I defer to Andy Self and Martin on this, you've got more  
30 potential to pull oxygen back into the goaf rather than  
31 just take the gas out straight out the way you want to.

32

33 Q. Well, the measure is in kilopascals; correct?

34

A. Yes.

35

36 Q. The figures represented there are kilopascals of, in  
37 effect, suction applied to each well?

38

A. Yes.

39

40 Q. Accepting the limitations you put on yourself with  
41 respect to your experience with goaf wells, what comment do  
42 you have on the rate of vacuum that we see represented in  
43 that average column?

44

A. I guess we have to think about what sort of pressure  
45 loss would you expect to see down the well itself for the  
46 sort of flow you are putting in a borehole of that  
47 diameter. It probably wouldn't be a lot of pressure lost

1 to that point. But when you get mixed up with the slotted  
2 liner you may see a bit more; quite a bit. I don't know.  
3 You would have to do the sums. These are the vacuums at  
4 the surface. How that translates to the vacuum you see  
5 underground I'm not sure. It could be, you know, totally  
6 the way to go. But it just seems high.  
7

8 Dealing in my experience with inseam drilling, those  
9 were the sorts of vacuums you had on inseam drill collars,  
10 which wasn't necessarily a great thing either, by the way,  
11 but that's what it was.  
12

13 MR RICE: I notice it is 1 o'clock, Mr Martin. I expect  
14 that that concludes my questions but I will just reflect on  
15 it over lunch.  
16

17 THE CHAIRPERSON: All right. 2.15.  
18

19 **LUNCHEON ADJOURNMENT**  
20

21 THE CHAIRPERSON: Yes, Mr Rice.  
22

23 MR RICE: I've completed my questions, thank you,  
24 Mr Martin.  
25

26 **<EXAMINATION BY MR HOLT:**  
27

28 MR HOLT: Q. Good afternoon, Dr Williams. My name is  
29 Saul Holt. I'm one of the barristers for the Anglo  
30 companies. I just have a few questions.  
31

32 One of the things that you have taken us through and  
33 which is very helpfully set out in your report was your  
34 analysis based on the available data of the gas reservoirs,  
35 relevantly the gas reservoirs for longwall 103 and  
36 longwall 104; that's right?  
37

38 A. Correct.  
39

40 Q. I'm going to ask you to verbalise your answers, only  
41 for the benefit of the transcript, not for any other  
42 reason. Now, if we could go to page 51 of your report,  
43 which is at 0052, Mr Operator, one of the things that you  
44 refer to in your report are the various other reports that  
45 you were provided with from what are described there as  
46 other consultants?  
47

A. Yes.

1 Q. Could we call out, please, the first set of dash  
2 points under the heading "Consideration of Other  
3 Consultants Findings". You refer there to what we have  
4 come to know as the Moreby 2010 report.

5 A. Yes.

6

7 Q. And what we will call a GeoGAS report in 2011?

8 A. Yes.

9

10 Q. And then the Palaris report in 2020?

11 A. Yes.

12

13 Q. If we can come out of that, Mr Operator, and go back  
14 down to the paragraph that starts "The Moreby 2010":

15

16 *The Moreby 2010 and Blanch et al 2011*  
17 *studies were very broad and undertaken*  
18 *prior to experience of actual mining ...*

19

20 Obviously enough?

21 A. Yes.

22

23 Q. You note, though, that the 2020 report was able to  
24 build on actual mining experience?

25 A. Yes.

26

27 Q. Can we then go out of that, please, Mr Operator, and  
28 call up the paragraph with the dot points that starts,  
29 "There are also a number of memoranda". You refer here to  
30 a number of memoranda also from Dr Roy Moreby that update  
31 the specific gas emission estimate files, and you have  
32 noted the files there?

33 A. Yes.

34

35 Q. The 17, 18, 19 - each of those relates to a year?

36 A. Yes.

37

38 Q. For example, the 2019 memorandum that you have  
39 referred to, which you also refer to in a bit more detail  
40 later in your report, was dated - I have it, so it is not  
41 a trick - September 2019; would you accept that?

42 A. I accept that.

43

44 Q. Thank you. What those memoranda from Dr Moreby do is  
45 to update, obviously as at the date of each of those  
46 memoranda, the specific gas emissions models based on the  
47 kind of lived experience of the mine up until that point?

1 A. Well, I don't know his basis for it, but I can --

2

3 Q. It is obvious on the face of the reports, though,  
4 isn't it? He talks about actual comparisons with real data  
5 that has come from the mine and core samples, and so on, on  
6 each occasion?

7 A. Well, he talks about specific emission - specific gas  
8 emission. My recollection is they are just curves of  
9 specific gas emission, or numbers, rather, on a plan.

10

11 Q. I see. Well, let's have a look. If we go over to  
12 your page 0053, please, so the next page, can we call up  
13 the paragraph that starts, "In the most up to date  
14 memorandum". Here you are referring to one of those  
15 memoranda of Dr Moreby; do we see that?

16 A. Yes.

17

18 Q. It includes there him reporting SGEs by "minimum",  
19 "likely" and "potential all"?

20 A. Yes.

21

22 Q. The "likely", as you have noted, all appear too low,  
23 but you then note that Dr Moreby's "potential all" includes  
24 the Fair Hill seam and appears closer to actual experience;  
25 do you see that?

26 A. Yes.

27

28 Q. So it is the case, isn't it, that in September 2019,  
29 Dr Moreby had provided a report which included a discussion  
30 of the potential impact of the Fair Hill seam and then  
31 included in one of his scenarios the results of that  
32 contribution, if there was to be one, from the Fair Hill  
33 seam?

34 A. Yes, when you say "report" --

35

36 Q. I'm happy to call it a memorandum.

37 A. Yes, it wasn't all that detailed. It was just results  
38 and - but, yes, it includes - but he has included the  
39 Fair Hill seam as "potential all", yes.

40

41 Q. One of the things that the report also does is to  
42 refer back to the core samples that were taken from above  
43 the goaf in longwall 103 and analyse those; do you recall  
44 that?

45 A. I don't, actually, but if you can refresh my memory --

46

47 Q. I'm happy to pull it up. I haven't given notice of

1 that, so I don't want to put you in a difficult position.

2 A. No, that's all right.

3

4 Q. All right, thank you. Could we call up, please - it  
5 may only have been given to RSHQ.

6

7 MS HOLLIDAY: It hasn't been given to us. It won't be in  
8 the public book.

9

10 MR HOLT: Mr Martin, I may be at an advantage for once.  
11 I have a document that's referred to in Dr Moreby's report,  
12 so I had made some assumptions about others having it.  
13 I don't think it is going to be a problem. Might I proceed  
14 by reading and promising, obviously, to you and to the  
15 witness that I'm reading it faithfully, just a couple of  
16 passages. I don't need to go much beyond that. If there  
17 is a difficulty, obviously our friend can raise it.

18

19 THE CHAIRPERSON: Yes. Are you happy with that,  
20 Ms Holliday?

21

22 MS HOLLIDAY: Yes, thank you, Mr Martin.

23

24 MR HOLT: I'm grateful. Thank you.

25

26 Q. I don't mean to have you at a disadvantage,  
27 Dr Williams. I'm sorry. When we talk about the core  
28 samples that were taken from above the goaf in  
29 longwall 103, that is some of the data that you had access  
30 to to make your own conclusions?

31 A. Correct, yes. I don't ever recall reading anything  
32 from Dr Moreby on the goaf samples from longwall 103, so --

33

34 Q. To be fair, I understand that you were provided with  
35 many thousands of documents. It's not a memory test.

36 A. Yes.

37

38 Q. When we're talking about that core sample from  
39 longwall 103, this is the work that had been done by Anglo,  
40 which you describe at page 45 of your report in these  
41 terms:

42

43 *Anglo has taken cores from above the GM*  
44 *seam over previously mined goafs and this*  
45 *provides an excellent assessment of where,*  
46 *and by how much, the gas has migrated - at*  
47 *least for seams above the GM.*

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A. Yes.

Q. In that memorandum of Dr Moreby's, he refers to that core sampling, and I will read it, as I have said I would:

*Based on core samples drilled over the goaf at Grosvenor and Moranbah, there is evidence that the limit of depressurisation and consequential gas release is about 150 metres. This indicates that the Fair Hill seam does not contribute significantly (zero to about 15 per cent) to longwall gas emission at least during the production phase.*

A. Are you sure that's longwall 103 you're talking about, not longwall 101?

Q. Look, it may be --

A. Because he mentions Moranbah North in the same breath, and that was done back in the time when longwall 101 was cored.

Q. In any event, may we take it for present purposes, because I don't want to spend too long on a document that others don't have, but for present purposes you would expect, would you not, someone like Dr Moreby to be looking at those sorts of core samples, as he updated his analysis, to test the predictions against reality?

A. Yes.

Q. In addition, you have referred, as I took you to before, to the 2019 memorandum with the "potential all" including the Fair Hill seam, which appears closer to actual experience. That means actual experience of the mining; right?

A. Yes.

Q. In other words, one of the predictions that was reported in Dr Moreby's 2019 memorandum, the highest-end one, included the Fair Hill seam and in fact appeared to be closer to actual experience?

A. Yes.

Q. Then I will note some of the comments that Dr Moreby makes about that, again undertaking, of course, that I'm

1 reading it verbatim. He notes among other things:

2

3

*The problem here is the large GRS --*

4

5

that's gas reservoir size --

6

7

*contained in the Fair Hill plies meaning  
that, say, 10 per cent either way makes  
a significant difference to SGE.*

10

11

I imagine you agree with that; right?

12

A. I do.

13

14

Q. So the point, in other words, in Dr Moreby's 2019 report is to recognise the existence of the Fair Hill, its capacity to contribute, and that, if it does, it could have a significant impact in the way that you have described?

17

18

A. Yes.

19

20

Q. He says:

21

22

*Therefore, having additional drainage  
capacity for gas management is essential.*

23

24

Again, I have read that verbatim from his memorandum.

25

26

A. Yes.

27

28

Q. Are you aware that between longwall 103 and longwall 104, there was a significant increase in gas drainage capacity put into place by Anglo at Grosvenor?

30

31

A. Not in great detail, but happy to assume there was.

32

33

Q. Thank you. And you understand - and we will come back and talk about it briefly in a few minutes - that part of that strategy was the closer-spaced goaf holes, that is, the 25 metre goaf holes that you have been talking about in your evidence?

36

37

A. Yes.

38

39

40

Q. But in addition, the increased actual drainage capacity, including changes to the infrastructure on the surface, for example, to increase the litres per second drainage capacity? You may not know the detail, but do you understand?

43

44

A. No, but, yes, that's okay.

45

46

47

Q. Thank you. In addition, if we could go back to

1 page 0053 in Dr Williams' report - we don't need to call it  
2 out, because I will go to the next page in a moment - the  
3 Palaris 2020 report you refer to there at the very bottom  
4 of the page?

5 A. Yes.

6

7 Q. If we go over the page, we can see at the bottom of  
8 that paragraph, after you have discussed some of the  
9 technical features of the report, the very last sentence:

10

11 *They have likely given a lot more weight to*  
12 *the seams below the GM and this has*  
13 *compensated leaving out the [Fair Hill]*  
14 *seam, such that their gas make figures*  
15 *aren't too different from those in this*  
16 *report.*

17

18 A. Yes.

19

20 Q. So we have the Moreby 2019 updated memorandum and then  
21 the Palaris report, which obviously was very close to the  
22 incident, but nonetheless, even using a methodology  
23 different from yours, ended up at about the same kinds of  
24 figures?

25 A. Yes, but very - yes, arrived at completely different  
26 ways. They had a lot of gas coming out of the floor, as  
27 I take it, and none out of the Fair Hill.

28

29 Q. Yes, and these are all models attempting to predict  
30 emissions of gas; right?

31 A. Yes.

32

33 Q. The thing about models - and it's not my phrase, as  
34 you would well know - is that all models are wrong and some  
35 are useful?

36 A. Yes, I would go along with that.

37

38 Q. And so the idea is, as you say, you want to understand  
39 the sensitivity of the model that you are using - yes?

40 A. Yes.

41

42 Q. You want to test it against real-world data as much as  
43 you possibly can?

44 A. Yes.

45

46 Q. And gradually improve the model over time, such that  
47 you can get as close as possible as you can to predicting



1 results?

2 A. Correct.

3

4 Q. Thank you. If we can then, please, understanding  
5 that, come back to your PowerPoint. Might we go to page 29  
6 of the PowerPoint. Sorry, I only have the actual  
7 PowerPoint page. Yes, thank you, this one. Perfect. For  
8 the record, this is RSH.019.001.0499. This was one of your  
9 PowerPoints where you're describing a comparison between  
10 longwall 103 and longwall 104 for the first 390 metres of  
11 face retreat?

12 A. Yes.

13

14 Q. What you identify there, if we look at the table, in  
15 the first column under "Goaf Wells", we can see there  
16 a significant difference between the 8.36 for longwall 103  
17 and the 19.05 for longwall 104?

18 A. Yes.

19

20 Q. Just so it saves me coming back to it later, if we  
21 look at the methane at the return, it is basically the same  
22 but in fact very slightly lower for longwall 104?

23 A. Yes.

24

25 Q. The question you ask at the bottom is, "So where is  
26 the extra gas coming from?" - yes?

27 A. Yes.

28

29 Q. Part of what you then do in your report - and I don't  
30 mean this pejoratively at all - is to think about where it  
31 might be coming from and to put forward a hypothesis, which  
32 you then explain, as to where it might be coming from?

33 A. Correct.

34

35 Q. That hypothesis is that it's coming from the Fair Hill  
36 seam or predominantly from the Fair Hill seam?

37 A. Yes - no, well, Fair Hill, QA, QB - that bracket of  
38 seams up there.

39

40 Q. Should we just say overlying seams some distance from  
41 the workings?

42 A. Yes.

43

44 Q. If I use the "Fair Hill seam" just as a shorthand for  
45 that, so that I don't have to use all three names, is that  
46 okay with you for the purposes of these questions?

47 A. Yes, okay, thank you.

- 1  
2 Q. So we're talking about the Fair Hill seam,  
3 understanding that slightly expanded meaning, and the  
4 hypothesis that you put forward is that gas is coming from  
5 the Fair Hill seam once the workings start and the caving  
6 starts happening and that it's making its way then,  
7 obviously, down into the goaf?  
8 A. Correct.  
9  
10 Q. And then it is making its way to the tailgate?  
11 A. Correct.  
12  
13 Q. How is it doing that, getting to the tailgate?  
14 A. The goaf is overloaded with gas. It's got to go  
15 somewhere.  
16  
17 Q. Now, as part of your hypothesis, you have proposed  
18 a mechanism by which a gas might get from the Fair Hill  
19 down to the goaf as it is forming, through cracked casings  
20 in wells that are shut off?  
21 A. In addition to the natural fractures down the goaf  
22 edge, but, yes, the cracked casing is the difference, yes.  
23  
24 Q. The cracked casing is the difference?  
25 A. Is the difference, yes.  
26  
27 Q. What do you mean, "the difference", in that context?  
28 What do you mean by that phrase?  
29 A. Well, it is an added source of conduit for the gas,  
30 so --  
31  
32 Q. Now, as you, with respect, very carefully point out in  
33 your report, there isn't any physical evidence of cracked  
34 casing or of that mechanism occurring?  
35 A. No, no.  
36  
37 Q. So it's an hypothesis about which you offer some ways  
38 of testing that hypothesis?  
39 A. Correct.  
40  
41 Q. But it is the proposition that it is the shutting goaf  
42 wells - I'm sorry, I withdraw that. It is that mechanism,  
43 that proposed mechanism, which is a hypothesis without  
44 physical evidence at this point, which is the reason why  
45 you suggest that 25 metre spaced goaf wells are problematic  
46 in this case; is that right?  
47 A. Yes, not the spacing per se, but the fact that you

1 have a whole pile of goaf wells, you have more than normal  
2 because you have made them at 25 metre spacings and you  
3 have shut half of them off.

4

5 Q. The only difficulty with that is if your hypothesis  
6 about the gas migrating its way down the cement casings is  
7 correct?

8 A. The only, did you say --

9

10 Q. The only difficulty with having those closer-spaced  
11 goaf wells and shutting them off in the way that has been  
12 described - the only difficulty with that is if your  
13 hypothesis about the gas migrating down the cement casing  
14 is correct?

15 A. Mmm-hmm. Yes.

16

17 Q. Obviously when you are dealing with an hypothesis, you  
18 want to identify the lines of evidence that might support  
19 that hypothesis?

20 A. Correct.

21

22 Q. Equally, you want to identify any lines of evidence  
23 that might falsify that hypothesis?

24 A. Correct.

25

26 Q. It is just a regular part of the scientific method;  
27 right?

28 A. Yes.

29

30 Q. Stepping out, before we go through a little bit of  
31 that process, the idea of closer-spaced goaf wells in  
32 longwall 104 following the trial of those things in  
33 longwall 103 - did you understand from the material that  
34 you read the reason why that was being done?

35 A. Yes. Yes, I understood - well, I formed the opinion  
36 that the mine believed the more goaf wells you put on, the  
37 better it's going to be.

38

39 Q. Can we be a little bit more precise than that, because  
40 might I suggest to you that the reasoning behind the  
41 spacing of the goaf wells at 25 metres was not so much  
42 about having more goaf wells, and we discussed this in the  
43 first tranche of hearings - not so much about having more  
44 goaf wells to draw gas out like it was a big bathtub, but,  
45 rather, to ensure that every next goaf well in the early  
46 stages of caving is coming on really quickly, so there  
47 isn't a delay in the next goaf well coming on stream; do

1 you understand that as a rationale for it?

2 A. No, well, you're pointing it now, and I can understand  
3 that's how they thought, but I didn't know that up until  
4 now.

5

6 Q. No difficulty. A lot of documents. Does that make  
7 sense as a rationale? And if I'm taking you out of your  
8 area of expertise, please tell me and we will stop, but  
9 does that make sense to you as a rationale, that it is  
10 important that goaf wells are coming online quickly during  
11 that first caving, especially when you have had problems  
12 with that in previous longwalls?

13 A. I would say you are taking me out of my realm of  
14 expertise in that one.

15

16 Q. We have Mr Self coming. I suspect I can speak with  
17 him about that. Understood.

18 A. Yes.

19

20 Q. Thank you so much. Just, then, to test a couple of  
21 things about that hypothesis, though, about the Fair Hill  
22 seam and the migration down the wells, the cracked casing  
23 wells, you are aware, because you point out, that there  
24 were a number of exceedances during the first 100 metres of  
25 retreat on longwall 104?

26 A. Yes, I will accept that, yes.

27

28 Q. And, indeed, you refer to the number of exceedances  
29 and the nature of those exceedances as being, in some  
30 ways - I don't mean this critically - a kind of marker of  
31 difficulties in managing gas?

32 A. Say that again, please?

33

34 Q. I will put it a different way. In your report you  
35 describe the HPis or the exceedances that occur as kind of,  
36 in essence, a marker of too much gas, if I can put it that  
37 way?

38 A. I also mention the gas delays --

39

40 Q. Yes.

41 A. -- in addition to the exceedances, and the gas delays  
42 were increasing and increasing, so they just seemed to be  
43 getting - it seemed to be getting harder and harder as time  
44 went on.

45

46 Q. You would accept I'm sure that it is important to  
47 understand and analyse the reasons for different

- 1 exceedances, to understand the reasons why they occurred or  
2 were caused?
- 3 A. Yes, that would be good.
- 4
- 5 Q. In any event, if we just come back to that first  
6 100 metres, there were a number of exceedances in the first  
7 100 metres, but might I suggest you couldn't expect caving  
8 or effect to have reached all the way up to the Fair Hill  
9 seam within that first 60 to 100 metres of the retreat of  
10 the longwall?
- 11 A. No, you wouldn't, no.
- 12
- 13 Q. So within that first 100 metres of the longwall, there  
14 is likely to have been no effect from the Fair Hill, even  
15 if there is ultimately an effect from the Fair Hill; is  
16 that fair?
- 17 A. Correct, yes.
- 18
- 19 Q. Thanks. And then in addition, and it possibly doesn't  
20 matter in light of that answer, would you accept - I think  
21 it is simply so, there may be no dispute about it - that  
22 within those first 100 metres when those exceedances were  
23 occurring, there were no goaf wells turned off?
- 24 A. Yes, but didn't they have problems with goaf wells off  
25 due to flame arrestor maintenance?
- 26
- 27 Q. That happens after that point, so that first  
28 100 metres - I think the point is made. Now, in the course  
29 of answering some questions from our learned friend  
30 Mr Rice, you were talking about the goaf wells and you  
31 noted that - and I don't mean this disrespectfully at all -  
32 the operation of goaf wells is not something that is  
33 particularly within your expertise?
- 34 A. True.
- 35
- 36 Q. If I ask you any questions that take you outside of  
37 your area of expertise, please say. I'm not trying to  
38 press you outside your area of expertise.
- 39
- 40 As we head towards 6 May last year, as you have  
41 identified, there were a number of wells that went off  
42 because they were in TARP, in effect?
- 43 A. Yes.
- 44
- 45 Q. And that was in large measure because of the level of  
46 oxygen, in particular, in the particular wells - yes?
- 47 A. Yes.

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Q. Are you in a position - and this is a question borne out of what I was just saying to you about expertise - to assist me with effectively what it means for what is called the goaf fringe as to how much oxygen there might be in goaf wells that are close to the longwall face or not?

A. No.

Q. Thank you. What I want to ask you about now, please, if we could have a look at table 4 on page 43 of your report - which, Mr Operator, is 0044, thank you. You went through this table in some detail with Mr Rice, so we don't need to revisit it at any level of detail, but we can see there, can't we, that it is showing effectively what is happening in relation to each of the goaf wells that we can see along the left-hand side?

A. Yes.

Q. And in particular, do you understand that goaf well V002A and V002A.2 - that's actually the same goaf well; it was that high-performing well we were talking about earlier? You are nodding. That's a "yes"? If you are not sure, please just say so.

A. Yes, well, I'm not sure, but on the plan there's no 2A and 2A.2, so you presume it is the one well.

Q. Yes. So we look at average methane flow, and if we assume for present purposes that it is the same well on that basis, we are seeing 883 plus 465, so we are seeing a very high-flowing well on that basis?

A. No, if the two wells are - if one is separated in time by the other, then the average is - it is not correct to just sum the average.

Q. In any event, let's focus on the 883. Unless I'm misreading it, that's the highest-flowing well?

A. Yes.

Q. Now, are you aware that that well, GR04V002A - let's just refer to it as that for present purposes - is the well in respect of which the flame arrestor issues, as they have been described, were associated?

A. I can't recall, no.

Q. Would you accept that from me for present purposes?

A. For present purposes, yes.

1 Q. Thank you. Now, was it in any of the material that  
2 you reviewed, given the high-flowing nature of it and the  
3 description of it - are you aware that it was partially  
4 drilled to about 10 metres above the GM seam and in fact  
5 ended up being connected to what is called the Dom fault  
6 that ran along the face line of the longwall 104 panel?  
7 A. No, I'm not aware of that.

8  
9 Q. And in any event, it obviously ended up being  
10 a high-flowing goaf hole. We've heard that on repeated  
11 occasions?

12 A. Yes.

13  
14 Q. If it be the case that that hole was connected with  
15 the Dom fault plane and an unusually large tributary region  
16 of the P seam, that might help to explain anomalous gas  
17 levels on 104, might it not?

18 A. It could.

19  
20 Q. Thank you. And because ultimately, as you have  
21 pointed out in your report, there was nothing like the  
22 issues associated with that first 100 metre retreat that we  
23 saw on longwall 104, with 103 - they were unique in that  
24 sense?

25 A. Yes.

26  
27 MR HOLT: Thank you, Mr Martin.

28  
29 THE CHAIRPERSON: Mr Crawshaw?

30  
31 MR CRAWSHAW: Thanks, Mr Chair, no questions. Thank you.

32  
33 THE CHAIRPERSON: Ms Grant?

34  
35 MS GRANT: No questions, thank you, Mr Martin.

36  
37 THE CHAIRPERSON: Thank you. Mr O'Brien?

38  
39 MR O'BRIEN: No, thank you.

40  
41 THE CHAIRPERSON: Ms Holliday?

42  
43 MS HOLLIDAY: No questions, thank you, Mr Martin.

44  
45 THE CHAIRPERSON: Mr Rice?

46  
47 MR RICE: None from me, thank you.

1  
2 THE CHAIRPERSON: Mr Clough?

3  
4 MR CLOUGH: None from me, thank you.

5  
6 THE CHAIRPERSON: Doctor, thank you for your attendance.  
7 You are excused.

8  
9 <THE WITNESS WITHDREW

10  
11 MR RICE: Dr Williams is the witness scheduled for today  
12 and indeed for tomorrow, Mr Martin, so I was going to ask  
13 if you would adjourn to Wednesday.

14  
15 There is one administrative matter we can deal with.  
16 There is a list of documents described as a tender list,  
17 dated today's date, bearing the letter M. I think the  
18 parties are aware of its contents. It's to reflect  
19 documents to be tendered, drawn from the reservoir in the  
20 public book which the parties have access to. I presume  
21 that all the parties have notice of this document.

22  
23 THE CHAIRPERSON: All right. Thank you.

24  
25 MR RICE: I tender the documents in that list.

26  
27 THE CHAIRPERSON: That document will be admitted into  
28 evidence.

29  
30 MR RICE: I should say, it is apt to be supplemented as we  
31 proceed.

32  
33 THE CHAIRPERSON: Mr Rice, does this matter have to be  
34 attended to at this stage?

35  
36 MR RICE: It doesn't, no.

37  
38 THE CHAIRPERSON: I'd just like to have a look at the  
39 list in a little more detail firstly, if that's all right.

40  
41 MR RICE: By all means. We can deal with it in the  
42 interim between now and Wednesday morning, perhaps.

43  
44 THE CHAIRPERSON: Is that all right?

45  
46 MR RICE: Yes.

47



1 THE CHAIRPERSON: It won't be admitted into evidence at  
2 this stage. I will have a further look at it.

3  
4 All right, we will adjourn until 10am on Wednesday.

5  
6 **AT 2.46PM THE BOARD OF INQUIRY WAS ADJOURNED**  
7 **TO WEDNESDAY, 24 MARCH 2021 AT 10AM**

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