Royal Commission on the Pike River Coal Mine Tragedy

Te Komihana a te Karauna mōte Parekura Ana Waro o te Awa o Pike

UNDER	**THE COMMISSIONS OF INQUIRY ACT 1908**
IN THE MATTER OF	**THE ROYAL COMMISSION ON THE PIKE RIVER COAL MINE TRAGEDY**

Before: The Honourable Justice G K Panckhurst
Judge of the High Court of New Zealand

Commissioner D R Henry

Commissioner S L Bell
Commissioner for Mine Safety and Health, Queensland

Appearances: K Beaton, S Mount and J Wilding as Counsel Assisting

S Moore SC, K Anderson and K Lummis for the New Zealand Police

N Davidson QC, R Raymond and J Mills for the Families of the Deceased

S Shortall, D MacKenzie, R Schmidt-McCleave and P Radich for certain managers, directors and officers of Pike River Coal Limited (in receivership)

C Stevens and A Holloway for Solid Energy New Zealand

K McDonald QC, C Mander, A Williams and A Boadita-Cormican for the Department of Labour, Department of Conservation, Ministry of Economic Development and Ministry for the Environment

G Nicholson and S Stead for McConnell Dowell Constructors

G Gallaway, J Forsey and E Whiteside for NZ Mines Rescue Service

N Hampton QC and R Anderson for Amalgamated Engineering, Printing and Manufacturing Union Inc

J Haigh QC and B Smith for Douglas White

J Rapley for Neville Rockhouse

T Stephens and N Blomfield for New Zealand Oil and Gas

P Mabey QC for Pieter van Rooyen

TRANSCRIPT OF PHASE THREE HEARING
HELD ON 9 FEBRUARY 2012 AT GREYMOUTH

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COMMISSION RESUMES ON THURSDAY 9 FEBRUARY 2012 AT 10.03 AM

THE COMMISSION ADDRESSES MR MABEY – NAMING OF ROADWAYS WITHIN THE MINE

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DAVID HAROLD REECE (RE-SWORN)

EXAMINATION CONTINUES: MR MANDER

Q. Mr Reece, can we just clear up those to issues relating to the two diagrams, the first one the goaf diagram, DOL3000.1500.11. And I neglected to get you to explain what is depicted in the top diagram, goaf diagram?

A. This is a, as it indicates it's a three-dimensional representation of the goaf panel and in the mining that had occurred in that goaf panel. It's not, as I say, it's not accurate it's simply a representation and just to point out a few things that, it attempts to describe how it's going to look schematically and give some sort of representation and a couple of things of note are that this gives an indication of the extent or the thickness of the coal seam. This gives a rough approximation of the size of the roadways in comparison. It also gives a representation of the grade or the dip of the seam and the difference, the height difference between the roadways so there's the returnal roadway up here, the intake roadway is down the bottom, significantly lower and this is done for the process of hydro-mining so that you're using gravity to move the coal that's been cut by the hydro-monitor from the top area down into the guzzler and it's picked up there. But this also represents how the actual mining process occurs in constructing an initial small tunnel, if you like, between the two and then the coal is progressively cut back down through this area so that you move that coal or you take out as much of the coal seam as you can, moving from the top, down to the bottom.

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A. This also describes the stumps that are left in terminology here, again by way of assistance to supporting the roof, my understanding is that this is not – it's not quite accurate, because there was also potentially some remnants left in the middle area there that were also standing.
Q. So that's a cavity in between the two pillars or two stumps, is that right?
A. That's correct. This is by and large, and it's not going to be cut out exactly square, but there's going to be a significant cavity in this area. The cavity again, as I pointed out in the sense that it starts off as cavity but then the roof will progressively cave in as you remove more and more coal.
Q. What's depicted further on from the diagram, where the word's, "goaf"?
A. Oh, okay, so this is what's been excavated. That's gone in effect. This is your goafing area that's broken and caved in, so goaf in the sense that it's the roof rock that's collapsed and fallen into that cavity, so you progressively retreat out of the area excavating the coal as you go. It's done in a progressive nature so that you take off slices, if you like, slices of the coal, let that collapse, leave some support in there to protect workers so that the caving of the roof doesn't override and collapse where you're actually working, so you leave some coal in there as a protection mechanism, and then you move the equipment back and start slicing out the next lift of coal, or fender of coal, that we'd call it.
Q. Can we also have up please DOL.3000.1500.12?

WITNESS REFERRED TO DOCUMENT DOL.3000.1500.12

Q. Just assist us now with the wording or the description.
A. Yes.
Q. And perhaps if you can just qualify what is actually described there.
A. Yep. Okay, this is a schematic again. A schematic diagram, it's not specific but it's introducing a couple of considerations and just to point out some of those things, a point was made yesterday, "What does it mean by the assumed that the return is cut off at the goaf due to the fall?"

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A. Where we went with this was just looking at a number of mechanisms for this goaf collapsing and what would happen and looking at where the air would go conceivably if this goaf collapses, and in this particular case it's saying well if the goaf collapses and cuts off this return which is this roadway, then the propulsion is going to be, the propulsion of the atmosphere out of here is going to be down the intake potentially across this cut-through, back up into the return but down this roadway and also down this way. That is one of a number of options. To some extent it's less likely that this would choke off here for a couple of reasons. One is that you have that grade. So gravity is going to send material downhill anyway. You generally get, even when you get a roof collapse in a mine it doesn't necessarily choke off or completely close off the roadway. It's not to say that it couldn't. It's less likely, but this was really just one representation. It's just as conceivable and probably more likely that this wouldn't close off and quite simply that arrow would just be pointing down this way as well. So it's one of a number of options. And just –

Q. So the arrow will be pointing down this way. The arrow would be down towards the main workings?

A. Towards the main workings and towards three cross-cut one west. The other thing I want to touch on here is that we've said a windblast path. We need to be careful with that term. Windblast is a specific phenomenon that occurs in coal mines, and we've touched on this in the report. We very much doubt and dismiss the fact that there is a windblast in the technical term. Windblast is a phenomenon where you get a large plate-like failure that causes a high speed rush of air if you like, generally greater than 20 metres a second, and the significance of that is that it will actually cause physical damage. It will propel people and move large objects. We're suggesting it's very much not a windblast. There's just not the area of goaf to collapse to create that sort of a blast if you like. So it's really the push of air, the wind that would result from that collapse.

Q. But notwithstanding it not being a windblast, do I understand the effect of a roof collapse potentially could be to render that stopping at the cross-cut?

A. Yes, that's correct. So we're still saying that there's a propulsion due to this collapse. Propulsion down here to potentially collapse that stopping.

Q. And what about the stopping at the cross-cut between the intake and the return?

A. Okay. This one had previously collapsed in the end of October due to a similar goafing event. At the time it was indicated that this was not terribly robust so it had actually been rebuilt and to a higher standard and I'd have to say that the previous installation was, it appears to be a lot more robust than this stopping was at the time of the explosion.

Q. We'll come to that.

A. Okay.

Q. Can I now take you to the point where we left off last night? You'd completed your description of the scenario, the case 3 scenario involving the accumulation of methane in the inbye, the extreme inbye area of the mine. Now, did you also consider other sources of gas, if only for the purposes of eliminating or gauging the likelihood of them being present, and in particular did you consider outburst and gas pipeline rupture?

A. Yes we did, again it was a case of working through each of the possible things that had been identified in the fault tree.

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Q. Outburst is something that you quickly just eliminated or you dismissed or?

A. We dismissed outburst mainly because outburst is a phenomenon where you get high gas in a seam. You tend to have high gas pressure and also a typically a geological anomaly such as a fault or a dyke, some discontinuity in front of you. It typically happens in development mining so as you're mining or developing a roadway towards virgin coal, so an unmined area that potentially hasn't been drained or hasn't been drained very well. It's extremely unlikely to get out outburst or an injection. It's an injection of gas and coal dust from a mining area. Extremely unlikely to get that in a pillar extraction area because you've already delineated the road or the area so you've naturally reduced the gas, the gas pressure. So highly unlikely in this situation. It has occurred in the last 15 years once in Australia in a longwall mine, in an extremely gassy mine, highly prone to geological structures faults also highly de-gassed and yet still had a problem with a gas outburst but it's quite, very unusual and certainly not known to happen in this sort of mining situation.

Q. Gas pipeline rupture. There was a gas pipeline used to drain methane from parts of the mine which ran down the return, down to Spaghetti Junction?

A. This is certainly a concern when you got gas entrained and very pure gas, so you're talking about pretty much directly from in-seam so potentially up to 98% pure methane. It's quite conceivable that these pipelines could be hit by something. The most probable area that it could be struck by a piece of equipment is where it crosses over a roadway. Generally in the intake because that's where you've got the bulk of the diesels. It could happen in the return. The pipeline actually ran along the return. It could happen there but you're less likely to have vehicles working in that area. If it did happen there, if it did happen in the return, we're talking about, even though it sounds a lot, we're talking about potential maximum of 126, 130 litres per second. It's actually not a lot of gas in that pipeline in the scheme of things if you work out the percentages. So we considered in the return. We also considered in the intake at the area of Spaghetti Junction where it crosses over that intake towards the riser –

Q. Just on that could we just have photograph DOL3000.1500.19 please?

WITNESS REFERRED TO PHOTOGRAPH DOL3000.1500.19

Q. That's the area you're referring to?

A. That's correct. Just a couple of things to point out, there is a whole lot of utility services in the mine. There's water pipes, compressed air pipes, I don't exactly know which is which other than to say that this is the gas drainage range in here, you would normally have these pipelines labelled so that you know what's what. This is quite unusual to have pipes like this, this sort of configuration in a mining situation. The other thing is the high-tension cables that are also interspersed with all these services in that particular area. So this is potentially an area where these could be hit by a diesel vehicle or something of that nature in that area so we considered the possibility of that being hit, damaged, broken in that area and what sort of impact that would have, because it's certainly hazardous and the combination of services that you've got there with high-tension cables, and we're talking about 11,000 volts in those cables, if you damaged that at the same time as the pipeline, it is highly likely that you would get an ignition at that point.

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A. We're talking about a very small amount of gas in proportion, so if you work out at that point if that pipeline was to be broken, you would inject about .1% methane into the general body. That's not to say that you wouldn't get an ignition at the pipeline itself, but it would be a fairly small flame that would occur from that, nothing like the nature of what we've observed.

Q. I just want to move on now to the mechanisms available in a mine to mitigate the build-up of gas.

A. Yes.

Q. Do you understand those to be firstly, ventilation?

A. Yes.

Q. And secondly, not in any necessary order of priority, drainage?

A. Yes. Yes, that's correct.

Q. In terms of the ventilation, did you find there were deficiencies in the ventilation system at Pike?

A. I certainly did. And to go through a few things, it was quite simply a case of looking at the ventilation system to start with and what was in place and just where the ventilation was being directed. That was then modelled because it – to an initial view it would seem that it would be quite difficult to get sufficient ventilation quantity into the further reaches of the mine. So, that was modelled rather than to take that on face value. There's a couple of things that arise from that. One is that – and it's potentially worth having a look at it on the mine plan, but one is that for the larger proportion of the mine workings there was one intake and one return, which is quite unusual for a mine which has four or five working areas extending from it, so that's quite unusual in the first instance. And the reason for that is you potentially – if you have a fall in one roadway, you've essentially significantly compounded your ventilation and potential for getting out of the mine.

Q. Now we put up yesterday the two modelling screen shots.

A. Yes.

Q. It may be worth just putting those up again, there are 31 and 32.

WITNESS REFERRED TO MODELLING SCREEN SHOTS 31 AND 32

A. So what I'm talking about is this is all what we typically refer to as pit bottom. It's the initial workings of the mine. It's set up for infrastructure and to support the extension and expansion of the mine workings. It's essentially in this case, once you get here, you're into the coalmining operations or the coalmining proper. It's set up so that there's installations in here that support the mining operation. Obviously you've got the shaft and the fan, so it's the ventilation heart, if you like, of the rest of the mine. Proceeding inbye from there it's quite surprising you pretty rapidly come into an area where you've only got one intake and one return and we haven't even got to the key mining areas yet. That means that these two roadways are very critical, just there.

Q. And those roadways, you recall that's close –

A. Oh, sorry, B and C heading north of pit bottom of pit bottom north, and I think that's inbye of five and six cross-cut, but I just can't see it on there – or between five and six cross-cut. So that becomes a restriction, quite a significant restriction in there just physically the amount of air that you can force through there, but nonetheless, it's not inconceivable. What then becomes somewhat difficult is that, as we've discussed, there's all these mining areas then that branch off from that single intake and single return that is serviced by those two single factors.

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A. So by the time you get to here, your ventilation's reduced to about 80 metres a second, and it's probably worth going to the next one if that's there. It starts to blow that up again, to expand on that.

Q. Yes, can we go to 32?

A. That's the one. So you can see that there's 84, 85 cubic metres in here and then it slowly reduces, it splits off, and that's fine, that's what happens. We use the air around these particular areas. But again, the concerning factor as far as the quality of the ventilation itself and the ventilation devices really comes under scrutiny right at this point at three cross-cut and one west where you have quite a weak brattice stopping held up with what are termed "pogo sticks". In essence, in the main headings of the mine and in combination with an auxiliary fan location, quite an unusual situation.

Q. In your brief you refer to at paragraph 61, the mine resistance characteristics?

A. Yes.

Q. In the context of ventilation. What do you mean by that?

A. Okay. Mine resistance is it's quite simply the friction factor that's created by the roadways themselves, so how rough the roadways are. If they're nice and smooth, concrete lined, circular, you have an ideal situation where you reduce the friction factor of the air and it's quite easy to pass the air through the mine. You have a low resistance, if you like. As you progressively roughen up, if you like, the edges, and it's as simple as that. You have very rough roadways in a mine, the friction factor increases and what that means is it's actually harder to move the air through the mine, so the pressure increases. Now what that means is and it's actually the pressure that drives, is the motive force of moving air around the mine. You lose pressure which drives the air as it goes progressively further into the mine, and what we're finding is that by the time that you get to this point of the mine just at the junction between pit bottom north and one west, where you're into these single intake and single return, you've used up quite an amount of pressure that's available to us to drive the air through the rest of the mine. In effect, there's a characteristic graph that shows you've got about 1480 pascals of pressure available.

Q. We'll come to that now perhaps. Just noting, red is return, blue is intake?

A. That's correct.

Q. Could we have up now please diagram 26 of the series? Can we enlarge that?

WITNESS REFERRED TO DIAGRAM 26

A. So what this is showing is the, and we're starting to get into some particular ventilation technicalities, but to just try and explain a few things. This dotted line here actually represents the fan, the main fan that’s underground at the bottom of the shaft, and the pressure that's available due to that fan and the pressure that it creates. Now it’s because it’s an exhausting fan it’s a negative pressure, it’s a suction. That’s why it’s as a negative value down here. What we find is that 624 pascals of the available 1487 is lost just in getting it through the tunnel, 520 pascals is lost in just pushing it up the shaft, so all that you're left with is 343 pascals to move that air around the working areas of the mine. Now what that means is that it’s the friction that causes the pressure to be lost or the motive force to be lost in that air. That just means there's less air, less velocity if you like to move the air around the actual working areas of the mine.

Q. So starting with the blue line?

A. Yes.

Q. Which is the intake air coming in?

A. This is intake.

Q. That’s the tunnel, that’s the drift?

A. The tunnel to about there, that’s the drift.

Q. We get to the mine proper?

A. The mine proper is there, so this –

Q. We get further into the mine, further inbye of the mine towards the workings?
A. Yeah. So this is panel 1, as it splits into panel 1 and then into the other three or so working areas up to the point where they go into the return. So that's then the representation of the return and how it goes through the fans, so there's an additional negative pressure from each of the fans. And what that's showing is that there's actually a boosting effect by each of those fans in there, which is unusual and actually is not necessarily a good thing. So that's showing that these fans are contributing to the point where you get to the bottom of the shaft and then it's, then you've got the pressure increased due to that fan, the main fan itself.

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Q. Now, coming to the main fan, the main fan is what is producing this current?
A. It's the, yes, it's producing.
Q. Ventilation circuit?
A. Yes.
Q. And that's situated where, perhaps if we have a look at 23 please on the map?

WITNESS REFERRED TO DOCUMENT 23

A. It's positioned at this point, the fan is actually sitting there, so again to trace the return, the return air comes down this roadway around here, through the fan and is then propelled up the Alimak and up to the original intended ventilation shaft, so it's drawn into the fan and flung out of the fan, if you like, and up the shaft and out of that.
Q. Now, having regard to that ventilation system, how would you describe it in terms of its effectiveness?
A. Well, again, from an effectiveness point of view, you've only got a single return which is limiting but for a small mine it's not unusual at this point. It does mean that if anything happens along this roadway that you've lost your primary return in effect that's what happened when the shaft

collapsed very early on. The other thing as far as effectiveness is the significance of the main fan being at the base of the shaft.

Q. And that's significance of what?

A. Well, it's highly unusual. It's something that, well I certainly, it's certainly something that I haven't come across and it's not something that would be contemplated in this situation for an underground coal mine.

Q. Why not?

A. Because it's in an area of, it's still in an area of high hazard. I suppose it's, it's one of the things that we used to actually have, and I apologise for referring to an Australian situation, but we used to have regulation that would specify where you'd have a fan and it would be on the surface and it's almost to the point where you wouldn't contemplate not having a fan on the surface. Most of the regulation then focussed on how you protect a fan so it's about having protection mechanisms because there have been explosions that have occurred in underground coal mines where if you don't have protection mechanisms, even on the surface, you can damage the fan, render it inoperable and even in a surface installation if you get a situation where you've had a fire or an explosion it's still your primary means of controlling the atmosphere in the mine and giving people maximum chance of escape. So even if, what we would have is what's referred to as explosion doors on a surface fan and on a shaft arrangement, so that if there is an explosion is actually bypasses the fan, it will propel out through these doors they're a safety factor, if you like, they're a safety fuse, so that the fan can be protected you can put those doors back on re-operate the fan, again you're in a somewhat safer environment, you can get to the fan, to the motors, you can measure what happening, re-operate that fan and try and get some ventilation happening back in the mine. Regardless of the damage that's occurred underground.

Q. The mine, if the fan is underground what does that mean in terms of the, and the power goes off, what's the consequence of that?

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A. Well, it means that you actually have to get in there or have a means of identifying what's happening, what atmosphere you've got before you can start it up. You can't just start a fan simply because you want ventilation if the environment is explosive, because it can cause subsequent explosions and that's not an unusual situation in a gas situation, a fire situation, an explosion situation, so to have the fan underground powered from underground power supply makes it problematic to actually get in there, know what's happening. Now, that's not to take away from the fact that you can have automatic remote sensing, remote monitoring to tell you what's in there, but again, in a situation like that, you've potentially lost that ability as well, so you're starting to cut down your options as far as knowing what's in there and being able to safely start that up again. The other issue with the fan being underground is it's very hard to protect it against something happening.

Q. In terms of the available ventilation what is your opinion of the number of faces that were being worked having regard to the ventilation quantity?

A. Yes, okay. I made this point earlier on, but to go into a little bit of detail, once you get inbye of panel 1, and it uses the first – it's the first one to get a good supply of fresh air which is fine, it makes sense. It then means that there's about 50 cubic metres available to the rest of the mining operations and it's fairly significant that there was a number of mining operations depending on that small, relatively small amount of air in proportion to how many faces were being worked. So there was the ABM panel, the roadheader, there was a heading with a continuous miner in it, and also a drill rig and a standing face up in that area, all to be ventilated by that 50-odd cubic metres. Each – so three of those had auxiliary fans. Each of those auxiliary fans were capable of drawing 22 cubic metres a second, so immediately there's – you actually can't run those fans at full power, so they'd have to be throttled back. They have to be reduced so that you can actually draw the amount of air that you got available to you. Then I sort of – I touched on – we actually had difficulty modelling the ventilation up into that area and then looking at our statements you could see that the deputies were, at different times, having trouble just getting the air to continue moving the direction that it should. Indeed, with the modelling, we had to go delving into actually what the layout was and what was operating just to get the numbers to the point where the ventilation would move in the correct direction and you can see from the deputies' reports that they were struggling to get that to work as well. Some of the particular installations that we saw were things like vent tubes that were being installed on the return end of an auxiliary fan and that's shown in six cut-through. It might be, if it's possible to put that up, I can show you exactly where I mean. Again, that's an unusual situation and what that was showing was that they were having difficulty getting the air from the fan into that return roadway, so they were actually putting additional tubes with bends to get it to the point of the main return.

Q. Can we have please 23, please?

WITNESS REFERRED TO DOCUMENT 23

Q. And can you just point out to us the area that you're talking about?

A. There's a better one than that. Okay, there was an auxiliary fan there and auxiliary fan there.

Q. You just have to put it for the record, you will have to put the –

A. Six cut-through between A and B heading, and A heading of two right, there was a fan in each of those places. And they actually had ventilation tubes, or ducts, or cans, whatever people what to call them, on the back of the fan to direct the air down into this roadway. Now what that's –

Q. Down into which roadway?

A. Oh, sorry, into B heading, outbye of six cut-through, this six cut-through here. Now what that's indicating is ideally what you want is for the air to naturally

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... by six cut-through, this six cut-through here. Now what that's indicating is ideally what you want is for the air to naturally be drawn down into this return. We need to make a point here that this main fan is the prime mover of the ventilation throughout the mine. The only reason we want auxiliary fans is simply to ventilate these dead-end stubs if you like, these single entry or these dead-end roadways because the air won't naturally pass from this ventilation circuit that's created by the main fan up into this roadway. It simply won't go into a dead-end. So the auxiliary fan is quite simply to draw air up into this roadway, into the ducting and out through the fan and then into the main return. A couple of things of significance with that. There should be, and certainly the procedures for the mine indicated that there needed to be, 30% extra air coming into this roadway here and going across or over this auxiliary fan of A Heading of two right simply to ventilate the fan itself because it's an electric motor and it's –

Q. Can we just have up please, 20? This is the fan you're talking about?

A. Okay. So this is an auxiliary fan. It's quite a standard installation. These are very much used throughout the industry. The fan itself, the thing that spins is actually sitting in this box arrangement here. You've got an inlet that's connected to the ventilation tubes that go into the mining face. There are variable inlet veins that are set up here with which you can actually restrict the amount of air that's drawn into that. The air comes into the fan. It's a centrificle arrangement, which means that it comes into the centre of the fan cylinder and is then spun through the fan and flung out at the base here. It passes underneath in this, there's actually a cavity inside there, and comes out through the tubing at the back end of the fan. There's an electric motor sitting at this point with a shaft that goes onto the fan itself. So this is how air is moved around those stub-end roadways.

Q. You spoke about the need, notwithstanding the deployment of auxiliary fans, still the need for the main, the main ventilation flow to be going across these auxiliary fans?

A. That's correct.

Q. You referred to the figure 30%?

A. That's correct. These fans have got to be installed in the main ventilation circuit which is provided by the main fan itself and quite simply because you still need to ventilate this fan so you need to have air that's not created by this fan, fresh air passing over this fan to dilute any gases and to cool that electric motor and so on. It's a flameproof electric motor. It's constructed in a way that it's entirely sealed within that enclosure, so it does have explosion protection on it. But nevertheless, as an additional control measure there must be excess air coming into the panel just to go over that fan and ventilate it.

Q. So did you conclude that the level of ventilation in that area of the mine, the extreme inbye area of the mine where there are a number of workings being carried out, was not satisfactory for the amount of activity that was being undertaken in that area.

A. That's correct, and we arrived at that conclusion from a number of means. One was the actual modelling, one was through quite simply reading the deputies' reports and seeing that they were struggling with ventilation. Indeed, there was one situation where quite simply the band that was backend of this ventilation tubing had come off or wasn't there for some reason on one of these fans and it gassed up this roadway, so really –

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Q. Going back to 23, the map, what do you say should've happened before this degree of activity was happening at that extreme inbye area of the mine?

A. Well, to me there's a couple of things that needed to happen. It would've been ideal to have this roadway completed.

Q. That's the joining of A heading?

A. Yes, A heading in one west itself.

Q. And work was going on with the Waratah roadheader?

A. The roadheader was working outbye, in A heading, but you also had contractors drilling and blasting so they're working in stone here and so it's understandable that was relatively slow going so there was a priority to get that done, there's no doubt there. So, ideally we would say that really needed to happen but failing that, the fact that you didn't have it, it was really a case of having to cut back on the extent of operations in here to match the ventilation and the gas that they were struggling with up in that area and it's quite simply a limiting factor. You can only work with the ventilation that you've got, you've got to manage the gas that's in there regardless of what they are, you end up being in a point where you've got to de-scale so that's within acceptable levels.

Q. In your written brief, paragraph 71 through to 75, you discussed the ventilation control devices, just generally speaking what a ventilation control device is?

A. Okay, ventilation control devices are anything that causes that main ventilation, or primarily, the main ventilation circuit to move into areas that you need it to move so it starts with the main fan and it includes stoppings that we've discussed, stoppings that separate, what we would call stoppings, an intake from a return, it keeps them separate, that's quite simply just walls that are built. It includes air-crossings, so overcasts that separate an intake from a return, it includes that R which denotes a regulator which is an artificial resistance, if you like, that's placed in a roadway to control the quantity of air that passes through there.

Q. And what was your conclusions to the quality of the VCDs at Pike?

A. Okay, variable, some were good. There were double doors, steel doors that were installed down here which are also referred to as ventilation control devices.

Q. Down here is where?

A. Sorry, that's a good question, I think it's one cut through pit bottom. Pit bottom north. So these were rated 35 kilopascal designed double doors between the main intake or the drift and the main return, at this point being the shaft, purely to get access in there. So that would certainly appear to be a construction of high standard and what we would expect.

Q. If I just get you to pause there. Can I ask for another map to be brought up, number 8, Ms Basher please?

WITNESS REFERRED TO MAP NUMBER 8

Q. And that's yet another map of the mine?
A. Yes.
Q. And there are a series of annotations through it?
A. Yes.
Q. Those annotations attempt to do what?
A. That was an attempt to describe the quality of each of the ventilation control device installations and it was constructed following interviews of particular statutory officials, so deputies and underviewers in the mine to try and get a good understanding of the quality of each of those installed devices.
Q. Thank you for that. Perhaps by reference to that, you've showed us or you've spoken to a good example or an example of a good ventilation control device?
A. Yes.
Q. Where were perhaps not so good ventilation control devices?
A. Well, it pretty much starts from there. So, we have a stopping that's in this area that would appear to be a relatively reasonably well constructed installation.

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Q. And that is where?
A. It's – that's a good question. It's – yeah, I don't know from this. It's actually, it's going to be approximately C heading, pit bottom north, and I think that might be just out by four cut-through – cross-cut.
Q. Yes.
A. So there's a relatively good stopping installation there, except for the point that it had a brattice trapdoor in it. So, we're talking about a cloth flap installed in a quite a reasonable stopping now. The statements that we've seen indicate that there was quite a bit of pressure, as you would understand on that flap, because it's very close to the main shaft, so that brattice, that cloth flap is experiencing almost the total ventilation pressure from that fan. It would be held in place simply because of the suction on it, but the fact that it's a brattice flap means that it could quite

easily be dislodged, damaged, very quickly and that stopping is breached quite easily. Then we move in from there and we're talking – and I can't quite see it in there – I think this stopping, even though it's shown in this installation that there's an auxiliary fan in there, I think it was a board – it was props and boards, so it's potentially a reasonable stopping. Thank you. Yes, so that's a board and brattice stopping, so again, it's not a solid structure, it's cloth, which is not, certainly nowhere rated stopping. And to look at further, the props are cracked so they've been damaged. The stopping is leaking, understandable given that you've already got a ventilation tube through that device, and this is all very close to pit bottom, so this is right at the start of the mine. We then –

Q. Can I take you to the cross-cut three?

A. Yes. I just want to mention that there's actually louvers in these two stoppings as well that are noted as "dilution doors" for later discussion.

Q. Just pause. That's in cross-cut six and cross-cut six, pit bottom south and one of one west mains?

A. Yes. So if we go to three cross-cut in one west, I've mentioned about that one and actually three and four are quite similar. They're very substandard stoppings, pogo sticks and brattice cloth. Now to describe pogo sticks, they are essentially spring-loaded conduit so they're a very temporary structure. We would normally use those in the ventilation or assisting a very small amount of ventilation to get into a short stub. They're not intended for any type of permanent construction. These are very temporary arrangements.

Q. And what's the consequence of inadequate –

A. Oh, we're talking about significant leakage, that you would get through there and it's just not a strong structure. Any over-pressure would knock those over quite easily.

Q. And presumably leakage –

A. Yes.

Q. – has an influence on the efficacy of the ventilation circuit?

A. Exactly, so you're losing quite an amount of air immediately through those, directly through those, so it's air that's not available to the actual working areas of the mine further inbye. There's an overcast that's described that's just inbye of the four cross-cut one west in five cross-cut, that had just recently been installed to advance the ventilation network in the workings into the next phase of the mining operation. And that's pretty much it as far as most of the ventilation devices are concerned, except I do want to make a point. As far as we are aware that stopping was not in place, so that was open, and that's fine, that's as it should be. But what we do find is that there is a stopping across this fan in A heading of two right, and that's a concern because that does a couple of things.

1055

A. So that's AF03. That does a couple of things. One, it immediately eliminates any chance of the 30% ventilation coming through and over that fan, and we believe that that brattice stopping was entirely across the roadway. Now it's not unusual to have a brattice stopping in there to restrict the air so that you force more air up this way, but what is not good practice is to completely close it off because you're actually eliminating that 30% in excess, you're eliminating the ventilation of that fan and electric motor itself and you're actually creating a dead air space in here so you're actually not ventilating this part of the roadway. The air is being forced up into the dead-end, into the stub, back through the tubes and through the fan. It's actually not passing up through here and ventilating that road. Not good practice.

Q. Can we just move on now to gas monitoring, which you start at paragraph 84 of your written brief?

A. Okay. There's a couple of quick points to make. We talk about the gas content of the coal itself. It's indicated as being in the order of six cubic metres a tonne, six to eight cubic metres a tonne. There have been higher figures for that. There's some significant numbers as far as we're concerned. It is a nine or 10 metre seam so there's six to eight cubic metres a tonne of gas, so that volume of gas for every tonne of coal in that nine to 10 metres of seam, and it has relatively high permeability, and what that means is that the gas will actually release itself from the coal quite easily. Some coal has low permeability and it can have a lot of gas in it like a sponge, but if the permeability is low the gas actually won't bleed out. When you break the coal up it will come out but not necessarily just bleed out. So this coal is six to eight cubic metres a tonne, 10 metres of coal which is a nice thick seam, and then relatively high permeability so the gas is going to be coming out. That puts it into the area of being quite a gassy mine and indeed we see in reading different documents that it’s referred to as moderate gassy. Other publications we see it referred to as gassy.

Q. So I take it from that there needs to be effective and accurate monitoring?

A. Monitoring based on the fact that there's quite an amount of gas in this particular seam.

Q. What, if any, were your concerns about the monitoring at Pike?

A. Monitoring itself, there was a lot of variability, a lot of inaccuracy that we found with telemetric installations. So these are automatic methane detectors that are installed on pieces of equipment or in parts of the roadway. We were seeing quite a degree of variability with calibrating them, particularly with the accuracy of them, with them not being used and some being in quite poor condition, and this was gases in primarily the methane detectors. Carbon monoxide detection didn't seem to be a problem. One of the issues with methane detectors is that they actually can be poisoned by high levels of methane. So these things are fine. It depends on the design and the span of gas that they can detect. But if the gas levels exceed what they are capable of measuring, they can actually be poisoned and become unreliable. We’re suspecting that there was some of that, and certainly it appeared that panel 1 return was prone to this. There was a significant amount of checking and recalibrating and replacement of that particular detector and it became quite unclear as to whether it was actually working at all towards the end and there's certainly no indication, no read-out of that particular detector anywhere but in the mining area itself, it wasn't recorded anywhere else.

1100

Q. In the outbye areas of the mine, the so-called less hazardous areas, did you have a particular concern?

A. Yes, again we had concerns here because, and this came from advice from the equipment suppliers, you also want to have a methane monitoring of the fresh air itself so that you know that you have good quality air, so an anomaly we keep methane in intakes below a quarter of a percent, that's typically what's fresh air, however, the detectors that had been installed we found were actually of too high a level so they were actually set to read 5% with an accuracy of plus or minus a quarter of a percent, so you actually had the inaccuracy of that particular unit negate the ability to detect accurately the quarter of a percent, so it actually was the wrong detector installed in those areas. Potentially less problematic in the sense that it's the ones in the high gas areas that you want to know about but the ones in the fresh air are generally protecting non-flameproof apparatus, electrical apparatus, so you have far less tolerance, these are normal electrical installations that aren't flame protected or gas protected if you like, so you need to have an additional safety factor on those. The other thing that particularly concerned us and was quite perplexing was the gas detectors in the main shaft itself and we found that there were initially two detectors in there and they were reading quite different numbers. It was concerning that that wasn't resolved, that that was the case and to some extent we are, we're not exactly sure which was the correct one. It would appear actually that the one at the base of the shaft was reading correct and it was reading twice the quantity of the one at the top of the shaft. There was concerns with the – and at some point that was, that one at the base of the shaft, was disconnected, so that was no longer reading.

Q. That was the bottom or the top?

A. The bottom.

Q. Was reading twice?

A. Yes. And then the one at the top of the shaft would appear to be in a fairly sad state of repair. There's also instances we found where there were quite high levels of methane that went through that main shaft and it would appear to have latched, what we would call latch, the detection, so it effectively went to about 2.75 or thereabouts and flatlined. So we don't actually know how much or how high the methane went to up that main shaft. The concern is, if you have 2.75 at the main shaft, and this was at a time when there's a gas-out further into the mine, that's in the main body of the air at the locations where you are producing the gas where there is much less ventilation air available to you, the percentage will be much higher.

Q. Can I move on now to gas drainage?

A. Yes.

Q. It's the second means by which the build-up of gas can be mitigated in a gassy mine.

A. Yes.

Q. Looking at the pattern of boreholes, what did you deduct in terms of what was being attempted in using or in terms of the in-seam drilling?

A. Yes. Well, it was indicated in early documents that we saw that the drilling in-seam was very much for exploration and that makes sense because it's a difficult seam, it's highly prone to geotechnical activity. There wasn't a lot of exploration that had been done so they were really finding the seam through horizontal drilling. There was also indication that, as I say from documents that that was the case that they were finding the seam, and the layout of the holes that were drilled, and the branches that extended from those drill holes supported that factor.

1105

A. However the issue remains that it is a gassy seam, and this, a large thick seam with lots of gas present and available to those boreholes. The problem with the location of those boreholes, given the fact that the premise was for exploration, meant that the logic was not to protect those holes sufficiently from intersection by roadways. And what I'm saying is that if those holes had been established from the perspective of managing gas, they would've been located somewhat differently. There would've been a greater attempt to avoid intersection with roadways. Once you intersect a gas borehole with a roadway, you've changed the integrity of the hole. Now we see this, sometimes they block the hole up, sometimes they ran hoses from one side of the roadway to the other side of the roadway and this is a common means of trying to protect the integrity of the borehole and continue the gas drainage.

Q. Were you aware that early feasibility studies at the mine had indicated that given the gas levels in this area there would be a need for gas drilling and drainage?

A. Yes, very clearly, it was, that was identified, I think, well certainly in a particular document, an earlier document, certainly 2006, 2005. There's a recognition that there's quite an amount of gas that would require drainage and gas boreholes. Numbers typically rule of thumb, once you're over five to six cubic metres a tonne, in a coal seam, you're generally heading towards gas drainage requirements, so this was six to eight.

Q. Can we have a look please at image, its number 30, please Ms Basher?

WITNESS REFERRED TO DOCUMENT 30

Q. Can we just for the present purposes ignore the diagram to the right, it's just it appears on the same page.

A. Yes.

Q. We're concerned with the diagram to the left.

A. Yes.

Q. What's that showing, to the left?

A. Other one, yes.

Q. That's it, great.

A. What that's showing is some typical or classic drilling for gas drainage inner seam, so this is intentionally targeting the seam to remove gas from it. There's a number of different types of patterns. Really, we would only focus on this fan pattern. It's the most efficient. It's been shown to be the most effective. You could end up in requiring this sort of arrangement, but the fan pattern as the lower one shows, you can have a drill rig set at this point and drill multiple holes in effect from that location and manifold it at that point into a single pipeline. Typically the spread or the distance between each of these holes would be in the order of 20 to 30 metres once you get into the full extent, obviously not here. But the objective here is to de-gas the coal. Now, this is just an arrangement. It's – the holes have extended in this situation to across into these development roadways, the point being it provides you with multiple opportunity. You actually de-gas this coal that's about to be mined. You also de-gas the coal for these roadways that are going to be developed some time later, so you will intersect these holes, there is no doubt. But the intent is you provide – you design it so that there's sufficient lead time, typically in excess of six months for that coal to be drained, so that once you come through here and intersect these holes, they're pretty much dormant, there's not a lot left in them. You block them off just from a safety point of view, but it's the intent is to target the gas and drain the coal.

Q. So is that the type of configuration you'd expect if you were undertaking a gas drainage programme?

1110

A. That's a gas drainage programme. Potentially that's probably in excess of what this mine required. Another configuration that's not shown on here. If you're simply developing two roadways like this you would at least have what we would call flanking holes. So these are holes that run up the sides of these roadways to dig as its localised de-gassing of that area so that you can create those headings, de-gas those headings. Again, some sort of lead time, but the point being, you're not actually intersecting them.

Q. Now some of the holes were drained and as you've already referred to this morning, were connected to a gas drainage pipeline?

A. Yep.

Q. Looking at that pipeline, what did you conclude in terms of how efficiently it was draining gas from those boreholes that it was connected to?
A. Yeah.
Q. And perhaps just for the record, those were boreholes 14, 16, 18 and 8?
A. There's probably a couple of comments to do with the fact of what boreholes were connected to it. There was a report done, there was a number of reports done that we really took guidance from and they were quite incisive. As far as the gas drainage and pipe range that were installed in the mine, that pipe range was 100 millimetres. It’s a four inch pipe, quite a small pipe. The other aspect is that it was simply a pipeline that took the gas away under its own pressure. So gas simply bled out of the coal into that pipeline and provided its own motive force if you like to get out of the mine through the pipe range to the gas riser at Spaghetti Junction and near the fresh air base and up that gas riser to the surface. Normally if you have gas drainage you would have a pump, a particular designed pump, protected pump, to provide some suction on that pipeline. It doesn't actually suck the gas out of the hole per se but it certainly evacuates the pipeline so that you can cause more gas to pass along it. So that’s on the one hand. The other thing is that a 100 millimetre is quite small. This is something that was made very specifically by the consultant that talked about that. So it’s quite small and in effect you just couldn't get enough gas through that pipeline to get all the gas that was coming out of the drainage holes into it. So there was a recommendation made by him and quite understandably, that it was actually limiting the effectiveness of the gas drainage. So the recommendation was to disconnect some of those holes from the pipeline and simply vented into the return just to get the de-gassing effect of the coal to occur so that when you intersected it with a mining machine the gas quantity in that area had been reduced. If it didn't do that, if you left it connected up to the pipeline it just wasn't draining, wasn't able to clear itself and wouldn't have de-gassed sufficiently to be able to intersect it. Even so, there were was still quite an amount of gas

left in those areas as evidenced by the ABM panel intersecting that borehole.

Q. And presumably that places more pressure or emphasis on the efficiency and effectiveness of the ventilation system?

A. Well that's all you've got left then. The ventilation system's got to be able to manage it because the drainage range is in effect not connected to it.

Q. Paragraph 56 of your written statement?

A. I'm sorry, which?

Q. Fifty-six. You refer to a discrepancy in the measured flow into the pipeline or range?

A. Yep.

Q. And what was measured coming out?

A. Yep.

Q. And you have commented upon what may have been the causes?

1115

A. Yes, as I say, and these were measurements made by the mine found that there was 126 litres or thereabouts flowing into the range in areas further in inbye yet at the gas riser there was only 13 litres at that point indicating that 113 litres is just not getting there for whatever reason and we've indicated a number of reasons that that could've occurred. Either leakage out of the range or you can get interconnection between holes, so it can actually come from one hole into the pipe range and actually flow back into another hole if it's over pressurised and go to another place, particularly if you've got this like open holes, but potentially the more probable situation is that that pipeline is just blocked and it could either be water in a low point so you still get water out of the gas, sorry, out of the seam so it's potentially water that's built-up in a low point in the pipe. The installation in the mine had these, typically has water traps that aim to, at low points, to drop the water out of the pipeline and get it out of that range but you need, these need to be maintained, they need to be emptied as often as it builds up. Ideally you have automatic water traps that are self-emptying. The other aspect is that you can get fine coal ejected out with the gas and it can also block up the holes, so the stronger suspicion is that pipeline's probably been blocked.

Q. All right, can I ask you now to turn to the other part of the equation if you like that being ignition sources?

A. Yes.

Q. And you commenced in your written statement at paragraph 99, with a discussion of this.

A. Yes, obviously if gas is something that's going to occur in most coal mines, we then went looking from a similar perspective down through the various potential ignition sources to try and confirm or deny particular ones. The most likely source that we found to jump to it was electrical sources and those could be created by a number of instances that we can certainly touch on, however, Tony Reczek will be here next week and we'll go into greater detail and that's way outside my area of expertise, however, I do understand the concepts that we're going through. So how far would you like me to go into those electrical sources?

Q. Well, just generally speaking in terms of under the heading of "Electrical sources" we've heard already the reference to the creation of harmonic currents?

A. Yes, yes.

Q. Which could cause arcing or sparking?

A. Yes. So if I could, the understanding that I have of that is airspeed devices are not unusual they're not uncommon in coal mines. They've typically been installed as a discrete installation on a single piece of plant. They provide better control of the electrical characteristics of the actual plant so that you get finer control, if you like. You don't have big currents required to start motors, so it actually makes the control of the electricity itself a lot more specific, makes it a lot finer, so it gives better control. My understanding is that the downside is that it generates these harmonics which are, in effect stray currents and they talk about it being that you're actually chopping up the electric waves that are, that you need.

Q. I don't think we need you to go into that sort of detail, we just need perhaps just a marker or book marker in your evidence that harmonic currents which Tony Reczek will address.

1120

A. Yes. Probably the significant point for me is that these stray currents are then liable, as I touched on, to track along electrical installations, metallic installations. So it becomes problematic as to where it's going to be realised.

Q. So where the arcing could take place or the sparking could take place within the mine?

A. Yep. Is in any of those installations.

Q. And again just as a marker, another aspect to ignition source connected with electrical source is undercapacity of power supply into the mine?

A. Yeah.

Q. Which again Mr Reczek will speak to?

A. Yes.

Q. And thirdly, something that the investigation team looked at was electrical discharge machining?

A. Yes.

Q. Which in very broad terms is what?

A. My understanding is it's still associated with the variable speed drives but it's particularly associated with the installation at the fan where you can get some electrical tracking along again metallic installations and it's been found to occur in shafts of fans and bearings on the shafts of fans in underground installations elsewhere.

Q. And in terms of the process that you went through or the elimination, the examination of different events?

A. Yes.

Q. We've also had reference to the starting up of the pumps?

A. Yes.

Q. And is that something that relates to the VSDs and the production of these harmonic currents?

A. That's correct. So the pumps were operated using the VSDs. So it was fairly significant to us and strongly coincidental that these pumps started up. The VSDs started at very close to this to the same time.

Q. Can I ask if we could have put up please Ms Basher, number 22. It's your fault tree, Mr Reece, headed "Ignition Sources"?

WITNESS REFERRED TO DOCUMENT 22

A. Yes. So what this is showing again, it just provides us with some logic, some road map to consider conceivably what other sorts of ignition sources were in the mine that we should chase up, try and confirm. So we looked at spontaneous combustion, frictional ignition, electrical discharges we've just touched on, explosives, naked flame, hot surfaces, and also an unusual one to some extent, hydrogen sulphide in pumps.

Q. The colours denote what?

A. The colours are really, after we'd been through the exercise of considering all of these was to then go back and say well what's likely, what's possible, what's unlikely, it's as simple as that. So the green colours are saying well we think this is likely, the orange ones are possible, the red ones are unlikely. So we're suggesting that, well spontaneous combustion, frictional ignition, explosives, hydrogen sulphide, unlikely.

Q. And we're parking the green chain as it's set out in the diagram under the heading "Electrical discharge?"

A. Yes.

Q. And I'd just take you briefly through the other possibilities that were considered by you and the expert team?

A. Yes.

Q. First of all, hot surface?

A. Hot surface, there's a number of things. Just to touch on some of the particular ones. A lot of this is associated with things like diesel, so it's a hot metal surface that's been created for a number of reasons. With diesel you've got an engine. There are protections on it, but that can create a hot surface. We've got a green one there that says, "Diesel runs in high methane." There have been recent situations in certainly over the last probably 10 years, a significant amount of concern with diesel engines, and what happens to them if they come into contact with high methane and they've been found to run uncontrollably. So the engine will speed up and you actually can't shut the thing down. There has been a lot of work done with research organisations around the world and certainly SIMTARS in Queensland to try and understand that, to model it, but more significantly, put trials in place. So there are now, as I've indicated there's a requirement for strangler valves to be fitted to diesel equipment and I believe that was in place at the mine.

1125

A. Nevertheless, it's one of those things that's quite significant and can't be ruled out if that strangler valve wasn't operating. We then looked at other things like pumps running dry and friction factor or hot bearings on other pieces of apparatus. Most of the red things struck off because we actually went and found with a reasonably high degree of confidence that it was either not happening at the time or had been shown not to be a factor.

Q. Spontaneous combustion?

A. Yes, spontaneous combustion is, New Zealand coals are quite prone to spontaneous combustion without going into too much detail of that, it's an unusual characteristic whereby coal will oxidise so it'll take oxygen in and in the process it will actually heat up of its own accord. A lot of things, a lot of substances do this but coal is particularly nasty because if you get it in the right circumstances it's about having broken coal, enough oxygen around it, not dissipating heat, it can actually get hotter and hotter and hotter until the point where it will actually catch fire itself. New Zealand coals, as I've said, quite prone to spontaneous combustion. There has been testing done of these, of this coal seam. There's been a little bit of testing done of the Rider seam. The information so far tends to indicate that it's not highly prone. For us to be more conclusive it would be ideally we'd like to have more testing. We've ruled it out primarily because we're relying on the systems in place the mine to look at the markers of the results of that so carbon monoxide predominantly and also the reporting from people. It's quite a noticeable indicator, it's an unusual, it's a particularly pungent smell, coal when it's burning, as most people are probably aware, so that's the smell that you'll find. It's often detected very quickly by people in mining situations particularly where you're in the direct downstream effect from it. It doesn't mean that it couldn't occur in some less frequented places but the indication so far is there's a fair degree of diligence demonstrated or indicated at the mine to say that they were looking for it. There was one isolated report of a smell. There was one isolated report of a smell, but unfortunately not substantiated, not pursued. There were spikes in carbon monoxide that did occur, primarily associated with explosives and the use of shotfiring, which is again, by-product of shotfiring.

1128

Q. Friction ignitions?

A. Friction ignition comes about from a number of things. I'll come to the most concerning one, but friction ignition is really talking about things like conveyor belts where you've got conveyor belts running over coal dust. There was a conveyor belt in the mine. It was in the main intake area, pretty easy to knock that one out because of the location of the survivors. Its incendive sources, such as rock being cut by continuous miners and so on, at the time the continuous mining machinery, or the mining machinery wasn't working so we had to cut that, to take that one away, but there's – you actually need two things. You need an incendive source and a rock that's prone to ignition. The concerning thing is that this rock was quite prone to ignition and we actually pursued that testing. There's quite an amount of information to say that that is a very real concern in this mine, regardless of anything else. There's pyrites in the seam – sorry, in the surrounding – sorry, there's an indication that's there's pyrites. That's yet to be fully confirmed. There is certainly high quartz. There have been a number of ignitions that have occurred in the mine, predominantly where you get into stone, so that's a very real possibility. However –

Q. Why did you discount that –

A. No continuous miners working. From that specific effect, but there is potential for rock on rock ignition that can occur, so where you get a goaf fall creating heat where you've got incendive rock striking incendive rock or even steel for that matter.

Q. In terms of rock on rock, can you –

A. To a large extent we discounted that because we don't suspect that the ignition happened in the goaf, for a few reasons. One is that if it did occur in there, it would primarily have had to been some sort of hot surface, such as rock on rock ignition, or spontaneous combustion up in the in the Rider seam and there weren't a lot of indicators of carbon monoxide present from that area and indeed, the visual information that we got from borehole 47, I think it was, didn't tend to indicate that there was a lot of damage there, so we tended to shy away from that.

Q. Just before the break, explosives, all the explosives were accounted for?

A. Yes. Explosives and shotfiring equipment.

Q. Naked flames, there was no electric arc welding, or?

A. Well, there was no cutting and welding. We do have concerns with contraband, so we haven't ruled that one out.

COMMISSION ADJOURNS: 11.31 AM

COMMISSION RESUMES: 11.51 AM

EXAMINATION CONTINUES: MR MANDER

Q. Mr Reece, can we just turn to the final part of your written statement. The issue of locating or attempting to define where in the mine the ignition point may have been. I understand that Professor David Cliff was heavily involved in this work?

A. That's correct, yes.

Q. Is it correct that this also involved modelling and the use of what are called computational fluid dynamic software?

A. That's correct.

Q. And was that for the purposes of inputting a number of factors, data and seeing what the most likely results were in terms of the various known factors?

A. Yes it was. The main point was to take a combination of the analysis of the facts with the assumptions that we had made and to put them into a separate assessment if you like of the explosion to try and again come at it from a slightly different process. So up to that point we'd just been working on the facts that we had at hand, primarily the video and the witness statements, a combination of those things. This was to then reverse engineer, if you like, those factors into well what sort of explosion would have happened. It was an indicative exercise really. It wasn't intended to be definitive in the sense that locating exactly where it was going to be. It becomes fairly difficult to do that even with this sort of modelling software. The software is similar in a sense to the vents then modelling - it's all using fluids or fluid dynamics.

Q. The broad conclusion was what in terms of the location of the ignition point?

A. Yeah. It really said to us that the ignition point was more likely to be further into the mine than Spaghetti Junction which was one of the concern areas, and there's two reasons for that. One is clearly the temperature experienced by the survivors. Had it been close to them, they simply wouldn't have survived. The comment was made yesterday about temperatures of coal dust and what sort of heat it had been generated. Temperatures from gas explosions are getting up between 1500 and 2000 degrees, so numbers like 1700 degrees Celsius are being talked about, so we're talking significant temperatures at the point of ignition and combustion.

1155

A. There’s got to be a fair amount of cooling for that to occur and that will happen as the gases are moving around the mine and there’s an absorption of the heat by the mine itself and that that temperature needs to be reduced before it gets to the survivors. The other thing that needed to be considered was the actual, the pressure wave and the fact that there was only one pressure wave that appeared to occur at the portal, through the video evidence, so again, if it had been further out there potentially would’ve been a reflected wave, so if it occurred further out of the mine it certainly would've ejected from the portal but it would’ve also propelled into the mine and then potentially reflected back out again.

Q. Perhaps if we can just put up the map 23?

WITNESS REFERRED TO MAP 23

Q. So you firstly said in regard to the very high temperatures associated with the gas explosion.

A. Yes.

Q. And having regard to the location of the survivors, you’ve told us that it would be inbyes, that’s an indicator suggesting further inbye than Spaghetti Junction?

A. That’s correct. We don’t exactly know where but it’s going to tend to be further up in this area and that was our original estimation.

Q. Further up in which area?

A. Up towards this area of the mine.

Q. That area being?

A. Well, anywhere from panel 1 inbye to a large extent.

Q. Now you just also referred to a reflection wave?

A. Yes.

Q. What's the significance of that?
A. Well, what we're saying is that, if it was further in here it's going to tend to project out of the mine. If the ignition point was further into the mine towards this area.
Q. This area being?
A. Well, from anywhere from panel 1 inbye. It's going to project out of the mine in one wave. If it was further out of the mine it's going to tend to project both ways.
Q. Further outbye?
A. Outbye and inbye from that point of Spaghetti Junction. But then you would expect this wave that's propelled into the mine to be reflected back out again, slightly later, but to have two fronts, if you like.
Q. So just to clarify that. "You'd expect to have two fronts," we didn't have two fronts?
A. Well, you would expect to have two fronts if the ignition point was further outbye.
Q. Right and you've indicated there in the proximity of Spaghetti Junction?
A. That's correct.
Q. Other factors associated with or assist in this exercise in terms of length of time?
A. Yes, it's really, it was the amount of time that the wave took to exit the drift. It was consistent with it being well into the mine and really this was from looking at subsequent explosions that were expected to have been initiated from the pit bottom area. So the subsequent explosions, albeit that we didn't go too far down this track of analysing subsequent explosions, but David Cliff certainly looked at the subsequent explosions and the expectation or the understanding from the analysis that they were ignited from this sort of an area. They were quite different from that first explosion as far as the time duration.
Q. Analysis of coked coal particles, is that of assistance?
A. Yes, this is more looking at, again, where it occurred and it's a little bit hard to determine those coke particles were found at the top of the shaft. The indications from the analysis were that it had been subjected

to between 450 and 700 degrees Celsius. Don't know where they've come from. There's certainly been some heat effect to those, was certainly picked up by the hot gas post-explosion or consistent with post-explosion. If it had been higher temperatures then it's potentially at the point of explosion. So what we're saying is for them to get to there?

1200

Q. There being?

A. To the top of the shaft. If that had been the point or very close to the point of ignition, then the temperature effect of that coal dust would have been much higher. So the fact that it was 450 to 700 or thereabouts suggests that it was impacted afterwards by the hot gases coming through. You wouldn't expect – so if it had been there that had been heat-affected, at the shaft that had been heat-affected, it would have been a much hotter effect if that had been the ignition point. So it's consistent with the hotter ignition point being in here inbye panel 1 and the hot gases transferring through here and picking up the coal and heat affecting it at that point.

THE COMMISSION ADDRESSES COUNSEL – APPLICATIONS FOR CROSS-EXAMINATION OF WITNESS – ALL GRANTED

1205

CROSS-EXAMINATION: MR WILDING

Q. Mr Reece, I'd just like to talk at a fairly broad level about mine design. What are the main categories of information about the characteristics of the coal field required in order to design an underground coal mine.

A. There's quite an amount of material that you need to obtain in the early instance. Typically, it relates to geology of the resource, characteristics of the coal itself, extent of the coal – so, some of the things that we look for is, how thick, how deep is the coal, what sort of particular characteristics of the coal itself; there's lots of different types of coals, they'd need to get an understanding of what sort of coal it is. That starts to open up questions about what sort of markets you get. Then we need to understand the geology of it, the surrounding rock; the strength of the rock. The stresses that are inherent in the area. How much water is in the seam itself? How dirty the coal is, if you like? How much, what sort of other processes that we may need to apply to the coal to make it saleable. Just the extent of it, just how much is there, how economic it's going to be to mine it?

Q. And the methane content?

A. Methane content, so it's looking at gas characteristics and it's not necessarily just methane. It's the type of gas and how much.

Q. And propensity to spontaneous combust?

A. Yes, it's – that's one that tends to be a little bit later down the track. We certainly look for it in the – it depends on prior knowledge. If there's prior knowledge that there is a concern, then that would be done sooner rather than later. If it's not prior knowledge, it may come somewhat down the track.

Q. In those types of information, at what stage of the design and development process do you need those?

A. All of those facts?

Q. Yes.

A. Well, right at the start really. That's your starting point to determine the economics of the resource and actually confirming whether it moves from what we would call a resource being into reserve or approve and reserve that's going to be economic.

Q. How accurately should it be possible to predict the economic cost of a project?

A. It takes a couple of stages and it's typically referred to as pre-feasibility, feasibility studies, and it tends to start at a range of plus or minus 20% and with additional information, additional research that comes in from that exploration and closer analysis of it, it's typically reduced down to 10% for feasibility, down to plus or minus 5%, ideally for setting up a mining operation.

Q. So by the time you've decided you're going to develop the mine, you ought to have been able to predict the cost within about 5%?

A. Thereabouts, ideally.

Q. How accurately would it be possible to predict the timeframe of the development stage after all consents have been obtained?
A. Again, it's one of those things that's historically based in the sense that mines are established in various known reserves. It can be done relatively accurately. Again, it depends on the novelty or thereabouts of what the seam is indicating. If it's consistent with what's been done before, then you can do it quite accurately. If it gets into novel things, such as different gases, carbon dioxide, or thick seam, or soft ground, then it reduces the amount of confidence that you can have in the timeframes, but it can be quite accurate.
Q. And is it fair to say that having insufficient information increases the financial risks attached to a project?
A. Absolutely, yes.
Q. And presumably the timeframe risks?
A. Yes, yes.
1210
Q. Does it also impact on health and safety?
A. It can do because you've got unknowns that you haven't quantified. To some extent you end up having to manage on the run.
Q. What are the issues associated with managing on the run or on an ad hoc basis?
A. Well it can be, if you've underestimated gas type or quantity, that you actually are behind the game if you like as far as establishing those controls. Whereas if it's accurately assessed up front and the information is readily available, then you can have those systems costed in and you don't actually come under the same sort of pressure or scrutiny to back them into the project if you like.
Q. And does it also mean that you might design systems, for example methane drainage, which turn out to be not appropriate or appropriately specified for the conditions you subsequently find?
A. Yes, it can be insufficient. Not only gases. It could be strata control, where you end up to some extent chasing your tail trying to catch up with what the resource is actually throwing at you.

Q. Did the experts reach any view or gain an impression about the adequacy of the information that Pike River had at the planning and design stage?

A. I wouldn't say we did a broad-ranging search or really went into a deep analysis of it, other than to say there were particular things that I suppose were caught in our filter if you like. And by that I mean as we read through feasibility studies, there were certainly things like knowledge of the gas, knowledge of the seam as far as the surrounding rock that we did note. So it was really things like, and I've touched on some of these, the fact that it was recognised in the early parts of the project that there was a reasonable amount of gas there and there was a recognition of drainage being needed, similarly with ventilation control. So it was really from that point of view. It was the filter that we were coming from as far as gas and ignition sources that we were particularly looking for in the early stage, whether there was recognition of spontaneous combustion or frictional ignition.

Q. And at those early stages it was recognised that there were issues to do with methane, for example, that would need to be addressed?

A. Yes, it was stated fairly specifically.

Q. Did the experts form a view about the timeliness of the gathering of information by Pike River?

A. As far as those feasibility studies and so on?

Q. At all stages?

A. Well there certainly seemed to be a fairly lead time. A lot of the fairly specific reports that I looked at 2005/2006 and some earlier than that as well.

Q. Could I just take the example of methane? You need that information that we talked about presumably in order to design a methane drainage and ventilation system which will be right for the predicted conditions?

A. Yes.

Q. And the corollary is that that system then needs to be built and there's a need to manage the operation so as to work within the capacity of that system?

A. Yep.
Q. And that's where the experts say Pike went wrong in part, is that right?
A. I think they didn't have enough. Certainly a case of wrong in the sense that there was more gas than they had a system to manage it and the ventilation was less than it should have been to manage. We look at gas and ventilation as two components to some extent of the same thing. We start with ventilation and if the gas is in excess of what the ventilation can manage, then we need to have gas drainage, but it's a case of matching how much gas drainage with what in excess of the ventilation.
Q. And having identified the potential issue of gas, it's then necessary for a prudent miner to put in place appropriate controls and procedures to deal with the risks?
A. That's true.
Q. Ms Basher, could we please have FEI.0003-1?

WITNESS REFERRED TO DOCUMENT FEI.0003-1

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Q. You will see that this is a document, Economic Commission for Europe Best Practice Guideline for Effective Methane Drainage in use in Coal Mines," series number 31, are you familiar with this?
A. Yes I am.
Q. If I could ask you Ms Basher please to go to page 25.

WITNESS REFERRED TO ECONOMIC COMMISSION FOR EUROPE BEST PRACTICE GUIDELINE FOR EFFECTIVE METHANE DRAINAGE IN USE IN COAL MINES - PAGE 25

Q. And could we please expand box 2.1? See that's the table, box 2.1, typical coal mine gas explosion risk controls and procedures. Does that set out conventional mechanisms for controlling gas risks such as those encountered at Pike River?
A. It certainly is from my reading, it's a very succinct list of the things that you would do for gas management in a coal mine.
Q. So in other words, those are the things that needed to be in place to manage the gas risks at Pike?

A. Yes.

Q. Are there any of those that the experts considered weren't properly managed at Pike?

A. The things that stand out to us is certainly the gas drainage plan and design implementation. Control and discharge of drained gas. There was an issue with restriction to contraband, I'm not saying that that continued on but there were certainly concerns or records that we found in early stages that were alarming for such an operation. There’s a little bit of concern with anti-static materials we saw a number of instances of use of compressed air hoses in what we would be concerned with is an uncontrolled manner. There’s a little bit of concern with maintenance of predominantly, well, both electrical and mechanical plant. Again, earlier indications of restrictions of smoking materials below ground but that links with contraband. Ventilation plan and control of ventilation was definitely a concern as was monitoring and measurement of mine gas concentrations. Use of auxiliary ventilation, I've already touched on. There were things happening in there that we were concerned with about the volume of ventilation available. De-gassing of headings, not to a large extent. I think there were processes in place, but I do raise a question about some of the documentation, not necessarily the practice. They’re probably the main ones. Most of the other things have been touched on and to some extent negated. Sorry, I'll touch on explosives to pressure barriers as well but it didn't appear to be there but were accessible and certainly a good practice.

Q. And have these all been quite conventional risk controls and procedures from about 2000 when the Pike River feasibility of design process commenced?

A. I would say long before that. There’s nothing there that hasn’t been around for 20 or more years, 25 years.

Q. I just want to take you to another page of that, number 14 please Ms Basher? In the fourth to the last paragraph reads, “By their very nature unusual omission and outbursts events are not easily predicted but the conditions under which they can occur are reasonably well known. Therefore, following good practice allows for more effective management of these risks." Is that a comment with which you agree?

A. Yes.

Q. And just finally on this document please, Ms Basher, page 20. And it's the second sentence of the top paragraph. "Ultimately all explosion accidents are a manifestation of failure to effectively implement safe practices and procedures." Is that a comment with which you agree?

A. I would.

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Q. Did the experts reach a view about whether that statement was of application to Pike?

A. Well we certainly didn't look at that specifically and put it in the frame, but – in the frame of our analysis or assessment. However, the systems and installations in particular, we had significant concerns with as far as their adequacy. So, certainly don't disagree with the statement, agree with your statement, and the things that we found at Pike, sadly, fit into that category.

Q. Just like to turn please to a variety of different aspects of the design of the mine and some of them have been touched on already. And I'll start first with the single drift. What are the additional or heightened risks of complications that a single drift entry, such as that at Pike River has, compared with the duel entry?

A. Quite simply, in the first instance you reduce your scope for response if something goes wrong, so if you've got a – if you have a roof fall or a failure in that area then you're severely limited right at the start. That can affect personnel escape or entry obviously, but predominantly escape. The other thing is for ventilation control. Primarily they're the two main things that you're going to be concerned with.

Q. Can you just explain what you mean by "ventilation control?"

A. Oh well it's, if you've only, and certainly in this instance, you've only got one ventilation intake, one ventilation return, so if you have – if you lose either one, if there's damage to either one, in this case you're talking about the drift, if that collapses, then your ventilation is immediately disturbed. It's restricted.

Q. And I presume that it increases the possibility of having vehicle interactions, because there will be two-way traffic?

A. Yes, and this is one of the things, particularly with a reasonably long drift, two and a half kilometres, this – you need to get into the situation where you decide how you're going to manage vehicles in that area. It's a tunnel, same as we have vehicular access through tunnels, it becomes an issue with needing to get in and out. Mine vehicles need to be – need to be aware that mine vehicles are significantly slower than normal vehicles, understandably so. You don't have the ability to manoeuvre. It's confined to a large extent, so it can take quite a significant amount of time to traverse a distance like that, so there would be, expected to be some sort of interaction of vehicles, vehicles passing, so that needs to be catered for either with passing bays or some control of just how the traffic is managed in there.

Q. And I presume if there is a contaminating event of the atmosphere for example, in this case, at pit bottom and stone, it will run the risk of contaminating all the air inbye?

A. That's correct, immediate – that's your only source of intake air, so it's – everybody's going to get it, in the proportion that the ventilation is distributed.

Q. Does it also mean there's only a single pathway for the infrastructure such as power, water, compressed air?

A. Not necessarily, because there are other means that after often provided for those where you could have a borehole from the surface directly to the location you want to put it.

Q. So does that mean that Pike River needn't have run all those infrastructure aspects through the drift?

A. Well, it didn't need to, but it then comes back to what are the surface infrastructure, and how easy is it to get access to that? So, really what we're talking about is you can take infrastructure across the surface of a mine, and take a vertical borehole down to the particular location that you want to connect up electricity or water and go direct to that point, but it depends on your surface access.

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Q. Would it be fair to say that from a design or safety perspective it would it is preferable for there to be more than one single drift entry?

A. This is certainly something that the Australian industry is grappling with and has been grappling with for some time, where there is a strong drive towards having three entries to a mine. It becomes an economic issue, but that's certainly been a strong drive for some period of time.

Q. By three entries, that could include, for example, two mechanical entries and then a vent shaft?

A. Yeah. It depends. Mechanical in the sense that it's aiding people. So it could be if it's horizontal access, then you've got two trafficable accesses that you could drive people in, or if it's by winch if it's vertical, there are arrangements that you could have two hoist arrangements in those entries.

Q. I just want to turn now to the second egress. You'll be aware that that was up a vent shaft located in the return?

A. Yes.

Q. Was that placement of a second egress in the return consistent with good mine design?

A. Again, it's one of the things that, it's a legacy to some extent that we are moving away from. It used to be the case that the second egress was always in the return. There is now a requirement that it not be in the return simply because you are potentially in the products in combustion that you are trying to escape from and it's the natural place that it's going to go to. So the drive is towards ideally providing a stronger case for uncontaminated air to come out and so, in effect, an intake roadway that doesn't have any services in it so you'd lower or you'd reduce the risk of contamination in that particular roadway.

Q. When you say a requirement, a requirement in Queensland?

A. Yes.

Q. Given that second egress's placement in a return, would it have been a suitable second egress even if it had a hoist or elevator?

A. It's problematic. I suppose at the upshot you could say yes because it's still a way out, but it's only a way out if you've got for something like this, breathing apparatus, and breathing apparatus that will allow you to safely escape out of that mine, and potentially it's not only breathing apparatus; it's actually the ability to find your way out. People often think that it's a tunnel, there's only one way you can go. History and research has shown that people can actually get lost in a very small roadway quite easily. Smoke, confusion, stress in this situation. So there needs to be a number of resources made available so that people can safely escape.

Q. In your view, did the combination of the single drift and the vent shaft egress provide a sufficient series and number of ingresses and egresses to ensure health and safety?

A. It's a tough question again because we're coming out of this legacy of having only two, and it's only one of those things where with good risk management practices and attempts to reduce the risk to as low as reasonably practicable, people are now saying in mines and moving on to say to be more proactive we should have more than two. So, in that instance with the benefit of hindsight the pressure is on a mine to have more than just two, one entry, one exit.

Q. But in this case it wouldn't have been sufficient to not have had a mechanical exit up the vent shaft, for example, a hoist?

A. And that's certainly one of the things that we found quite perplexing is that that second egress as it stood regardless of the thoughts on it, put it fairly and squarely on people to climb out, which is something that certainly we've touched on in the report, would not be something that we would accept.

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Q. Mr van Rooyen in his witness statement of 27 January this year, paragraph 63 says, quote, "If at the beginning in July 2010, the focus had been on driving towards the surface egress point rather than on developing the hydro-panel, it may have been possible to reach the egress point in the quarter ending 31 December 2010." In your view, is that something that ought to have been done prior to hydro-mining commencing?

A. I can understand the rationale, the problem I have is from the mine design perspective. You still have the problem of an inability to adequately escape whilst you're creating that driveage. So I have fundamental problems as a mine manager with even the second egress that's there whilst you're doing that.

Q. So you're saying that they had to, for example, get a hoist or mechanical means of egress in that vent shaft prior to developing the mine any further?

A. That's where I would've gone and the reason I say that is because it's a significant issue to climb out 105/110 metres of vertical shaft as it is, let alone under breathing apparatus.

Q. And so that means that should've been done in 2009?

A. Yes.

Q. If I could just turn to the collapse of the main vent shaft in February 2009, during raise boring. Can you just briefly describe what raise boring is?

A. Certainly. The process of raise boring, it's a method of constructing a shaft. It's quite a common method, it's a very attractive method. It's quite quick, it's quite efficient; it's quite cost effective. The way you do it is to have a very large drill rig on the surface that will drill a blind hole, if you like, to the seam workings. You require seam access, so you actually need to be in the mine underneath the entry point of the drill rig so you blind drill into a roadway with a large drill in the order of 300 millimetres or thereabouts, and once you strike the mine workings and into the coal seam, you actually put a backreaming head on that drill string and ream the hole or ream the shaft back up to the surface. So it's quite attractive. The downside is that you can only do it in the right sort of strata. If you have weak strata then it's actually got to be self-supporting for sufficient time for you to be able to get back into that shaft and support it and that's typically done in a remote means with shotcreting, so you actually support your way back down through it but it needs to be self-supporting for sufficient time to get that secondary or to get that support in there.

Q. Does the collapse of that vent shaft during boring tell you anything about the appropriateness of the method chosen?

A. Well the method's fine it's just the wrong structure, the structure wasn't up to standing for that, sufficient amount time to get in and support. So wrong method for that strata. And I might add that that's one of the things that you're trying to determine in identifying the rock strata that you're working in.

Q. Should it be possible to understand the strata sufficiently in advance to choose the right method of making a shaft?

A. Yes again. It's an area for experts as far as geologists and geotechnical engineers in combination with experts that do that sort of, the particular type of method of access. It's only one of a number of methods of access. Again, it's by degrees, it's not absolute. It's not as if we're constructing a civil design, it's not a bridge that we can fully design. We're working within parameters and percentages of accuracy.

Q. What are the other methods which might appropriate to weak or weaker strata?

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A. Well you can simply do a blind sink from the surface which is less safe to some extent because you actually have people in the shaft, but you're only excavating small parts of the shaft. You don't actually know what you're mining into until you get there, but what it does is it takes drill and blast and dig out the shaft, typically in the order of three metres at a time and concrete as you go down. There's also a compromise, almost a compromise method between raised drilling and stripping, or blind sinking, called strip and line, which is a small raise bore in the order of sometimes a metre and a half diameter, so same sort of principle as far as raise boring, but it's a small hole and you then strip the shaft down so it can be applied where you're less confident in the strata. Takes longer, costs more, but again it's about trading off degree of confidence in the strata with the method that you've got available. Sorry, the other, the last one is to actually blind bore. You can actually get a really big rig and just simply bore a five metre diameter shaft in one go. Tends to be done with mud, you actually fill it with mud. It tends to be self-supporting, a very safe method, not without its risks as far as – again, ground control but also not knowing where you're going and what sort of instabilities you've got in that.

Q. That ventilation shaft having partially collapsed, aside from rectifying that, ought a prudent operator to have then reconsidered the design of the ventilation system?

A. Not exactly sure, it's a structural failure. That's giving indication of issues with the geology. The shaft itself is your prime means of ventilation so there needed to be – we still need to retain the ability to ventilate some way, so you've still got to get connection to the shaft or provide a shaft or some other means of returning that air to the surface and installing a fan. But the actual collapse is more indicating that there's an issue with the geology rather than the knock on ventilation.

Q. Ought a prudent operator to have reconsidered the adequacy of its knowledge of the strata?

A. Absolutely, yes.

Q. And to the extent to which that knowledge was considered insufficient then undertake more exploration?

A. Yes.

Q. And ought a prudent operator to have reconsidered at that stage the adequacy of the emergency egress?

A. Definitely.

Q. Just want to turn to methane drainage, what are its main benefits?

A. Well, your – the aim is to work – if we consider the hierarchy of control and without wanting – I don't know if you've looked at risk management principles, but considering the hierarchy of control, in a risk management perspective, we're trying to move towards and engineering-type solution to a hazard in a mine and by that we're reducing the amount of energy that's there through the methane, so you're actually trying to get the methane out of the resource before you put people in there, or put people in that particular area, so that's the objective. And then there's a number of ways you can go about doing that.

Q. And consequently it also reduces the gas load within the mine?

A. Yes, so you're reducing the overall gas load. You're reducing, to some extent, you're reducing the dependency on ventilation, if you like. You don't need as much ventilation to manage the gas. You've still got to manage, obviously, the heat load, the dust load, what gas is going to be released and make it fit for people, for humans to be in.

Q. And does it also reduce the outburst potential?

A. Yes, it can do and certainly that's one of the primary means of reducing the risk of outburst. Again, we're looking at what are the thresholds for outbursts, so – outburst doesn't, isn't a phenomenon that occurs everywhere, but it's a case of understanding the nature of the gas and the hazards so that if you get into those sort of – those risk areas, then you need gas drainage to manage that threat.

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Q. And in a situation like Pike where you've got a thick seam with predicted high permeability and a methane content of six to eight metres a tonne, methane drainage would have worked?

A. Yes absolutely.

Q. You said there are a couple of ways of doing methane drainage. One of them is to do surface to in-seam drilling, is that right?

A. That's correct, yes.

Q. Just explain that briefly?

A. It's a relatively, well I was going to say it's a relatively new development. it's something that's been around for a long time in gas development in gas resources around the world, but from a coalmining perspective it's a relatively recent development whereby you drill holes from the surface into the seam and it typically comprises two essentially at least two holes from the surface. One tends to be a vertical well, the other one will be an inclined well and they actually intersect. So you drill a vertical well down to the seam horizon. You drill an inclined hole some distance away, maybe a kilometre or more. You drill that on an angle to intersect the coal seam and then to continue through the seam itself. So you're actually drilling the hole through the seam and then to intersect the vertical well and it's a case then of draining the gas through that particular hole but to the surface. So you'll have the same sort of installation on the surface where you've got pumps and so on to extract it.

Q. And I take it, an advantage of that is that it can be done well in advance of development of the mine?

A. You can do it any time you like really, and the further away the better. But it's obviously a, it's a cost impost but it's also a cost benefit in the sense that it becomes a commercial resource.

Q. And because the gas is no longer there to the same extent, it actually removes the risk during the development stage?

A. Reduces, reduces the risk.

Q. And presumably could also reduce the need for infrastructures such as a methane drainage system underground?

A. Yes it could do, yeah. It depends on the characteristics and the permeability of the coal. If the coal is highly permeable it will still draw methane in there, but by the same token your gas drainage is also going to be drawing gas from much further away if that is the case.

Q. Do you know whether surface to in-seam drainage could have been done at the Pike coal-field?

A. No I don't and I would presume that it would be difficult given the terrain.

Q. There are various reports which suggest that the methane level in the coal-field could have been reduced by a gas drainage to somewhere between four and five metres cubed a tonne. If that had been done, to what extent would that have impacted on the risks underground?

A. Well it certainly would have reduced the gas load on the ventilation and they're the typical ballpark figures that we aim to achieve with drainage before you actually go mining, and primarily for that, simply to reduce the volume of gas that's going to be released and to make it so that the typical ventilation can manage it. The issue is there's only a finite amount of ventilation. You can't just continue to put bigger and bigger fans in just to suck more air through a mine.

Q. Ms Basher, could we please have DAO.012.02486-8?

WITNESS REFERRED TO DOCUMENT DAO.012.02486-8

1245

Q. This is part of a document of Drive Mining Pty Ltd by Miles Brown, entitled "Gas Drainage Assessment" and dated 15 May 2010. Can you see underneath the blue table is the following advice. "This schedule highlights the fact that draining such a thick seam without a large lead-time or enough data to quantify an accurate decay curve, leads to the conclusion that if there is eight metres cubed to tonne of gas then development rates will be affected. The solution will be to gain more knowledge quickly and if high levels of gas are found, introduce the smaller spacing of drainage holes. This will increase costs, however, will assist with increasing development rates."

A. Yes.

Q. Do you agree with that statement?

A. Yes I do.

Q. Not only did Pike River prudently need to conduct the right pattern of drilling but also allow sufficient time for drainage prior to production?

A. Yes, and that goes to your earlier point as far as getting it down to four to five cubic metre a tonne.

Q. Ms Basher, could you please put up DOL3000.130009/1?

WITNESS REFERRED TO DOL3000.130009/1

Q. You've already said to Mr Mander and also in your witness statement that this wasn't appropriate or designed best for methane drainage but can you comment on the ethicacy of the in-seam drilling shown there as a gas drainage device?

A. I suppose the points I was alluding to were if you look at the primary layout of the boreholes, this one is very much, it's not doing anything as far as the mining area is concerned. This hole, or these series of holes up through here are almost to the point of heading in the right direction for drainage except you really want to keep them away from the working areas so once it's intersected it becomes less than effective. The holes that have come through here and everything seems to be –

Q. Sorry are you able perhaps to identify those holes as you go, for example, I think the top one there is GBH11 is it?

A. This one's 11.

Q. Yes.

A. Up through panel 1, I think that's 11. I think this one's hole 8, I can't remember all of the others.

Q. So perhaps if we start from the top and if you can describe how effective they are as a methane drainage device?

A. Okay, as a methane drainage device hole 11 really isn't doing much other than taking, it would be taking some gas out of this area but as the point I've made previously, it then becomes a feeder into the goaf, albeit that it had, had they been tracking the gas decay out of that area it had reduced significantly but it was still providing gas feed. The problem is that there's nothing in this area so you've got, I don't know, 100-odd metres of coal that's not had any de-gassing.

Q. That's 100-odd metres between the in-seam drilled hole GBH11 and GBH13?

A. Between these two holes, yes. The other thing is that once you intersect them and I don't know if this hole was intersected but the intersection then renders the hole somewhat redundant but what you would do in there ideally, is to drain up to, so this hole here is providing some sort of cover. Ideally there'd be similar sort of approach up here. It's difficult because you just can't get in there to do the drainage straight up so that also needs to be taken into account. So you literally aren't in this area until you've mined in there but there would be drainage as soon as possible really up into this area and pushing up into these areas. Or indeed, closer spacing of these holes in here to at least de-gas the entire area but to do that we're talking about the pipe range that Mr Brown is referring to.

1250

Q. So does that mean that that pattern at Pike River would've been an ineffective pattern?

A. Well, it's not going to drain the entire resource.

Q. If I could please Ms Basher, ask you to put up DAO.001.04909/25?

WITNESS REFERRED TO DOCUMENT DAO.001.04909/25

Q. We have that same numbering issue from last year, sorry, Commissioners. This is another report of Drive Mining Pty Ltd, Miles Brown, this time dated 22 July 2010, to Pike River Coal Limited and you'll see that he sets out a proposed pattern of drainage. In your view, would that have been effective in draining the seam?

A. Well, it's certainly a lot more effective than what was there, and that's pretty much what I've alluded to in my previous comment, is a pattern similar to that.

Q. Does that mean that had that advice been followed, that the methane content with the coal seam would've been reduced?

A. In those particular areas, again, it's localised, but yes, those, that was the area that you're trying to target, so it's about minimising the gas reserve or reservoir in the particular areas that you're going to mine.

Q. And would that have been effective in minimising the gas in the areas of mine that had been developed up to the date of the explosion?

A. Yes, it would've.

Q. Provided that there was sufficient time allowed?

A. Yes, it's time. There's also another factor and that is the orientation of holes. One of the things that you find is hole orientation can be better or worse depending on some of your coal characteristics, but given the nature of from what we understand of the drainage and the gas that was coming out, one would conclude that that drainage pattern would still work.

1253

Q. And you'll see that immediately below that table, the line, "The recent in-seam core results of panel 1 of 8.25 m^3 a tonne was considerably higher than expected and represents additional challenges to drain."

A. Yes.

Q. Then Ms Basher, if we could go to three pages further along in that document. I'll just read this. There's a statement, "If ever the DRI 900 limit is exceeded, then development must not mine this area until drainage has occurred and a new core sample has been taken and found to be below this value. As Pike River is approaching the outburst threshold limits, additional drilling should be conducted to both drain the coal of gas but to understand the gas reservoir."

A. Yep.

Q. How, in your view, ought a prudent mine operator to have responded to the advice given in those statements?

A. What he's alluding to quite simply is that there needs to be a diligent assessment of the gas content in the mining areas, and for us that would mean a fairly rigorous process of drilling and taking cores in the seam ahead of mining to determine the actual content and to ensure that you had drained the coal down below those threshold levels, and I mean this is getting on from beyond that into the threshold levels but you simply don't mine.

Q. Concluding, you simply don't hydro-mine?

A. No, no. It depends where it is. Anywhere you get it in excess of those thresholds you don't mine until it's drained down to below the threshold.

Q. Can you just explain that threshold for us?

A. In Australia there are a couple of thresholds and it depends, and without going into too much detail, but there are numbers and there's a graph if you like that indicates the thresholds above which you're actually prohibited from mining from a gas perspective, particularly in that bulli seam, but now being applied to any seam in the country.

1256

Q. And that threshold is?

A. Oh, well, it varies between six and nine cubic metres a ton, depending on the content of carbon dioxide and also how much you know about the seam itself, as far as geology and so on. So, what Mr Brown was alluding to there is that if it ever got up to nine cubic metres a ton at 100% methane, then you'd be at that threshold.

Q. His advice of 8.25 metres a ton was in respect of panel 1?

A. Yes.

Q. Does that mean that was sufficiently close to nine to require more testing to be undertaken in that area of panel 1?

A. You would certainly – and that's what he's alluding to, you'd certainly want to be getting more information just to see, well, to get a better idea of how close, how high it was. One pinpoint, if you like, one part of the 10 metre seam starts to indicate that you need to look closely.

Q. Ms Basher, could we please have up again DOL.300013009/1?

WITNESS REFERRED TO DOCUMENT DOL.300013009/1

Q. Once again this is the map of the in-seam drilling done and I'd just like to understand the effectiveness of the drills around panel 1 at draining methane. You'll see just to the right of it there appears to be a in-seam flanking hole, is that correct?

A. Yes, that's correct, yes. This one here that you talking about?

Q. Would that have been sufficient to drain the methane within that area?

A. That certainly would've been far more – quite effective. That's the sort of thing that you'd want to see but you'd also want to see the same thing repeated over the other side as well.

Q. Well when you say, "It's the sort of thing you'd want to see," the one on the right, am I correct, had been done?

A. Yes.

Q. But the problem is that it wasn't met by an equal flank and one on the left-hand side?

A. Yes, that's correct. One of the things you need to determine and to some extent it's through trial and error, is just how far the effectiveness of your drainage, so you can actually and should start to determine how far from the hole your gas is being drawn from and you do that by a series of cores.

1259

A. So you actually drill, drain, core, you get an idea of time to drain and indicative of how far away from the actual hole itself that you are having an impact, and that helps you design your system so it's not a blanket 20 or 30 metre coverage of a borehole, it could be more, it could be less, but you actually need to determine that.
Q. And just to look at the consequences of not having an effective pre-drainage system, there are a number of instances in the accident/incident schedule that I understand you've looked at?
A. Yeah.
Q. That refers to methane layering and accumulation?
A. Yes.
Q. Could those have been avoided or the chance of them occurring have been reduced by pre-drainage?
A. Well certainly. The gas is there. Pre-drainage is going to reduce the quantum of gas, but I would hasten to add as well it's a combination. It's always a combination. There's ventilation issues as well.
Q. And just finally on this topic, does that mean that to the extent to which the first explosion might have been fuelled in part by accumulated methane, then that could have been reduced by having an effective gas drainage system?
A. Yes.

COMMISSION ADJOURNS: 1.00 PM

COMMISSION RESUMES: 2.01 PM

CROSS-EXAMINATION CONTINUES: MR WILDING

Q. Mr Reece, we were talking about the methane drainage system before the break and I'd just like to turn to the methane drainage system that was installed?

A. Yes.

Q. You've said in paragraph 98 of your statement that it was "under-designed." What are the key characteristics of a system that you say would've been appropriate?

A. The main characteristics that we're concerned about as far as under-design is really in response to Mr Browns report talking about the size of the pipeline and the rise to some extent but also the lack of any process of evacuation, so of pumping, in the drainage range itself, but then also the boreholes themselves and the number and location.

Q. Does that mean that you agree with Mr Brown's report in so far as the gas drainage system recommendations are concerned?

A. Yes, I do and that comes obviously from his status as an expert in the field and my own practical experience.

Q. And would it be right to infer from your evidence at the outset that the need for such a system as that recommended by Mr Brown is something that a prudent coal mine operator ought to have been able to ascertain in advance?

A. Yes, and certainly it was indicated in reports that were provided. Sorry, provided to Pike River by organisations such as Minarco.

Q. Ms Basher, could I just have please NED0010070105/5?

WITNESS REFERRED TO DOCUMENT NED0010070105/5

Q. This is a page of a Ministry of Economic Development Petroleum report series, PR4227, "Monitoring report on in-seam gas levels and flow rates, Pike River Coal Mine, author Mr Van Rooyen in 14 October 2010." And you'll see that in paragraph 2.2 he says, "During the reporting period two major events resulted in poor or no gas flow readings being possible.

1404

Q. The first was ventilation constraints due to the ventilation, main ventilation shaft collapse. And the second being the underestimation of the watermake in the in-seam drillholes resulting in the gas drainage reaching full capacity in pressurising not allowing holes to be safely accessed for measuring." I just want to turn to the water content. Is the significance of that that it can cause blockages to the methane drainage system?
A. Yes it can, not uncommon.
Q. And once again, that water content is something which ought to have been able to be ascertained in advance?
A. Yes, it's something that you look at in the exploration process.
Q. Are the poor or no gas flow readings of concern to you?
A. Well, yes. That's what the drainage system's there for. It's not working it's blocked.
Q. How would you say a prudent operator should measure the gas flow?
A. To measure the gas flow?
Q. Yes.
A. Okay, well, there'd normally be dedicated regime of periods that you'd actually go and measure and there'd also be a technique of measurement so, and typically that's done with orifice plates, but without getting into the technicalities, there's particular techniques and particular times and locations that you would take it to check.
Q. The Department of Labour report in paragraph 34.3 recommends that Pike River should have installed a real time flow sensor and a pressure sensor. Are they sensors that are commonly installed in drainage systems?
A. Yes they are, they tend, what it's looking at, you don't have multiple ones of these. If you put them too close to the actual drainage range it can be affected, so you typically look at sectionalising the range and putting some real time monitoring in that.
Q. And would those monitors have fed into the SCADA system?
A. Yes.
Q. How would the information from those have assisted Pike River?

A. Oh well, it gives you very quick, or, relatively quick indication of health of the system, so you typically graph it and see that there’s a decrease in trend or a problem developing so it provides for early response.

Q. So they would have picked up with any issues such as blockage, straight away?

A. Yes.

Q. You referred in your evidence-in-chief to a suction system?

A. Yes.

1407

Q. And the Department of Labour report at paragraph 3.5.2 says, “It is not clear why a suction unit without a flare could not have been installed on the Slimline riser and this was a step PRCL should have taken to improve the efficiency of removing methane from the mine.”

A. Yeah.

Q. Is a flare the same as a flame arrester?

A. No they’re different things. A flame arrester was installed on top of the gas riser and all it is, it’s just a protection mechanism so that as the gas is being released from the riser there's a gas cloud. There is a chance that that could be ignited by something like an electrical storm. You don't want that ignition to be going down into the hole, so you have a flame arrester on top of the hole to protect against that. A flare is a different thing. It’s where you intentionally combust the methane that’s coming out of that riser to convert into carbon, but largely into carbon dioxide. So they're two different, two very separate and distinct techniques.

Q. Because Mr Borichevsky is recorded in paragraph 3.5.2 of the Department of Labour report as saying the following. “A suction unit and flare were planned for any new riser and this option was considered and rejected for the slimline riser because of the proximity to the main vent shaft and the hazard of igniting the airway.”

A. Yep.

Q. Is that a reasonable approach to have been taken?

A. I can understand the logic. Obviously if you've got the riser near a vent shaft you run the risk of compounding the effect of the two and you wouldn't want to have a flare certainly at that point near the shaft. That doesn't preclude the technique potentially moving it further away, having the riser at a different location so its proximity, or the other thing that he's talking about is indeed don't flare, don't burn it.
Q. When you say moving away?
A. Mmm.
Q. Does that mean Pike River could have simply installed a pipe at the top of the riser for however many metres?
A. Yep.
Q. And had it venting elsewhere?
A. Yes.
Q. And that would have alleviated the issue to which Mr Borichevsky refers?
A. In simple terms yes, but again I don't know the topography but yeah.
1410
Q. You also referred in your evidence-in-chief to a discrepancy of 113.2 litres a second between the gas flowing into the line and that at the riser. According to the Department of Labour report that discrepancy was evident at the beginning of October, and am I right in understanding that discrepancy was still present then in November?
A. As far as we know, yes.
Q. What steps ought a prudent mine manager to have taken, or operator to have taken on becoming aware of that discrepancy in October?
A. Oh, well, it's a case of finding what's causing it and correcting it, but typically that would be we'd have somebody with the dedicated responsibility for looking after that system.
Q. Is that discrepancy matter that ought to have been looked into and rectified urgently?
A. Well it should be, given that it's a control system that you have available to you. I suppose the only other side of that is that it's not actually

draining a huge amount, but nevertheless, it is a control mechanism that you want operating for you, so you'd be setting about to correct it.

Q. And depending on where it is, it's potentially adding to the accumulation reported in the mine?

A. That's correct, particularly if it's a leak rather than a blockage.

Q. If we can go to page 6 of that same MED report please Ms Basher? Now this is that same Ministry of Economic Development report of October and you can see in that table the third row up that the drainage line is at full capacity some time just around March 2010. What steps ought a prudent operator to have taken at that stage, in response to that?

A. Well, the simple answer would be to get some more capacity by whatever means. It depends to some extent what the knock-on effects are of that, if your ventilation capacity was managing it, then you're still within the bounds, but if the drainage range is at capacity, then you've got none left, you're only reliant on ventilation, so the options available to you is to, as Mr Brown has indicated, larger pipes or suction, or both.

Q. Now, Mr Brown in his report of May – so this is DAO.021.02486/11 – says, "If the current four inch pipeline was replaced with a 10 inch pipeline to the current six inch riser, then pipe pressure would be manageable flows of 100 litres a second." Do you agree with that?

WITNESS REFERRED TO DOCUMENT DAO.021.02486/11

A. Yeah, the only thing I'm a little, I'm not quite sure about is what the 100 litres a second is referring to, that's just, it doesn't quite stack up to me. You would have more than 100 litres a second in that pipe range. He may be referring to the 100 litres a second per hole for the number of holes that were there, but I can't comment on that.

Q. Do you agree that replacing that pipeline as he suggests was a prudent step to take when the line reached capacity?

A. Yes, yes.

Q. Would that have avoided the need to free vent?

A. Well, that’s my understanding that was the objective that he was looking for with that, so you’re actually reducing the gas load on the ventilation on the mine itself.

Q. Is free venting regarded as a prudent practise nowadays?

A. Oh, it’s a stopgap measure. It’s, from my understanding, it’s not done these days, and I probably haven’t seen it for I guess about 18 or 20 years.

1415

A. It was something that was done to try and move the problem from the direct mining area and put it directly into a return, so it’s about moving the problem whereas these days you would have some sort of a pump arrangement to assist in getting it out of the mine. To some extent it depends on the magnitude of the gas that you’ve got.

Q. I wonder if I can take you to the diagram of the in-seam drilling which was done again, DOL3000.130009/1?

WITNESS REFERRED TO DOL3000.130009/1 - DIAGRAM OF IN-SEAM DRILLING

Q. Are you able please to, with the pointer, point to where there was free venting and first describe the location and second describe how it might've contributed to an accumulation of methane in any particular area?

A. I actually couldn't do it with accuracy at the moment, mainly because I know that there's a list of holes that were connected, it would be by difference, I'd actually have to go back through the plan and identify the ones that weren't connected but it’s predominantly going to be, the ones that are free-venting, would only be free-venting into the returns. You would not have, or you would aim not to free-vent boreholes into an intake. So I couldn't actually identify them specifically.

Q. Well we might seek some information later of that case.

A. Sure.

Q. If I could just turn to the root of the methane drainage system and you referred in evidence-in-chief to the potential for it to be knocked by vehicles?

A. Yes.
Q. Is it prudent practice to place the infrastructure, such the methane drainage pipe and the compressed airline et cetera, in the locations that they were placed in Pike River?
A. To a large extent, other than where it crossed over the intake, so you would normally aim to keep it in the return and keep it away from that vehicle traffic. So the area around Spaghetti Junction and into the fresh air based area was problematic.
Q. Right. And would you normally have it out of the way of vehicles either being underground or at such a high level or a place that it couldn't be hit?
A. Yes, you typically wouldn't put it underground. You'd generally elevate it, keep it up high, visible and as far as you could out of the way, so in one top corner of the roadway and again, as I say, ideally in the return not in an intake where you've got vehicles frequent.
Q. If you weren't able to place it completely out of potential path of a vehicle, would it normally be protected, for example, by some barrier or other piping?
A. That's often the case with services. You generally tend to do that in a lower area, more confined area so it's a case of design, engineering design and yes one would protect, particularly if it's only 100 ml pipe, you'd certainly be looking to protect that and it's quite easily done with a half pipe that can be made as a shroud or a surrounding of it.
Q. And you're aware that the riser was located at or near the fresh air base number 2?
A. Yes.
Q. Is that considered prudent?
A. Not if you want it as an actual fresh air base. They're actually conflicting if you like. Fresh air bases intend to be, and that's an unusual term from our perspective, but nevertheless, I'll go with it. It was to a more, from a Queenslander/Australian perspective it was actually intended to be a refuge, a place of refuge with fresh air but you wouldn't have something

of a hazardous nature like that in that sort of a location, you'd want to keep them significantly separated.

Q. When you say, “Significantly separated,” does that mean a certain distance or a different roadway?

A. A different roadway, you wouldn't have them anywhere near each other.

1420

Q. Other locations of the range and in particular the riser and the fresh air base something that ought to have been of concern to a regulator?

A. Yes I believe so.

Q. If I could just turn please to a different topic which is the ventilation system and some of its components, and I want to first turn to the placement of the main fan underground. What are the risks associated with having the main fan underground?

A. Well there's a number of them, the obvious one being that if there is something that happens, if you get an explosion, it’s in direct line of fire or an expected line of fire so there's potential damage straight up. There's also a difficulty with access simply because of the nature of it being underground and mines aren't, you don't always have electric power, so if you use electric power to the fan you've lost the fan. Similarly, it’s potentially in a mine where there's gas, if you have problems with the ventilation for any other reason, for instance a ventilation stopping were to be breached and there's a gas build-up you actually have to stop that fan simply because of the gas build-up near the motor. The motor would be the thing that I would be concerned with. So they're the main ones that come to mind.

Q. Are they matters that ought to have been picked up on in a risk assessment at the time of consideration of where the fan should be?

A. I would expect so.

Q. And are they matters that would have been weighted as having potentially catastrophic consequence?

A. Certainly, if you've got an explosion and the fan is damaged I would think so.

Q. The Department of Labour report page 106 at paragraph 3.8.23, states that there should have been a forcing fan at the entry. I take it that would have overcome those catastrophic risks to which we've just referred?

A. That's a novel approach. It's an attempt I suppose by us rather than to say well this is insufficient, to then say well what are some ways around it, given the difficulties that they were facing, and it was a suggestion, as I say, albeit it novel that that could have been a way around it to provide easier access to the fan to take it away from or take it out of those particular problems that I've just noted. It was also something that had been suggested by one of the people at the mine.

Q. Have the experts undertaken any modelling to ascertain the efficacy that a fan in that place would have had in ventilating some of the more difficult to ventilate headings that you referred to in paragraphs 47 to 49 of your witness statement?

A. No we haven't.

Q. What other alternatives might there have been to a fan in that location?

A. Well there are other options. You could have an exhausting fan there, but that would introduce problems in itself because you'd then be travelling and that would become your return. That's not ideal. There's also combinations that you could look at. You could actually have a forcing fan there as a backup, so use a combination of forcing fan and exhausting fan on the shaft, on the surface of the shaft.

Q. And that means that the fan at the top of the vent shaft would have then become the main fair?

A. Yeah, but again you need the capacity there. So potentially you could put a fan there with the capacity to provide you with that ventilation. The concern from my understanding is the difficulty to get access to that location. You could potentially have a forcing fan backup in case you lose the exhausting fan and can't get access to it. But again these are novel solutions. Indeed, the underground fan is a novel solution, but we're talking minimisation of the level of risk.

1425

Q. Now as I understand it, the main fan wasn't flameproof or intrinsically safe?
A. Just to qualify that, the motor on the main fan, yes.
Q. Is it an acceptable practise to have non-flameproof or non-intrinsically safe equipment underground?
A. It is in areas of known fresh air, so that's the stipulation.
Q. And we saw yesterday the line delineating the restricted from the non-restricted zone?
A. Yes.
Q. In the course of the investigation, did you become aware of any rationale for determining where the placement of that line was?
A. Not that we could find. That's not to say that it's not there, so, but not that we could find.
Q. Is there a rationale for that type of placement in Australia?
A. Yes, it generally tends to be due to mining areas and mining activities that are near it and the likelihood of fresh coal and gas concentrations that are likely to be near it, so it tends to be by location and coupled with mining activities, and then obviously it links in with the type of installations you'll have, be it a flameproof or non-flameproof.
Q. In Australia is it permissible to have non-flameproof or non-intrinsically safe equipment in coal measure in a gassy mine?
A. Yes, it is. But, again, it's under controls and up to particular locations that have been identified.
Q. If I could just ask Ms Basher please for DOL300.01300.07/45?

WITNESS REFERRED TO DOCUMENT DOL300.01300.07/45

Q. And this is a map on page 44 of appendix 6 to the Department of Labour report. If we could have please Ms Basher, that top box expanded? And that's essentially an aerial sketch of the underground motor and fan, is that correct?
A. That's correct, yes.
Q. And am I right in saying that that doesn't appear to show any explosion protection for the motor?

A. Oh, no – well, it doesn't show explosion protection for the motor, but the motor is in fresh air and it's separated from the return air by the stopping, so in a sense, there is some protection from explosion in the sense that it's in the fresh air, but the problem becomes if an explosion travels from the return through to that way, how much damage it's going to cause; what rating that stopping is; what the confidence in the protection of the fan firstly, but also the motor in the second instance. So it's not an issue per se as far as the motor being explosion protected and creating a potential explosion because it's in fresh air. It's more a case of a resulting explosion of damaging the installation.

Q. Would it have been possible to have, for example, doors swinging open to enhance the protection of the motor against the force of an explosion blast from the area which says "air flow"?

A. Yes, I don't know. I think this is something that we'd need to put our minds to, just how you'd go about that and how practically you would do it? We certainly haven't sat down and thought about how you would do that, because you actually need the fan to be in the air flow, but what we're talking about is to have a bypass that's going to operate so that the fan is taken out of the air flow. It's not immediately apparent from that drawing.

1430

A. You may well rely on a different installation whereby you had other roads that could potentially open as a short-circuit if you like. I expect that you could do it but we haven't turned out minds to how you would do it.

Q. Is something such as a bypass something that you would expect there to have been consideration given to given the importance of that fan and its novelness?

A. Yes definitely. In the same way that if you've got a surface fan you have a bypass arrangement on the actual evase of the shaft so something that allows the free venting of the explosive force before it gets to the fan.

Q. And that's not apparent on that part of the diagram, is that correct?

A. Not that I can see. There's a description of a bypass airflow here but I'm not, and that would be in this area as well, that's the, from my understanding this fan installation would eject through that but there would be louvers beside it so that if the surface fan, for instance, needed to start up, then this bypass would allow air to flow through it but that's the only thing I can see as far as any bypass arrangement's concerned. But you still have the fan pretty much in direct line of the impact of anything coming through here.

Q. Is it possible to design roadways so as to prevent equipment such as a main fan being in the path of an explosion?

A. Well, that's what I say. We haven't done it. It's novel because there just aren't fans of this nature installed underground. There are booster fans that are installed in a couple of mining installations, certainly in Australia. It's not uncommon to have booster fans underground in other countries, but it needs to be indicated pretty clearly that they are an adjunct to the surface and main fan installation and each time they're done they have a similar bypass arrangement to this. You could conceivably widen out that area.

Q. When you say, "Widening up that area," you talk about the area marked "fan exit bulkhead with bypass louvers".

A. Yes so you could either cut this open or potentially put another roadway in there that you would seal off with a less rated, a lower rated stopping, if you like, so that it became the preferred slip route, if you like, but look really it's just off the top of my head and we'd need to sit down and give that some serious consideration. You still need to manage the trajectory of any force that comes in there, so potentially, that installation just as it is wouldn't suffice. You may need to look at a complete redesign.

Q. Right, but management of that force would be an important matter given the novelness and importance of this fan?

A. Absolutely, absolutely. As I say, the same as the surface installation.

Q. Just turning to the surface auxiliary fan.

THE COMMISSION:

Q. I wonder if you can just help me with a couple of things about that plan. It's not your plan I take it?
A. No it's not, no.
Q. Do you know who drew it or?
A. No I don't actually. It was actually provided to us by the Department of Labour in the material that they had obtained.
Q. The airflow that is shown coming in from the bottom with the label "airflow" that's from the return?
A. Yes, that's correct.
Q. Whereas the motor, as you've pointed out, is beyond a stopping and positioned in fresh air?
A. That's correct.
Q. Right. What are these things called machine doors?
A. Okay, these are the double doors that separate this return from the main drift that runs up here so they're the 35 kilopascal air lock between those two roadways.
Q. And just one other detail. The fan is exhausting out to the main vent?
1435
A. Yes. The airflow, and this is something that needs to be understood about how centrifugal fans work. The air is actually drawn into the fan itself. This is the fan rotor if you like, and the air is drawn in through a bell housing into that fan and then it's spinning that way, but I'm not exactly sure if it spins over the top or underneath, but either way it spins and flings the air out through a discharge point potentially through that bulkhead and up into the shaft.
Q. Presumably this is diagrammatic. The base of the shaft would not be as close as that to the fan, or do you not know?
A. I'm not sure of the scale of this, but if you look at the bottom that – oh it actually shows the fan which way it's spinning. So it's flinging air out of here. This goes into the base of the workings, then it would go up the Alimak, then across that short horizontal drive and then into the actual

main shaft itself. So it's up through this point, up the Alimak, across and then further up the shaft.

CROSS-EXAMINATION CONTINUES: MR WILDING

Q. Just turning to the auxiliary surface fan. I think I'm right that that receives its primary power via and electricity cable that ran through the drift and up the vent shaft?
A. That's correct, well that's my understanding yes.
Q. And if the primary power tripped then, of course, it would lose power and be reliant on backup diesel generators?
A. That's my understanding.
Q. Am I right in understanding that only one of the two generators possibly started on the day of the first explosion?
A. I think, well I'm not exactly sure but I know that there were issues with that starting up.
Q. Was that arrangement with its electricity being received up the vent shaft and backup generators a satisfactory arrangement for a backup fan?
A. It's one of those things that is a difficult situation because you've got to power it. Putting power to a surface installation through an underground part of the mine is not ideal because you need ventilation in order to introduce electricity into a mine and if that electricity is powering the fan then it becomes a double jeopardy to some extent. You can't have it both ways. You can't power in the cable to start running the fan because you need the fan to create ventilation so that you can introduce power.
Q. It was foreseeable that if methane caused the main fan to trip, then power would always be lost to the auxiliary fan and it would be reliable on the generators?
A. That's correct.
Q. Am I right that the experts had concerns about the placement of the main auxiliary fan and motor?
A. Yes to some extent, yes.

Q. What were those concerns?
A. Well again it’s about protection of the fan on the surface and the point is, and again this has been established through bitter experience, you need to ensure that that surface fan is protected so you have again some means of bypass so that the prime force that potentially comes from the explosion doesn't damage your fan so that you've still got ability ideally. I mean it’s not perfect, but some ability to restart that fan and get ventilation going again if you lose the fan indeed. There have been instances where the fans haven’t stopped in those situations.
Q. And in this case what was wrong with the protections that were being used?
A. Well the protection was actually after the fan itself. Again, the fan was somewhat out of the line of fire, but there's some concern there, and those explosion flaps or explosion doors, we have some concern that they were under-designed, too small in nature. Also have some concerns that they may have been a little bit too robust in the sense that they may not have easily released or been blown off.

1440

Q. Just on your first point, was that suggesting that the fan and motor ought to have been placed a further distance out of the way of a potential blast up the vent shaft?
A. Well, potentially on the other side of the explosion flap, so that any force went through the flaps before – and that was placed before the fan.
Q. If I could just have Ms Basher please, DAO.001.00359/17?

WITNESS REFERRED TO DOCUMENT DAO.001.00359/17

Q. And you’ll see that this document is entitled, “Review of surface auxiliary fan failure 051010”. And then under that dated, “7 October 2010”?
A. Yes.
Q. And the first sentence under the event reads, “On 5 October 2010, at 9.45 pm the auxiliary surface ventilation fan (currently used as a main fan while underground fan is being commissioned) failed.” Then underneath, the second and third to last lines, “The failure of the surface

auxiliary fan was the second of this type of failure. The reason is yet to be determined by the engineering department." Do you see that?

A. Yes.

Q. I want to ask you a question in relation to the prudence of mining. You are aware that the main underground fan was finally commissioned on 10 November 2010?

A. Yes.

Q. And the Department of Labour report at page 101, paragraph 3.8.4 says, "The underground fan FA001 was then commissioned on 22 October 2010 but almost immediately ran into problems with the power to the electric motor tripping, as a result of ongoing faults with the liquid cooled." It essentially goes on to say "VSD". Do you have any concerns about production and development occurring given the proximity of those two events affecting the sole two sources of ventilation to the mine?

A. This, given as I said that your fan is pretty much the heart of the ventilation system and without ventilation you don't mine, then it's certainly becoming highly critical, your two fans are – well, the surface fan has had a problem, albeit that not necessarily indicated as an ongoing problem, but nevertheless there's a problem with it and at the same time you're commissioning that main fan, so both or your systems are to some extent not stable.

Q. And presumably caution is required when such important systems aren't stable?

A. Yes. It's an unusual situation for a main fan at a coal mine to be unreliable. I'm not talking about this event. As I say, the intent is that it is, it's one of the fundamental pieces of equipment that you must rely on and almost have a total commitment trust in the effectiveness of it.

Q. If I could ask Ms Basher, please for you to turn to page 19 of that same document? You've seen this document, Mr Reece?

A. Yes.

Q. This is part of that same review of the failure of the surface fan on the 5th of October 2010, and you'll see under improvements, there is a list of different items?

A. Yes.

1445

Q. Which of those would you say needed to be done prior to production continuing or development continuing?

A. Okay, a comment I make on this is that some of these are related to the fan, some are not, but nevertheless they raise concerns. So the first two not necessarily specifically related to the fan but I would have concerns with issues with communication underground. It's a little concerning that there weren't specific procedures to follow with regard to starting up those generators. Again, it's your lifeblood. The next two are systemic-type failures as far as spares and drawings. The drawing's essentially is not going to stop you but the spares could be an issue. IMT is an ongoing type of thing. Fresh air base is not related to the fan but it still indicates a concern, as does gas monitoring. So a lot of these don't particularly relate to the fan. But when we start to get into damper doors not working, that is particularly related to the fan. The mechanical inspections. It is to do with the fan and potentially why the fan got into that place in the first instance, but it's not something you're going to do to solve the problem now albeit that it does need fixing.

Q. If I can just pause you there, though.

A. Yep.

Q. Putting to one side whether they relate to the fan or not?

A. Sure.

Q. Which of these were sufficiently important to require rectification urgently?

A. Communication, maintenance system, the procedural stuff as far as particularly de-gassing, and again the procedures for starting up of the generators, so most of them. The last few don't really relate, I wouldn't, even though they're fairly important.

Q. The damper doors?

A. Yes. As I've indicated, the damper doors definitely.

Q. And the problems with the high risk of not knowing what levels were present underground due to relying on UPS par to real time monitoring?

A. Yes. So you want a high degree of confidence before you start up in full operations and you need to prove it before you go and do that.

Q. If I can just turn to a different topic, which is the adequacy of the ventilation. You have referred to in your witness statement at paragraph 68 to a serious lack of ventilation with the five working faces?

A. Yes.

Q. What were those five faces?

A. Well it's panel 1, the ABM panel, so without naming them it's wherever you had mining activity occurring from panel 1 inbye. So panel ABM panel, roadheader panel, continuous miner panel, and to a lesser extent where the drilling operations were going on.

Q. You said at paragraph 69 of your witness statement, "This means that there was less than 25 cubic metres available for each place requiring ventilation, not allowing for leakage."

A. And that actually includes the drill and blast place as well so end it that way.

Q. How much was required? And to explain, I'm trying to get an understanding of whether less than 25 metres cubic available is significantly too little or just slightly too little?

A. It would be nice to be definitive, but it depends on how much you're going to allocate for each location and that depends on how far it is and how gassy the area is. So on face value it could be enough, but if your gas load is too high it's really dependent on how much you need to get that methane level down below 1¼% in effect, ideally so that you can be operating in that area.

1450

A. It also depends on the amount of leakage that you have in the mines so just because you have 120/130 cubic metres available at the fan doesn't mean that that makes it all the way into the mine, so that's where we're coming from with our 25, that's maximum that you've got available with poor standard of ventilation devices and leakage of that air, you rapidly drop away from the amount of air that you've got available once it gets into that working area, in the actual working face.

Q. That system has to be sufficient to cope not only with the regular activities but also with unpredictable but foreseeable events?

A. Yes.

Q. And you would characterise a goaf collapse as an unpredictable but foreseeable event?

A. Yes but whereas, rather than talking about the actual ventilation quantity, we actually starting to talk about the ventilation devices, but yes. Or a combination of both.

Q. Well, I'm just wondering if the stoppings were built to 35 kPa, so that wasn't an issue in the explosion, would the ventilation quantity have been sufficient to cope with the goaf collapse?

A. Probably not in the sense that you would have high percentages of methane passing down that return which had happened previously. So explosive mixtures potentially going down that return.

Q. So between five and 15%?

A. Yes.

Q. You're aware of Mr Rowland?

A. Yes.

Q. If we could please have, Ms Basher, ROW006/4?

WITNESS REFERRED TO MR ROWLAND DOCUMENT - ROW006/4

Q. This is a page of a document by Mr Rowland of October 2010, but in fact signed 2nd November 2010, entitled, "Brief Report Pertaining to Current Model Update and Point in Time Circuit Capacities at Pike River Mine." And in the second paragraph he says, "There is somewhere around 120 metres cube a second of total air available which if all of this is utilised can service only four auxiliary fans running on full speed which allowing industry standard excess flows to prevent recirculation. This is aside from leakage or service flow so it is obvious that some increased capacity is relatively urgently required from a quantity perspective. As such it is evident that you will need to excavate the second intake and return paths as soon as practicable during the mining schedule." Do you agree with that advice?

A. That pretty much is inline with what I've just been indicating. The qualifier I'd say, and this is evident from the mine, that's with the fans running at full speed. So the fans had been and had to be de-rated from full speed simply because it couldn't get that amount of air to the faces.

Q. And when you talk about the fans you mean the auxiliary fans?

A. Auxiliary fans, sorry yes.

Q. Might not having those auxiliary fans running at full speed have contributed to the accumulation problems reported in the various incident schedules and production reports?

A. Exactly.

Q. Mr Rowland refers to servicing only for auxiliary fans, is that the same or can be equated with working only four faces?

A. Should be yes. But I would add, in saying that, it's not a case of having one auxiliary fan for each stub roadway. You can actually, and this is normal practice, you will have often two or even three parallel roadways with vent tubes in each one so they can ventilate quite a substantial area generally so I just want to make sure that it's understood that it's not just one single roadway it can be a couple of roadways.

1455

Q. I just want to turn to the ventilation system in November. Ms Basher, could we please have up CAC0115A/6?

WITNESS REFERRED TO DOCUMENT CAC0115A/6

Q. And this is a summary of comments contained within deputy statutory reports, dated November 2010 of Pike River Coal Limited and you'll see at the top, "19 November 2010." Fourth column, "Roadheader placed 4.3 metres high, off to the right, layering outbye of road keep Venturi on top to disburse CH4." Then under that, "19 November 2010." Fifth column, "3.5% in area 1 west 2RC heading."

A. Yes.

Q. Does that indicate that on the day of the explosion the ventilation and gas drainage systems were not sufficient?

A. Certainly to have those percentages of methane, says that there's a problem there and that the ventilation – certainly the ventilation system's not coping with it. It's probably worth is – we're talking about what, general bodies or have you?
Q. Certainly.
A. We typically talk about general body of air as a particular mining term to indicate that it's the full dispersal if you like of the air in the roadway so it's not a layer. So it's not just a particular location, or it's not the side of the roadways, it's actually spread throughout the body of the roadway. At 3.5% in the body of the roadway it may not be the only indication of gas. There may be high gases higher up in the roadway as well.
Q. And I won't take you to the DOL reports but if I just summarise briefly, according to paragraph 2.25.2 of the DOL report, the power usage shows that the ABM was almost certainly not cutting at the time of the explosion.
A. Mhm.
Q. Correct?
A. Yes, yes, that's our understanding.
Q. According to paragraph "2.26.13, power usage suggests that the roadway header was not cutting at the time of the explosion?"
A. Yes.
Q. "2.27.7, "There is no indication from prior usage that the continuous miner was cutting at the time of the explosion?"
A. Yes.
Q. "2.30.4, But from 12.20 onwards the monitor would not have been cutting because there was no flume water underground?"
A. Yes.
Q. "2.28.12, It is unknown if the drill rig was operating?"
A. Yes.
Q. Just at a first blush, it appears as though the system might be adequate because there's not much work going on, on the day, is that just too simple an analysis?
A. Say that again please?

Q. At first blush, it might appear to a lay person that the ventilation and drainage systems were sufficient for the conditions on the day?
A. Right.
Q. Because there wasn't work going on, it seems at four of the five different places?
A. Yes.
Q. Is that just too simple an analysis?
A. I think it's a simple analysis, but it's a fair comment, at the time, given what's there at face value. My – the concern we've got is that the ventilation as it stands is marginal anyway, so that's what we're struggling with, regardless of what operation was occurring.
Q. And notwithstanding that lack of work in four out of the five places, those extracts I read you from the deputy statutory reports of 19 November 2010, would suggest there was still a problem with the ventilation and drainage systems in combination on the day because there was still accumulation?
1500
A. There was and it's been noted in those same reports that they were struggling with boreholes in the ABM panel, so in the section that was up there.
Q. And am I right that there was significant cutting about 27 metres going on the day before?
A. The previous two shifts, yes, yep.
Q. And could that have led to accumulation, which might still have been present on the 19th?
A. It could have done. I don't know. It's not uncommon in a gassy mine to have particularly productive shifts to expose a lot of fresh coal and if the conditions are right if you like for that situation to have a continuing bleed of methane in the workings and create problems. But the other issue, the things that I suppose we focused on was the fact that they'd intersected or had intersected the borehole and potentially also had some problems with the ventilation system in the form of the vent tubes in there. Haven't substantiated that particular one but there are some

indications that there may have been some concerns with it. So we've got a gas source and ventilation issue.

Q. Ms Basher, could we please have CAC.0115A/9?

WITNESS REFERRED TO CAC.0115A/9

Q. Now if you look down the fourth row, 10 November 2010, and then under the flammable gas and general body of air, it says, "Plus 5% in area A Heading. Specific safety issues. Two boreholes in face and roadheader place. Top hole making gas. Put seven bags in. Hole gas flow dropped slightly." And if we go to page 10 of that, the fifth column down, the 8th of November, under flammable gas, "3.0% in area. A heading one west two right," and once again next to it reference to blocked gas drainage lines. I won't go through this more, but ought a prudent operator to have done in response to reports at that stage of accumulations between 3 and 5%?

A. They were two different mining locations. Some of the significances of those is the first one was the roadheader. So what was happening in there was that they were actually using the roadheader in A Heading to mine back towards the pit bottom area, and I located particularly as far as cross-cuts, but the concern is they've actually got a roadheader that's mining stone with gas boreholes in the face. So that's quite a concerning issue because you've actually got a source of methane directly being fed onto a piece of equipment that's got cutter picks that are rotating and potentially creating a frictional ignition concern. So that's on one instance. The other one is that again the ABM panel struggling with gas boreholes, not being able to dilute it. The fact that there's 3% and 5% are getting into significant levels. To me it's a case of modifying your mining operation so that your ventilation has the capability to manage the gas. It's indicating that trying to block the gas up if you like, but the ventilation system's still not coping with it. So it's a case of how do we get the ventilation to be able to manage this gas level that we've got.

Q. And that is sufficiently important is it, that it ought to have been done before further production and development work?

A. Definitely. It’s a case that you can't product if you've got those gas levels there. It’s fundamental. And they would have been working and indeed that’s what some of those deputies’ reports were indicating, that they've had to manage that to reduce that gas before they can start, but it seems in some of those areas they were having varying degrees of success.

Q. Are those levels ones that ought to have been of concern to a regulator?

1505

A. They should've been concerned to, a regulator should have been concerned to management. Again, it depends on the frequency and the nature and cause. It’s not the sort of thing that you would actually report to a regulator but it would depend largely on the cause of it but it would certainly be something that’s not necessarily widely known but understood as far as how it was being managed.

Q. Just to give us a guide, had a regulator in Queensland become aware of those issues, what steps would've been taken?

A. It would be in a case, typically in the area of the quantities that were resulting, the cause the reason that that had resulted, but fairly specifically the response would’ve been to provide a discreet and specific management process of the way through it and potentially not mining until that had been demonstrated. And that could be quite specific it could be directly through the chief inspector and I’ve had instances where that’s exactly how it had to proceed where the chief inspector became involved and it had to go directly to him.

Q. Could I please turn to a different issue which is the possibility of an extra intake or fan. In your witness statement at paragraph 61, you state the mine was in the process of completing an extra intake heading in one west mine but it was always going to be restricted to a single return system. Mr Rowland in his witness statement, Ms Basher please ROW001/9.

WITNESS REFERRED TO STATEMENT OF MR ROWLAND – ROW001/9

Q. At paragraph 35, the second sentence says, in explaining a statement, “The intent of that statement was to emphasise the importance of increasing the quantity of air in the mine as soon as practicable and not resting on the apparent laurels of the new circuit capacity." New para 36. "The preferred means of doing this from my September report was excavating a new intake/return adit adjacent to the seam outcrop to share the intake and return loads between this site and the existing Alimak raise/ventilation shaft and mine access drift. I understood Pike planned to do this as it was by far the most efficient option from a ventilation perspective and probably the cheapest and fastest to realise." In your view, had that been done would that have assisted in ensuring the sufficiency of ventilation for the number of faces being worked underground?

A. Without mining I would certainly expect it would because what it would've done was change the friction characteristics of the mine and thereby allowing that pressure available from the fan to be more adequately utilised in providing ventilation through the mine. So it conceivably, quite conceivably, increase, reduce the pressure that was being overcome and increase the quantity that you've got available. And that was what he was driving at.

Q. Is that a matter that ought to have been done prior to Pike doing work at five faces? In other words, one of the possibilities you've raised so far in saying they should've managed the work to keep it within the ventilation system, was the alternative for them to increase the ventilation by doing this if they wanted to continue at their existing level?

A. Yes. And there's probably two aspects to that. One is the point that I've made that the shaft and the fan arrangement was less than ideal so there needs to be some improved means of ventilation and potentially egress. The comment has been, and I've certainly read this comment a number of times as far as creating that additional roadway that gives you another egress, also potentially improves the ventilation, as I've just said. The problem I've got is you've actually got to get there and that's a mining process in a problematic situation, so it then throws back to well, just how do we mitigate, how do we reduce the risk that we have and still continue to mine.

1510

Q. And that means if they were going to get there, first they had to ensure back in 2009 that there was an appropriate mechanically assisted way out of the vent shaft?

A. That would certainly approved your escape chances, yes.

Q. And second, that they managed their work to within the ventilation capacity while they were getting there?

A. Yes, and again, conceivably have some sort of better means of protecting that fan.

Q. I just want to take you to another document DOL.3000070172/1.

WITNESS REFERRED TO DOCUMENT DOL.3000070172/1

Q. And you'll see this is a technical services department memorandum from Greg Borichevsky to Doug White dated 29 October, re proposed second egress intake and fan location. You'll see at the bottom of the page, "Section 3, proposed second egress, second intake, second fan location. The surface location of the site is located 250m north-west of the current one west mains." It then goes on over the next page please, Ms Basher. And in the last sentence, or second to last says, "This suggests second egress can be established by June to September 2001, subject to the extent of fault encountered, DOC approvals, and construction windows." Is that timeframe of concern to you having regard to the state at the mine in October and the work being undertaken?

A. Well, it doesn't talk about any other mining activities, I suppose, that's one aspect. Timeframe, it still comes back to the aspect of regardless of the timeframe, you still have to provide a safe place of work for the ensuing period and if you had, you couldn't – to me, my understanding from what I understand of the ventilation, you couldn't be doing that and sustaining the amount of mining activity that was going on.

Q. This matter, being attempting to increase the ventilation by putting in another intake egress and return?

A. Yes.

Q. Is that a matter that ought to have been considered at the design and development stage of the mine?
A. Yes, it would. My recollection was that there was certainly some intent to do that, but yes, it's – you normally have a mine plan that would look five to 10 years in the future.
Q. In other words, the need for more ventilation and the method of getting that was something that ought to have been built into the design of the mine prior to development?
A. Yes, regardless of circumstances that you found, there would be some ongoing plan for what it was going to look like.
Q. If I could just turn to a related but slightly different topic, which is that of a ventilation engineer, would it be prudent for a mine the size and state of development of Pike River to have had a ventilation engineer?
A. From our perspective, it's not a case so much of the size and state, it really becomes a necessary from our perspective, certainly in a Queensland, New South Wales situation underground coal mine. It's one of those things that's been pretty much standardised in – oh, for quite a number of years now, to be honest, probably in excess of 10, 10 or 11 years or more.
Q. Necessary from when?

1515

A. From the start of the mine and even beforehand. I've seen some mines particularly where there's been known difficulties. So potentially high gas mines will have a ventilation engineer as part of their initial design.
Q. And what's that person's role?
A. Well it's to work as part of the mine design team with establishing ventilation systems, gas drainage systems linked potentially in with gas drainage systems whatever they may be. But it rolls on from the design engineering stage into operational aspects of it. So the role changes somewhat. It moves from one of the hypothetical into the practice and that then becomes not necessarily different discipline but becomes an operational discipline then. That role tends to be very closely aligned with the mine manager. So if the ventilation hiccups, the ventilation

engineer will be the first phone call and the mine manager will be the second phone call or the other way depending on which one answers the phone first.

Q. And when we talk about the ventilation hiccups, does that mean that a ventilation engineer would be enquiring into these various incidents we've referred to of 3% and 5% methane accumulated?

A. Constantly. They would typically have it live on their system and be responding to it daily and shiftly.

Q. And I take it when you say, "constantly," does that necessarily mean that the duties of a ventilation engineer can't be adequately undertaken by a consultant overseas?

A. One would suggest that that would be the case. Sadly, we find that some of our mines are relying upon that, but there will tend to be still some designated or delegated resource at the mine who is fairly diligently monitoring the state of the ventilation. It depends on the level of risk.

Q. And would that person have an understanding of ventilation and engineering?

A. Yeah, yes.

Q. When you say it depends on the level of risk, in Pike River given the incidents to which we've referred, given the design to which we've referred in the ventilation system, in your opinion did it need a ventilation engineer?

A. Yeah, I believe it certainly would appear so.

Q. And it needed that from certainly the latter design stage?

A. Yeah, I would suggest from yeah, from later design.

Q. And would that person be going underground?

A. Yes, very much so.

Q. With what frequency?

A. To me, again it depends on the resources, but in a mine of relatively high gas content it would be there would be somebody looking at it most days. Indeed, it would be a case of, it would be an exception for a gas drainage engineer of that nature not to be there each day or every second day. A ventilation engineer potentially not so much. We're actually starting to talk about combinations and things now about managing gas, managing ventilation. In a mine this size you potentially have one person and I would expect them to be responding to it on a daily basis and probably going underground every second or third day.

Q. You referred to mine manager picking up the phone of the ventilation engineer picking up the phone. Who or what level of company would you expect to be aware of the issues with the ventilation system and in particular gas layering accumulation and those types of matters?

A. My experience? If we've got a problem for a day the chief operating officer would be talking to me as the mine manager and wanting to know why. And the general manager would already be answering and so…

1520

Q. And that's in relation to one issue?

A. Yes.

Q. Just want to turn to the ventilation management plan and I understand from paragraph 3.9.1 that the ventilation of the DOL report that the plan of Pike River was signed off on 11 November 2008. In paragraph 3.9.8 of the DOL report the following is stated, "However given the critical nature of the plan to the safety of those underground it was reasonable for PRCL to have put sufficient resource into making it a relevant and workable document. The VMP itself required that it should be reviewed within one month of monitor extraction starting and then on a two monthly basis." The first question is, who should be responsible for developing a ventilation management plan?

A. Well, in our case it's by a ventilation officer, ventilation engineer but if you don't have one, and there is allowance for there to be, not to be a ventilation officer/engineer, then it's the mine manager's responsibility but I hasten to add that that's by exception. If you don't have a ventilation engineer or officer, it's the mine manager's duty by default but not for an extended period of time. So you don't have one and the mine manager be the ventilation officer. But it's the ventilation officer's responsibility to provide that.

Q. How often should it be reviewed?

A. Well, that depends on the state of the mine. Certainly if you are changing something of significance then you would review it to ensure that it's appropriate so certainly for something like the hydro-panel or a extraction panel of significance you'd review it just to check that your assumptions and initial design was adequate and then you probably actually wouldn't wait a month it'd be a case of once you've started within a week or so you'd actually be checking the measurements, checking the model.

1523

A. There'd be modelling that would be linked with that, so once you've done it and our requirements are if you have a significant ventilation change, and that means that even to the point of installing an overcast, you'd actually be checking the day after that ventilation change has been made and verifying that you modelling and calculations were correct.

Q. So shortly after hydro-mining commencing, there should've been a complete understanding of the ventilation system, how it was working and any issues?

A. Yeah, see, it's actually not a major ventilation change, other than you're starting to introduce more methane in there. That ventilation would already be established. I think it's more a case of ensuring that your gas management system was capable of managing that excavation. Does that make sense? It's slightly different to the previous answer.

Q. Still dealing with the ventilation management plan, the Department of Labour report at 3.9.1 says that the plan "also refers to risk controls that were not in place such as Maihak, tube-bundling, gas chromatography and bag sampling, explosion barriers and respirable dust sampling."

A. Yes.

Q. Are they all controls that in your view ought to have been in place prior to production?

A. Some of those – there's a – that's a fairly wide net actually that you've cast, but some of those definitely because they're part of health and safety per se, so airborne dust and so on. The tube-bundle is a slightly different aspect that's different rationale, different logic, not necessarily before production. Ideally at the time of the hydro-panel starting would've been ideal. It actually depends on the rationale that you're installing the tube-bundle system for, but typically for our purposes you would be looking to that if you were in a gassy mine, or a mine that's prone to spontaneous combustion very early on in the piece so, pretty much soon after you have a mine and it's being excavated.

Q. I might come back to some of those individual matters then later on.

A. Yes.

COMMISSION ADJOURNS: 3.25 PM

COMMISSION RESUMES: 3.46 PM

CROSS-EXAMINATION CONTINUES: MR WILDING

Q. Mr Reece, I'd like to turn to methane monitoring and you have before you DOL.3000.1300.10/1, which you'll see is described as "Configuration of fixed sensors supplied by Energy NZ Limited." Does that describe the placement of the sensors in the mine as worked out by the investigation team?

A. As far as we're aware schematicwise, yes.

Q. And so just working clockwise from the top right, the methane sensors were a surface vent fan?

A. Yeah.

Q. Which was working. Vent shaft bottom which was not working. Vent fan motor, main fan which was not calibrated. South of monitor pumps, which was working, yes?

A. Yes.

Q. And drift first grizzly, which was working. Now, Ms Basher, could we please have DOL.3000.1300.9/1 and if we could perhaps blow up the workings a little bit more please?

WITNESS REFERRED TO DOL.3000.1300.9/1

Q. Mr Reece this is one of the attachments to Appendix 6 of the DOL report, setting out the layout of the mine. I just want to touch on a topic which Mr Mander raised yesterday. Are you able to tell us and describe at the same time the particular location where you say there should have been more methane sensors?

A. Just methane sensors?

Q. Well first methane and then...

A. Yeah. Okay. The logic is that we wanted, for methane in particular we want to find a few particular variables. One is we want to protect the escape roads from high quantities of methane so we want to make sure that we've got less than 2% methane in return roadways in particular. So, we would typically have monitoring around the main shaft, so particularly around that fan as there were in places so there was a monitor on that motor there, but also monitoring in the return itself so that you can ensure that there is less than 2% methane in that main return. You would similarly have –

Q. I will just pause you there. That meant that there had to be a methane monitor working somewhere between the bottom of the vent shaft inbye in the return?

A. Yes, and you really are aiming to pick up the main stream of that ventilation. So really anywhere in that area is fine as long as it's the main stream and as close to that shaft as possible.

Q. Right.

A. Then you'd have similar installations in the return or the returns from each panel, so certainly panel 1. As indicated yesterday you'd also have something in here, in this sort of an area.

1550

Q. And where are you pointing to?

A. Inbye of, between five and six cut-through in B heading sorry of one west, ideally to get some sort of indication of what was coming from this area. You could potentially have that similarly in C heading between three and four cross-cut of one west. You're really just trying to get the combination of gases and the contribution of each particular area. So that's predominantly it from a return perspective other than you would look also at having something down this area, so that you're actually getting an idea of what's –

Q. Where are you pointing to there please?

A. Sorry, down at the south mains area, the return from the south mains area. We'd also have a monitor on the various intakes to ensure that the air that's being supplied to those mining areas was free from methane. Now, to some extent it's dependent on the installations that you have in the mine and the reason I say that is that this is a very short panel from our perspective. It's a very short panel. Normally you would have that extending quite a distance, that panel 1, it would be extending quite a distance away from the main headings and you would typically have electrical installations in here, in that cross-cut or thereabouts and you would have monitoring on that to ensure that wherever that electrical installations were that you were ensuring that it was free from methane. So conceivably at this area you actually have a lot of electrical installations for the mine at these locations so conceivably you'd then have a monitor back here.

Q. Can you just describe that location?

A. That's B heading, I think, between four and five.

Q. Are you happy to provide the Commission with a map setting out where you would recommend the methane, carbon monoxide monitors ought to have been?

A. Yes.

Q. And the information that would have derived from that?

A. Yes, because they're quite different and there's different levels of methane for different purposes and also CO detectors, carbon monoxide detectors in different locations for different purposes as well.

THE COMMISSION:

Q. Is it possible to do that overnight Mr Reece, I anticipate your evidence will continue tomorrow

A. Yes if I can, yeah, yeah that should be all right.

1553

CROSS-EXAMINATION CONTINUES: MR WILDING

Q. And I presume those monitors would be connected to the SCADA system?

A. Yes.

Q. And they would be alarmed?

A. Yes. Well, they'd be alarmed and potentially drop power off too, if they were protecting electrical apparatus.

Q. So they'd be interlocked with the electrical system?

A. Yes, not all of them, but the ones that were protecting electrical equipment.

Q. Why weren't the monitoring equipment on the movable machinery sufficient and the handheld monitors?

A. Ah, sufficient? Well, it's a different purpose. They're monitoring people and equipment in particular locations whereas the fixed installations are monitoring the ventilation that's coming to a particular piece of apparatus.
Q. And were the monitors on the machinery interlocked with the electrical system so as to be able to cut out the power?
A. As far as I'm aware, yes, that's the intent.
Q. Were they interlocked with the SCADA system?
A. No, not as far as we're aware, not all of them, certainly the mobile equipment, no.
Q. Can it be?
A. Some of it can, some of it can, so you can't, with diesel apparatus, you certainly can with equipment mounted on continuous miners fans and so on.
Q. And would an advantage of that have been to allow trending data to be gathered?
A. Well, it's not only – yes, it certainly would give you trending but it'd also give you an idea of what the gas levels were in those particular locations on an ongoing basis.
Q. The concerns that you've raised about the methane monitoring system, are they ones that ought to have been of concern to a regulator?
A. Yes, yes, I believe so, but to some extent it's a case from our perspective of they're fairly well established standards, so it would be by exception rather than to go looking for them, so what I'm saying is, it's fairly accepted practise that they'd be there and operating. The regulator would be aware that they are there, typically the process that a regulator would follow on inspecting a mine or attending a mine would be to go and check that monitoring before he goes underground purely to get an idea of what was happening and the trending that had occurred and also so that he could, he or she could correlate that with what they found when they went underground.

1556

Q. Had a regulator been aware of the extent of the methane monitoring at Pike, ought it to have been concerned about that?
A. Well, that would presume that there was an awareness of the gas levels that were being found. But again by the same token my experience with regulators and as a regulator, is that you would not only check the electronic system but you'd also be checking the documentation, document system. That information was certainly there and accessible, but it also makes it easier actually if you've got the trending and it's easy to bring up.
Q. Are your concerns about the inadequacies of the methane monitoring system sufficient that in your view you'd say the mine ought not to have continued with its development and production activities without first rectifying them?
A. I guess this is a little bit of a conundrum for us, well for me because it's anticipated that that's what you'd have, so you actually don't have to make the decision, that you would it in place. So therefore, moving backwards from that, if it's not there then you would have to say that you need it in place before you continue. For our purposes, if we have an established monitoring regime in a mine and it is not functional then we have short-term capability to manage that and it could be in the sense that you would put a person in that area with the detector. Failing that, you can't ensure that it's being managed, so you actually have to shut it down.
Q. I'd just like to understand the relationship between the level of methane recorded at the top of the vent shaft centre and that which might be present inbye. In your witness statement at paragraph 90, you've suggested that if there was a methane spike at the top sensor of the shaft between 1.7 to 1.8, that inbye the methane level could be at least twice that?
A. Yes.
Q. Mr Rowland filed a witness statement. It's dated 25 November 2011. And he refers to a methane spike of 2.8% at the auxiliary fan shaft. What he says, ROW.007/1 is, "By simple maths and assuming that all of

the gas contamination was from the monitor panel, then the gas concentration in the monitor panel return to cause such a spike at the shaft would be around 10% methane. Given that some of the methane is made elsewhere then it would be slightly less than this but it would still have been an event of extremely high concern."

A. Yes.

Q. Would you accept then that inbye the methane level could be in some places about three times the level at the vent shaft reading?

A. Yes.

1600

Q. So really, the fixed measurement that the sensor Pike had wasn't able to give it an ability to accurately understand the methane levels inbye?

A. That's correct, I mean, that's why I say you have multiple sensors. And potentially not telemetric you'd have, you'd be looking at tube-bundle as well.

Q. Just turning to the accuracy of that vent shaft centre at the top and you've referred already to it reading approximately twice the level of that as the sensor at the bottom when the bottom sensor was working?

A. Twice the sensor at the top, sorry, the sensor at the bottom is reading twice the top.

Q. Right. Perhaps if we can take you to DOL3000.130010/1 sorry page 146, my mistake.

WITNESS REFERRED TO DOL3000.130010/1

Q. And it is my mistake so the sensor at the top of the fan is the one shown in red at the bottom of that graph?

A. Yes.

Q. And this was data from Pike River SCADA system was it?

A. Yes.

Q. And the line at the top of that graph shows the readings from the sensor at the bottom?

A. That's our understanding, yes.

Q. And that's sensor ceased to work on 5 September?

A. Yes.

Q. Was that sensor at the top of the shaft recovered following the explosion?

A. Yes it was as far as I'm aware.

Q. Has it been able to ascertain whether it was reading correctly?

A. I don't think so, I'm not sure. I think there was some concern about the health of it.

Q. As I understand it, it's thought that I can't read any higher than 2.7 or 2.8% is that correct?

A. Yes, well, that was something that we found that, well, actually they did test it and found that there was some latching characteristic of that. That wasn't the sensor itself that was the actual analysis of it. So, the analyser on it so.

Q. So where we have graphs showing that the reading is somewhere around 2.8% at the top of the vent shaft they could in fact be higher that that?

A. That's correct.

Q. At the vent shaft?

A. Yes.

Q. What steps would a prudent mine operator have taken in response to that bottom sensor ceasing to work on 5 September?

A. Well, to me there's a question to be asked in answer of two sensors in the same air stream reading substantially different, so that needs to be established before anything is done and there needs to be some accurate calibration of one or both sensors if there's only going to be one sensor then it needs to be absolutely reliable.

Q. When you say the same air stream both the top and the bottom were sufficient approximate that they should've read the same?

A. Yes, there's no other air being introduced.

Q. And so a prudent operator on seeing that pattern of the two having the variable reading should've enquired into that?

A. Absolutely.

Q. Urgently?

A. Yes, it's concerned particularly of what you're saying.

Q. Right. When you undertook or your team undertook explosion modelling, was the background level of methane as shown in those types of reports taken into account?

1605

A. Well, it – not to any great degree because it's going to fluctuate and it would be to some extent be skewing the data, so it was – base levels was considered but no more, so it was primarily very low levels of methane, so it was primarily concerned with the major fuel source.

Q. Right, does that in essence mean that when you looked at the volume of methane required, you calculated that against a mine with zero methane?

A. Yes, pretty much, yes.

Q. I take it one of the advantages of a tube-bundle system would've been that it would've enabled the accuracy of the vent shaft sensor to be validated?

A. Yes, not exactly. The point of tube-bundle is – and it's been touched on – is it's a delayed reading if you like, and it's probably been discussed here, but you would certainly get some correlation, not necessarily exact calibration, but you'd get a correlation at a point in time so that there would be at least some agreement. And we're talking orders of magnitude, so it may be .3 verses .35, slightly different types, yeah.

Q. Am I right that the sensors Pike had both fixed and on men couldn't read above 5%?

A. That's correct, yes.

Q. A tube-bundle system can read more than 5%?

A. It can read up to 100%.

Q. So that would've been the only system which enabled Pike River to have an accurate understanding of the methane content within the mine?

A. That's correct. You can get – but you can get telemetric sensors that go higher than 5%, but that wasn't the case. And indeed it actually flies in the face of what you should have, so that should be more than enough.

Q. And presumably on seeing reports within for example the incident reports or accident reports stating that there was 5+% methane, a prudent operator would've explored ways of working out just how much more it was?
A. Yes.
Q. Tube-bundle monitoring is likely to be destroyed in part in an explosion, correct?
A. It's likely yes.
Q. If it had been installed, could it still have been of some assistance in an explosion?
A. Yes, it could, 'cos it's – yes, it's certainly going to be damaged in fire. It's only plastic tubing, but nevertheless it's still going to provide, unless it's closed for whatever reason and the sample can't be drawn, it's still going to give you some sort of indication at that point, but the other thing of relevance is that it's not just one sample point. Its multiple points so you create the opportunity where you've got some redundancy and by difference you can start to get some picture of the other gases that are in the mine and their particular location. Aside from the fact that if that explosion or fire has damaged all of them at the point where they leave the mine, but other than that situation, you've got multiple sources of information.
Q. Could I just turn to a different issue being stoppings? You've already made a number of comments about those. At paragraph 3.12.9, page 113 of the Department's report, it stated, "There is no evidence of any engineered design for permanent stoppings."
A. Yes.
Q. What steps ought to be taken to assess the required strength and design to which a stopping ought to be built?
A. The process that's been followed primarily from a Queensland response that's then flowed on into New South Wales was initially to do basically destructive testing on stoppings, so, a design engineering calculation of the structure and then construction and destruction of that apparatus in testing facilities in the US.

1610

A. Now there's no need to go to that extent because essentially most of the work has been done and there tends to be a multiple of styles of stopping installations and constructions that are readily available these days that have ratings and indeed organisations that build those sort of devices. That's not to say that it can't be done within the mine by mine personnel, but there are a number of designs of types of stoppings that meet those requirements.

Q. Well the report refers frequently to stoppings ought to have been at 35 kPa?

A. Yes.

Q. Is that simply because that's a level which features within regulation within Queensland already accepted to be safe?

A. Yes, in simple terms that's the requirement for a Queensland main roadway stopping.

Q. And an overpressure from, for example, windblast creates about 10 kPa does it?

A. Well it depends on the size of it and that's the problem, but that's the sort of ballpark figures that we're looking at.

Q. So that rating's been ascertained as sufficient to withstand a collapse or windblast?

A. Yeah. But it's not only that. It's also looking at some degree of confidence that it may resist other overpressures, not just wind from roof collapse.

Q. There were audits undertaken by a Mr David John Stewart who was engaged by Pike River. He did that in February to April 2010. At paragraph 27.5 of his witness statement, STE.0001/8, and we don't need it Ms Basher, he says, "I suggested that the stoppings be improved and that the miners constructed them had some training in stopping design and purpose and I also sent via an email to the technical services staff copies of drawings of stopping designs for them to see to base their structures on." At what stage in the development of the mine ought those installing stoppings to have had sufficient training to enable them to construct them to achieve their purpose?

A. Before they construct the first one, I'd suggest.

Q. So this was an issue which shouldn’t have arisen because the stoppings, all of them, should have been satisfactory from the outset?

A. Yeah. And that’s not to say that you don't have different styles of construction and different ratings of constructions, but it’s about matching the design to the location.

Q. In that regard the DOL report, page 117 paragraph 3.12.38, refers to Minex guidelines and says that “A mine should never have more than four temporary stoppings back-bye the headings in any circumstance. However, circumstances could indicate the need for fewer temporary stopping should the risks justify it.”

A. Mmm.

Q. Do you agree with that comment?

A. From my background, no. That's certainly significantly less of a standard than we would accept.

Q. So how many temporary stoppings would you say there can be back-bye at the headings?

A. If we talk about temporary stoppings it’s probably worth just looking at what a temporary stopping would be in that situation. A temporary stopping for our purposes would be with typically props and battens and brattice and typically you wouldn't have any more than one or two at the most, you know, and we're talking about a production panel for a couple of reasons. One is purely from a simple good ventilation practice. Aside from the rating characteristic, just to reduce the leakage so that you're getting maximum air into that particular panel.

Q. At 3.12.25 of the department’s report it also says that there are Minex guidelines to the effect that temporary doors are not recommended further than six cross-cuts back-bye of the heading. Do you agree with that?

1615

A. Yes well, it's an unusual statement I suppose for our purposes. We don't necessarily have temporary doors in stoppings, they tend to be more of the substantial construction. I can understand that it's alluding to the fact of brattice flap in a stopping but again for our purposes you wouldn't have that sort of construction that far back anyway, you would be installing and there's no reason that you can't install the permanent item closer than that.
Q. Rather than take you through this today, would you also be willing to consider providing a document setting out the standard to which you say stopping ought to have been constructed within the mine?
A. Well, the only thing, I mean, it's easy enough, I'd just go on the Queensland schedule, it just depends, that's just the basis that we use, other than that, and that's easy enough to supply.
Q. I just want to turn briefly to the stopping at cross-cut three, one west, and that's the one that it is thought failed in the first goaf collapse scenario, correct?
A. Yes.
Q. And the recommendation's been made that that should've been constructed to 35 kPa?
A. But typically that's what we would have in a main roadway.
Q. In which case it might've withstood the force of the goaf collapse over pressure?
A. Yes.
Q. Paragraph 3.12.17 page 114 of the DOL report, is the following. "One reason why the stopping in cross-cut three, one west may not have been made permanent was because the auxiliary fan for the roadheader place (AF005) was venting through the stopping. There was no reason that this should've prevented the substantial part of the wooden structure of brattice that formed the framework for the permanent shotcreting from being constructed." Given that it was venting through, what construction do you say that stopping should've been?
A. I think it's problematic that that fan is there at all. It is part of my issue with it. I can understand why it's there but I don't necessarily agree with

the decision to put it there, however, given the fact that it is there it could've been more of a substantial structure, but nevertheless, it's still not going to be a rated stopping in that event simply because it's got a fan in it. Hence, potentially, the decision to leave it as a temporary sort of a structure.

Q. So with that fan there could it have been constructed to a level which would've avoided the risk from an overpressure event?

A. Potentially but you've still got the fan through it so any that any overpressure's going to come through into the fan anyway.

Q. Right, so in other words there's an earlier issue which is whether the fan should've been there?

A. That's correct. Yes. So the stopping may well have stayed but you still have an opening where that fan is. And that's not to say that it's not a, again, it's complicated by the fact that there's quite a lot happening inbye that particular area so this comes back to my earlier concern about the volume of mining activity that was happening inbye of that three cross-cut.

Q. Could I just turn briefly to the stoppings which are dividing the restricted from the non-restricted zone. And Ms Basher could we please have FAM00057.01/1?

WITNESS REFERRED TO DIAGRAM OF STOPPING - FAM00057.01/1

Q. Now if I could ask you to look at the stopping at the point marked L please?

A. Yes.

1620

Q. Now a witness Dene Murphy filed a statement dated 2 December 2011 and he says, "It would've been possible for a goaf rockfall or some over pressure event in the return to have pushed methane down through the flap in the brattice at the stopping where the flume went through marked L on the mine map. There was a risk that additional turbulence could've brought the methane down that was potentially laying in the thunderdome. If there was disruption to the ventilation circuit at that time it could've migrated into the area where the fan electrics were." I take it from your evidence-in-chief that you agree that an over pressure event could have dislodge the brattice door at point L?

A. Yeah, we had a look at this. There's certainly some concern with that construction. Our perspective though is if there's a goaf event that we've discussed then it's probably more likely that the three cross-cut stopping is going to be damaged rather than it translate down past that three cross-cut into the return, so I'm saying this is more likely to be damaged in the initial instance, rather than that being intact and for that pressure wave to be pushed down and into this. So I take the point is, firstly it's a substandard design, but secondly there's already an inferior construction inbye that would've undergone pressure before it ever got down there.

Q. I take it a brattice door wasn't sufficient to divide that restricted/non-restricted zone?

A. Certainly not in that location, it's highly suspect.

Q. There was blasting occurring on the 19th of November. Are you able to point to where that was occurring please and describe that?

A. Look I did talk a bit about it earlier on, sorry, did go through it with the Department personnel earlier on and I – it was down in this area and I can't remember exactly which roadway it was and that's mainly because we went down that path and pretty quickly dismissed –

Q. You're describing the area - main coal sump?

A. Sorry, yes. Somewhere, I think it was off B heading somewhere in here, off into the pillar or something like that.

Q. Did you consider whether that could've damaged that brattice door or stopping at point L?

A. Not so much the one at point L, but what we were concerned about was the design of the ventilation in this area given that that was happening, and our understanding was that this area was actually – these were temporary doors that were rolled up so that the – couple of things happen so that they actually didn't damage the stoppings that were in there, 'cos my understanding was that when they'd been doing shotfiring it had damaged the construction of stopping – the constructed stoppings in there, so they had rollup brattice doors I think in this area that short-circuited the pressure around in this way, and that potentially means that this could've been damaged, dislodged, so it certainly wouldn't negate that issue.

Q. And if it had been, it would've allowed potentially methane laden air to flow through into the restricted zone?

A. That's correct, yes. But the – we'll need to think about the ventilation modelling there, even though it would potentially initially push out, you still have this negative draw of the air back around this way.

Q. Right. I just want to turn to the significance of the failure of stopping in an earlier goaf collapse, and as I understand it, there was the stopping failure following the goaf collapse at about 4.00 am on the 30th of October?

A. Yes.

Q. Are you able to point to the stopping which collapsed on that occasion?

A. It was that stopping up there. That one cut-through in panel 1, one cross-cutting.

Q. What steps ought a prudent mine operator to have undertaken following that?

A. Well, obviously it needs to have a more substantial construction and that's our understanding of what was done.

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A. However, there still needs to be some ability to access that roadway. So they needed to have some means of getting through that stopping given that it's the most direct access to the return and again that's our understanding that it was done. The stopping was made more robust, the door in there was locked and controlled as you would expect, but the thing for me is it still raises the question about well if we're going to fix that one the next one out-bye also comes under scrutiny and that needed to happen.

Q. That really would have signalled to a prudent mine operator the need to assess the integrity of all of the stoppings. Is that a fair comment?

A. Particularly in that area when you're getting that sort of pressure and you're continuing to mine in that area.

Q. And to do so urgently given the nature of the activity being undertaken in the goaf?

A. Yeah.

Q. If the cause of explosion was or the source of fuel for the explosion or the methane accumulation, would the stronger stoppings rated to 35 kPa have made any difference?

A. Not necessarily about the rating at this point. It's about confidence in the structure and potentially assisting you with reducing leakage that gives you better ventilation control. That's the point of it. Really the rating doesn't come into effect until you have an overpressure event that you're trying to assure the quality of that installation. So you're really after airtight reduction of leakage to start with. Secondly, that strength of construction.

Q. So insofar as the accumulation possibility is concerned, the significance of the inadequacies in the stopping is that they might have allowed leakage, therefore failed to properly prevent the accumulation reported in the various reports?

A. Depends where you're talking about the accumulation I suppose to some extent. If we're talking about accumulation in this area, it wasn't material because you actually wanted it there.

Q. Understood, but if we're talking about accumulation further inbye?

A. If we're talking about it in here, then potentially yes. With substandard stoppings in three and four cross-cuts leakage through there and loss of ventilation as you go up into that area, then it potentially becomes problematic, but it's also a factor of the ventilation losses before you get there regardless of the stoppings. So it's about the pressure losses in the drift and the shaft as well. Only having it enough a reduced amount of air, volume of air once you get past panel 1.

Q. If we just look at another potential consequence. The DOL report, 3.12.29 page 116 says, "Stoppings rated to 35 kPa in the mine would have enhanced their chances of ongoing survival…"

A. Yes.
Q. This is the men if they had survived the first explosion?
A. Well the stoppings and the men, but yes, yep.
Q. "... and enabled them to reach fresh air more quickly. It would also have enabled rescuers to enter the mine more safely and restore ventilation more easily." How?
A. Well that's the objective and that's why we talk about rated stoppings, to try and ensure survivability so that your ventilation system can be either continued or reinstalled or up and running again. So simply by the fact that the stoppings are intact. That's why I say that the stoppings are rated based on destructive testing and the destructive testing is to actually create an overpressure in an attempt to blow them up and they've got to survive I think it's three blasts.
Q. Does that mean that after the first explosion when the natural ventilation flowed into the mine, if there was a stopping still in place it might have helped create an area of fresh air there?
A. That's correct, yep.
Q. But without a stopping in place the air would naturally flow the quickest route up to the vent shaft?
A. It would short-circuit, yep.

1630

Q. Right. Should there be a person with dedicated responsibility for checking stoppings?
A. Again it's the type of function that a ventilation officer would fulfil, but that's not to say, that would be one of their roles but it's also the role of statutory officials such as deputies to be checking those and the quality of them.
Q. Were the deficiencies that you've become aware of in the construction and effectiveness of the stopping ones that a regulator should've noticed on physical inspection?
A. Again, from our perspective it is something that is already regulated so it would be a case of expecting to see particular design and construction

in place so it would almost be something in passing that would be noted rather than specifically focused on.

Q. Right but would it have been apparent on physical observation that the stoppings were not built to a satisfactory standard?

A. Yes it would.

Q. What would be the appropriate action for a regulator to take in that circumstance?

A. Well, in our circumstances it's pretty straight forward. You would require a stopping of that standard to be built.

Q. Would it reach the level of potentially requiring a mine to build those before continuing with its development or production activities?

A. Yes, depending on where it is, yes.

Q. If I could just turn to another topic please of stone dusting? Stone dusting primarily mitigates against coal dust explosion?

A. Yes.

Q. Does it play a role in mitigating against a methane gas explosion?

A. This is somewhere where I need to correct myself actually in the report and I've probably overstepped the bounds where I've said it's proven to mitigate against gas explosion. I've since been corrected and the comment has been made that it may potentially reduce the intensity.

Q. This is stone dusting, not stone barriers.

A. Stone dusting, stone barriers. May well reduce the intensity not necessarily eliminate. But certainly in the area of coal dust explosions, certainly significant mitigation in that.

Q. And stone dusting also helps provide a light surface that assists in the event of an emergency evacuation. Is that a fair comment?

A. And indeed normal day to day operation, it improves the visibility, yes. Given that if it's still in place and that's problematic.

Q. The Department of Labour report at paragraph 220, sorry page 220, paragraph 4.40.1 says, "PRCL instigated a stone dust sampling regime in August 2010 and the first sample was carried out at the end of October 2010." When would you expect a mine to have a stone dust plan in place?

A. Stone dust sampling, again, it's one of those things that starts when you're mining coal because coal dust is being generated. That's the purpose of stone dusting to be interspersed with coal dust so it should be the same time as you start mining coal. Albeit that you've actually needed to get a little bit far ahead so that you get to the point of having enough workings to sample.
Q. And 4.40.2, says, "Results of seven stone dust sample received by PRCL from SGS Minerals on or about 10 November 2010 and all samples contained more than 30% combustibles ranging from 33.2% to 76.9%. These percentage constituted failures according to the SOP for collecting stone dust samples." What does that mean?
1635
A. What it's saying is that depending on the sample there's more than 30% combustible matter and the higher range more than 76% combustible matter so it's actually coal dust that will combust in the event of a gas explosion or some other event propagating into a coal dust explosion, typically what you are required to have is combustible matter content, so the amount of dust that will combust less than those percentages, and it depending on the location and the statute, it tends to be in the order of 20%, 25% or less.
Q. Does that mean that the level of stone dusting in those samples was such that there was still an ignition risk present?
A. Of a coal dust explosion, yes, that's what the concern is.
Q. You said in your witness statement at paragraph 35 that, "There could've been accumulations of coal dust in the ABM development heading?"
A. Yes.
Q. And is that the area in which there was significant cutting?
A. There had been, certainly on the previous couple of shifts, yes.
Q. Yes, 27 metres?
A. Yes. The point is, you generate coal dust through the grinding process of cutting coal, so it's about looking at those particular areas where that's being done.

Q. Stone dust, sorry, coal dust can be ignited on a hot surface, I think at a temperature significantly lower to methane, is that right?
A. That's correct, yes.
Q. About 220 degrees?
A. Of that order, yeah.
Q. What temperature does methane need to ignite?
A. It depends on what's caused it, but there's a number of – there's a range of numbers from 550, 650 degrees.
Q. Is it possible that coal dust could've ignited on a hot surface within that area and in turn that ignited accumulated methane?
A. Yes, and in a sense that's the basis that we consider frictional ignition, so it's friction of some piece of moving apparatus on coal dust.
Q. So that's a possibility that can't be ruled out?
A. Definitely.
Q. We don't need this Ms Basher, but in CAC0115A/7, there's a report of a reference in the deputy statutory report, 16 November 2010, "Needs stone duster at ABM, sharing stone duster with RH and CM, only one between three machines." Is that in accordance with prudent practise?
A. It's not an uncommon event unfortunately. The stone dusters unfortunately can be prone to problems, depending on the type that you've got, so that's less than ideal, but there needs to be greater diligence in maintaining it and repairing and having machines, stone dusting machines available.
Q. Well, if there aren't machines, does that mean people are stone dusting by hand?
A. That's certainly what we're led to believe.
Q. Was that regarded as an effective technique?
A. Oh, it's better than nothing, but you tend to find that you don't put very much on, but there's a couple of – it needs to be remembered, there's a couple of ways of stone dusting. We're talking about after you've mined out a particular area of coal, you need to stone dust the roadway itself in that particular area, but there also needs to be stone dust introduced into the return air through, typically through the fan, so there's a couple

of means of introducing stone dust into mining areas that need to be in place, so what they're talking about is stone dusting the actual roadway that's been cut. Doing it by hand is less than effective because you just simply don't get enough stone dust to stick to the roadway itself.

Q. Would it be fair to say that production ought not to occur when there is inadequate stone dusting?

A. Well, that's certainly what we would stipulate if you, for whatever reason if you haven't stone dusted within a 24-hour period, then it shouldn't be mined.

Q. And how ought a regulator to react on observing inadequate stone dusting?

1640

A. If it's something of a localised nature, then it needs to be directed. It depends how extensive it is. It's not uncommon for regulators to stop mines and direct the mine to stone dust a particular dark area, what we would call a dark area.

Q. Could I just turn briefly to stone dust barriers, and this is one of the areas in which, am I right in understanding you're withdrawing from the statement that stone dust barriers are intended and proven to extinguish a flame front from a gas ignition?

A. Yes.

Q. To what extent are they effective in mitigating the effect of a methane gas ignition?

A. I'm led to believe that there's potentially some reduction in intensity but that's about it. They won't actually stop the flame front.

Q. Mr Murphy again in his witness statement of 2 December 2011 says at FAM.00057/14 paragraph 76, "I asked for a long time about putting explosion barriers (back bags-stone dust bags on the ceiling) to protect pit bottom and stone. Explosion barriers were not in the plan until the south was done and then they just never were built." What stage of a mine's development should stone dust barriers be installed?

A. It tends to, you actually need to have sufficient distance of roadway available to you to start installing them simply because the propagation of a gas explosion that's likely to raise coal dust into suspension won't happen instantaneously. The practice tends to be when you're in a development panel in particular that once you're in between one and 200 metres, then you start to install, depending on the type of barrier, but you start to install the barrier itself.

Q. Does that mean from when Pike River was one to 200 metres into coal measures it ought to have commenced installing stone dust barriers?

A. Well that's certainly an option and that's something that it could have mitigated. It's not always the case that you would install it in main returns. They typically tend to be in separate panels, but given that you've got two separate panels in effect in the mine inbye, you're actually trying to protect an incident in one area from impacting on another area, so you certainly would tend to put them in the different development panels but it's conceivable that given that you've got a fan underground that you would look to put a stone dust barrier in that main return to give some protection to the fan.

1643

Q. So had they been appropriately installed in Pike River they might've mitigated to some extent the force of the explosion?

A. Well, it depends, we're saying it's a gas explosion so it's not so much the force. It's not going to help the force of the explosion. It's really the flame-front that you're trying to interrupt.

Q. Could I turn to a different topic please which is hydro-mining? We've already had a couple of weeks' evidence last year about it so I only want to cover some topics. In the department's report, page 122, paragraph 3.15.12, it says, "PRCL should have driven the first section of the A heading for one north to act as a bleeder road during the extraction of 1W, 1R." How would installing a bleeder road have assisted with methane control in the goaf?

A. This is not peculiar to hydro-mining in fact I don't have any expertise in hydro-mining but it is about mining and pillar extraction principles and what it's alluding to, a bleeder roadway is nothing more than a separate return, if you like, that provides additional gas carrying capability but more so the ability to move the fringe of methane in the goaf away from working areas. So what it's describing is rather than having two headings in that panel, it's suggesting three headings as an option and what that would provide for is that third heading to create some negative pressure in the goaf to provide additional control of the methane in that goaf so in effect, you could draw the fringe back into the goaf rather than the current situation with two headings, you're forced to have the gas come straight into the return.

Q. So if it drew the fringe back that means there would've been a lesser quantity of methane in the goaf?

A. Potentially, it's a trade-off here and it depends what your hazard is. You've got to be careful with this, it's not a blanket rule. If you have concerns with spontaneous combustion it's something that you've got to manage fairly carefully. You don't want a fully ventilated goaf area if you have spontaneous combustion because you can actually exacerbate that issue so it's a trade-off with managing the hazards. In this case if they're saying and they have the spontaneous combustion's not an issue and I wouldn't go so far there needs to be further confirmation, then spontaneous combustion's not an issue, there is scope to put a bleeder in to draw that fringe back. You could potentially reduce the total volume of methane in there but you would need to be managing and this is where the diligence comes in. You need to be watching very closely your balance of gases that are coming out of that particular panel.

Q. So if I could just put some propositions, does that mean had there been a known low propensity to spontaneous combustion within that panel, then a bleeder road would have assisted in the management of the methane in the goaf?

A. It would yes, it's an option.

Q. To make that assessment about whether to put a bleeder road in, there has to be sufficient knowledge of spontaneous combustion propensity?

A. That's correct.

Q. And you've said in the DOL report, paragraph 3.43.4, that there was a very limited data set upon which to predict the propensity of spontaneous combustion?
A. Yes.
Q. In other words to assess whether a bleeder road was an appropriate mechanism more information was needed about spontaneous combustion propensity?
A. Ideally, in that seam and the one above.

1648

Q. And that ought to have been gathered at or prior to the design of the hydro-panel?
A. That's correct.
Q. I just want to turn to a possible role of spontaneous combustion in the first explosion and I wonder if we can look at SOE.008.00001/111.

WITNESS REFERRED TO DOCUMENT SOE.008.00001/111

Q. This is part of a report by SIMTARS headed, "Review of gas data following Pike River explosion 19 November 2010 for New Zealand Police – Operation Pike dated 5 May 2011." And you'll see there that it shows, in figure 12.53, a temperature about 120 degrees on 31 December 2010, can you see that?
A. Yes.
Q. And it says, in the middle paragraph, "Of note is the peak in temperature around the 80 M, presumably metre mark, SIMTARS was informed that this depth was approximately the same as the Rider seam and may indicate that combustion activity was in the Rider seam. The absolute temperatures measured indicate a significant combustion event in this area." Do you agree with the view expressed there?
A. Yeah, I can't disagree with it, yeah.

1650

Q. No. And that means that it's possible that there could've been spontaneous combustion elsewhere in the Rider seam?
A. Yes, given the right conditions. This is indicating, and that's just the comment there, is that it may indicate that it's combustion there, it's not

necessarily indicated spontaneous combustion but I'm quite happy to accede that it potentially is spontaneous combustion given the characteristics of the ventilation around that area at the time.

Q. As I understand it, you say that had there been spontaneous combustion as a source of ignition in the goaf then you would've expected to see physical evidence in the panel 1 video footage of damage?

A. No, no. What we're saying is this, if that had been the ignition point, if there'd been an ignition there and hence potentially spontaneous combustion then we would've seen, expected to see some physical evidence in that area.

Q. What was the physical evidence that you would expect to see?

A. Oh, I would expect to see some charring and probably a lot more physical damage in that area.

Q. Is it possible for there to have been a goaf collapse bringing down spontaneously combusted coal which just ignited the tail essentially of the methane flow, the majority of it already being further outbye of the goaf?

A. Yeah. It's certainly something that we considered. There's a – it's difficult to predict. One of the reasons that we shied away from that was because of the indication that there was less confidence that that was the ignition point, because of the lack of physical damage and potential concerns with the type of explosion that would've resulted, whether there would've been reflected waves from that. But the other thing is to consider the spontaneous combustion mechanism itself. Spontaneous combustion typically needs an air path or an oxygen path through broken coal. That's not to say that there wasn't any in there. If it had been up in the roof however, it was starting to create – well, to me it's starting to become difficult to create a spontaneous combustion situation in that Rider seam if it's up in the roof at the time because you're not getting the ventilation circuit passed there. That's not to say that it wouldn't happen. It's just - it's a little bit more difficult to conceive of, that's all.

1653

Q. Could I just turn to the issue of the method of managing methane in the goaf. One of the factors leading to methane in the goaf was borehole GBH11 backfeeding methane into it, as I understand it?

A. Yes.

Q. And in the DOL report at paragraph 3.15.4, page 120, it says, "PRCL could have avoided GBH11 altogether by shortening panel 1 by approximately 20 metres. This would've eliminated a significant extra load of methane being emitted into the goaf. The operations meeting minutes for 4 August 2010 note under mine design 'panel 1 - will not intersect GBH11 at back of panel.'" Do you agree that it would've been desirable to have that panel shortened so as to not intersect GBH11?

A. Well it certainly – it's debatable the amount of – well it would be worth considering the amount of methane that's being put into there. In essence I can support that thinking, I suppose the only thing that goes against it is the fact that they are wanting an inert, fuel-rich inert anyway, but if we're talking about reducing the total quantity of methane, then yes that would make sense.

Q. Am I right in understanding that in some mines the goaf is managed so as to essentially not have methane approaching the explosive limit.

A. Yes.

Q. Ie. it's kept well below 5%?

A. Yes.

Q. Might a combination of avoiding GBH11 so it wasn't backfeeding, proper methane drainage to below five metres a tonne, being the target set by Miles Brown and a bleeder road have enabled Pike River to manage the goaf so that it was having methane below the explosive limit, ie adopt a strategy other than having it fuel-rich inert?

1656

A. Without doing the calculations I think they probably struggle to be able to do it.

Q. So you think that they had to manage the goaf in the way they did by having it fuel-rich inert?

A. Certainly with what they had. I think, even if they'd had a bleeder and that drainage I think they still would've struggled to keep it out of the explosive range.
Q. So, the ways that they could reduce risk would be to have a bleeder road, avoid intersecting the back feeding borehole and thus reduce the quantity of methane in the goaf?
A. Yes, that's a way around it yes.
Q. Are there other ways?
A. Really just, it's just more drainage, post-drainage potentially.
Q. In the goaf collapse scenario, to what extent would the goaf have to collapse to expel enough methane to cause the predicted explosion?
A. Yes, that's a good question. Potentially not a lot and again I think there were calculations done just to how much would need to collapse to start to expel that. It wouldn't have to be the entire area. Indeed if the entire area collapsed that would be a major expulsion of methane but hard to put a number on it but it's probably more than 10 square metres that I would expect it to start to push that out but that's just off the top of my head.
Q. So significantly less than even a quarter of the goaf, potentially?
A. You'd want enough to start to move it but potentially that sort of order.
Q. You referred in your evidence-in-chief today, to dilution doors. If we could have please, Ms Basher, DAO.001.04562/1?

WITNESS REFERRED TO DAO.001.04562/1

Q. This is a memorandum from the technical services department from Greg Borichevsky to Doug White dated 24 August 2010 in which some of the details of the dilution doors are referred to you'll see in paragraph 1 it says, second sentence, "These doors are to be operational prior to the commencement of hydro-extraction of panel 1." I take it you're familiar with the layout of the dilution doors that were installed?

1659

A. Yes.
Q. But not working?

A. Yes.

Q. In your view, if they were working, would that have made any difference to the first explosion?

A. There's probably a few comments to make here. I don't – I personally don't see this is a good mining practise, because it's actually creating problems elsewhere in the mine. The nature of the collapse or a fall such as this is potentially problematic to try and get these to operate rapidly anyway. Indeed, if you could get them to rapidly operate, they'd be quite violent in nature in being able to respond, because what it's attempting to do is to short circuit the air so that you dilute the gas that's been ejected from that particular area, so that you don't get an explosive mix or indeed a high percentage of methane carrying through to the main fan. So, it needs to have a very rapid response to open the louvers to short circuit the air to create that dilution effect, and given that these doors are on the main return and not very far away from the panel 1, it's difficult to conceive of them working and doing that particular job. I understand, and this is potentially may well be going off track a little bit, but I understand other installations of this style of dilution door and in Spring Creek, but that's some way away from the actual main headings and that's the point. The issue is that when you have these dilution doors short circuiting air in this manner, you actually cut the ventilation or significant reduce the ventilation that's available for the rest of the mine. You've actually created another problem, so to me, flawed logic. The mine manager or the general manager at the time directed that they not be operated and we've made comment in the report that that was probably the right decision. In effect, in actually in modelling it we found that it actually didn't substantially provide you with any assistance.

1702

Q. And even if they were in the right place, far enough away, would the ventilation capacity have been sufficient to allow those to be effective and still ventilate sufficiently the rest of the mine?

A. Well, there actually wasn't anywhere you could put them in the right place so it actually needed to be in the panel and you couldn't do it.

There was actually one cut-through and even then potentially it just had to be so rapid that it was already over.

Q. Just want to turn to the significance of the vent shaft collapse of February.

THE COMMISSION ADDRESSES MR WILDING –TIMING

THE COMMISSION ADDRESSES COUNSEL – TIMING

COMMISSION ADJOURNS: 5.05 PM

COMMISSION RESUMES: 5.18 PM

CROSS-EXAMINATION CONTINUES: MR WILDING

Q. Mr Reece, could I just turn to the significance of the vent shaft collapse of February 2009 to hydro-mining. Am I right that the goaf collapse scenario involves a propagation through to the island sandstone?
A. That's what we suspect, yes. That didn't necessarily need to, but it depends to some extent on the height or the width of extraction and the height that that's going to cave to, yes.
Q. And although, not necessarily in the DOL report but in the attached expert report of Professor Bell, there's reference to the vent shaft collapse of February 2009.
A. Yes.
Q. Involving progressive ravelling of the rock mass over a period of weeks until control at a depth of 65 metres, some 30 metres into the island sandstone?
A. Yes. Yes.
Q. Is that consistent with your understanding?
A. Yes, it is, yeah.
Q. Would it be fair to say that a prudent mine operator ought to have been alerted by that to the possibility of propagation up to the island sandstone?
A. Definitely, in a cave-in situation?
Q. Yes.
A. Yes, definitely.
Q. And therefore that's something which ought to have been taken into account when assessing how wide the hydro-mine panel should be?
A. Yes.
Q. Ms Basher, could we please have DAO.001.10780/1?

WITNESS REFERRED TO DOCUMENT DAO.001.10780/1

Q. You'll see this is a report from GeoWork Engineering Pty Ltd of 25 October 2010 to Pike River Coal Limited. Have you seen this report?

A. Yes, I have, yes.

Q. If I just take you to page 4 of that please? You'll see down the bottom it says, "4. Minimal caving of the island sandstone is indicated for the 30 metre wide panel 1. 5 increased height of island sandstone cave-in is indicated with a 45 metre wide panel 1."

A. Yes.

1721

Q. If we could just go to page 10 of that please Ms Basher? You'll see that it says on page 10, paragraph 6, from the second sentence, "Due to lack of data critical parameters have been assumed which does result in some uncertainty. Required geotechnical and geomechanical data would include…" It then sets out a variety of types of information that would be needed. You see that?

A. Yes.

Q. Having received that advice, what steps would you say a prudent mine operator ought to have undertaken?

A. From a mine operator's point of view what's being asked for here by the geotechnical engineer is further information from the mine to help him provide more accurate responses to what's likely to happen from the proposed action of the mine. So really it's a case of – typically what you'd do is if you want to do something at a mine, you've asked an expert, you would provide the expert with that information so that you could get a response from them prior to undertaking that action. So the point being, a geotechnical engineer has asked for further information, given further information, they provide you with a response, you act when they've responded.

Q. And you presumably don't undertake the subject activity until that process has been completed?

A. Exactly, otherwise why ask them.

Q. In DOL report page 136, paragraph 3.2.2, there's a comment that Pike River Coal Limited should have carried out a systematic overall risk and hazard assessment for the operation of panel 1.

A. Yep.

Q. I want to just show you a document, please Ms Basher DAO.003.08875/1.

WITNESS REFERRED TO DOCUMENT DAO.003.08875/1

Q. You'll see that document's entitled, "Operational preparedness gap analysis." You've had the opportunity to look at this yesterday?

A. Yes.

Q. Does that equate to what might've been the result of a risk assessment or is it a risk assessment?

A. It's certainly to me it's more of an action plan resulting from a risk assessment. It's certainly not a gap analysis, but then that's just correction of terminology, that's not particularly significant. But, it's certainly an action plan that would result from a risk assessment, that's the structure that you would see.

Q. Did you find evidence that there had been a systematic overall risk and hazard assessment undertaken?

A. There – well there had been a risk assessment undertaken. I suppose the concern is given from this action plan is there's a significant number of actions that needed to be formatted as a result of that. For our purposes and typically from a Queensland response the requirement prior to any workings of this nature is to conduct a fairly detailed and diligent risk assessment prior to any of those works being conducted and that being submitted to the regulator and the actions being implemented prior to that second working taking place.

1725

Q. What are the matters on this document that you would say needed to be done before commencing hydro-mining?

A. Well, really it's, that's the action plan's indicating the things that needed to be done before hydro-mining. And particularly for me the ones that they've indicated as high priority, it's difficult to know when it's intended to be done. But certainly the ventilation network, ventilation planning, Broad Brush Risk Assessment itself, monitoring the ventilation TARP and hydro-extraction plan one would expected all those things were done before it commenced. They're not the sort of thing that you do after the fact because you need them in order to continue.

Q. What's meant by Broad Brush Risk Assessment?

A. Yes, there's a number of, well, typically for us a Broad Brush Risk Assessment is a high level risk assessment that's conducted of the whole mining operation. But this seems to be suggesting that it's not a risk assessment of the entire operation, it's more related to those particular aspects. So really to me, it's just saying there's got to be a risk assessment of those particular things. Again it's the same sort of discipline it's just the scope of the risk assessment that you're going to conduct that changes.

Q. The department's report at paragraph 5.6.10, page 237 says, quote," The system used at PRCL also focused on single specific risks and there was no evidence of a Broad Brush Risk Assessment of the mine or an understanding of how various risks in combination could constitute a higher risk."

A. Yes.

Q. Does that mean in your view there ought to have been such an assessment undertaken prior to production?

A. It goes virtually back to one of the aspects we talked about this morning as far as feasibility is concerned and after feasibility but there would be a broad risk assessment of the mining operation it considers all hazards at a high level and you then actually stratify your risk mitigation processes based on that so it helps you to target particular things, so a Broad Brush Risk Assessment would identify such things as gas ventilation, spontaneous combustion, and there would be, from that, a particular risk assessment and risk mitigation processes for each one in particular, rather than take an ad hoc approach to those particular things as you found them. So it's really trying to provide a strategic response to them rather than a point by point.

Q. So a Broad Brush Assessment would've enabled an understanding of the various deficiencies to which you have referred to today with the systems in the mine?

A. Well, it should have identified those things.
Q. And it would've helped understand the consequence of those?
A. Yes, and the integration of them.
Q. And in your view would it have led to the conclusion that Pike River was not in a state to move to hydro-mining until the deficiencies with the systems had been rectified?
A. One would hope so but I mean that's, it's really a case of working through the risk assessment process, to some extent it's not fair for me to comment on a risk assessment that's not done or to take it off the cuff and in effect that's the reason why you do a risk assessment because it's not something you do off the cuff.
Q. The Department of Labour report makes some criticism of the risk assessment matrix process used by Pike River and it says also at paragraph 5.6.10, "In a high hazard environment, such as a gassy underground coal mine, it would be expected that a more sophisticated risk management approach would be adopted including techniques such as fault tree analysis, event tree analysis and BowTie. The latter should be used for major hazards, it is the combination of the fault and event trees."
A. Yes.
Q. Are they conventional methods to use in the underground mining industry?
A. From my experience they are, albeit that it's from an Australian perspective. The industry has been a little slow in taking those up but certainly there is a strong drive and has been a strong drive for probably the last six or seven years, certainly, probably more than that, to encourage the industry to use fault tree and BowTie for major hazards and for the assessment of major hazards, so not unconventional, not unknown, indeed practises that have been around for many years.

1730

Q. We had evidence last year in relation to use of lead and lag indicators.
A. Mmm.

Q. Is use of lead indicators something which is now common within the underground coalmining industry in Australia?
A. It's common. It's something that's espoused. The only comment that I would make is that I think we have a way to go before we get them established adequately and correctly, but there is certainly a lot of intent to have lead indicators. My concern is I think we measure the wrong things. That's a personal view.
Q. Ms Basher, could I please ask to be put up DOL.3000130008/1?

WITNESS REFERRED TO DOCUMENT DOL.3000130008/1

Q. That, once again, is the plan at the back of the Department of Labour report, of the mine. When you look at that, did you or the experts have some concern about the sheer layout and number of activities being undertaken in the mine?
A. Yes, we did.
Q. What was that concern?
A. It was really the area inbye panel 1, and the fact – and I've touched on this previously – but the fact that there was one intake, one return and all progressing from that was the ABM panel in two right, the potential continuous miner, albeit that it wasn't operating at the time, the roadheader that was working down in this roadway, and the drilling operation. There's a lot happening, there's effectively three auxiliary fans all working off that single intake, single return, so there's a lot of activity in a fairly congested area and in effect a fairly small area of the mine.
Q. So aside from the ventilation capacity you were concerned about the amount happening within that small space?
A. Yes, that's correct.
Q. Why?
A. Oh, a few reasons. One is simply being able to manage it and co-ordinate it. The other is you actually don't have a lot of room and it sounds a little bit odd, I suppose, but you actually need enough pit room in order to co-ordinate the movement of machinery and people in that area and it's starting to become a fairly congested area. If you can

imagine all of these roadways with the red lines in them, have ventilation tubes, they've got services in there so pipes, electric power, they all need supplying with consumable items, so roof bolting material, stone dust, there would've been an awful lot of equipment in a fairly confined area in there, so it would've been fairly tight for space and simply the working area. So, from my point of view as a mine manager that says to me, "Very busy."

Q. Can I just ask you a couple of discreet questions, turning back to the health and safety system, analysis of accident and incidents within a company and analysis of production and statutory reports, are they matters which are commonly done within a prudent mine operating company?

A. Yeah, constantly, yeah.

Q. And who, within the company, would receive the results of those?

1735

A. Well it depends. You've really got a hierarchy within the organisation. So it tends to go right through from, typically from deputies who would be the first recorder/inspector and so on, and certainly with investigations and incidents and so on, through to shift underviewers or undermanagers, the mine manager and in some instances the general manager depending on the severity and for some instances, particularly where the incidents, incident investigations depending on whether there are injuries or significant instances, could go further than the general manager.

Q. You've had the opportunity to look through the Commission's summary of incident and accidents.

A. Yes.

Q. Would that suggest to a prudent mine manager anything about the culture at the company?

A. It does from the point of view that there were lots of things happening. It's hard to draw conclusions from it and that's where I would be cautious. Some of the things that I found in looking at some of the investigations was they didn't necessarily get to the heart of the matter which is sadly not an uncommon situation. But the problem is that that means you're not actually solving or resolving so that it doesn't happen again. So that's a concern I have with the number of them. They tend to be fairly superficial.

Q. In relation to the number of documents within the health and safety system, the department report at page 239, paragraph 5.7.9.1 says this, "PRCL had structured hazard management systems in place. Notwithstanding a huge number of documents or because of a huge number of documents there seems to have been little effect on the management of critical hazards underground." Did you reach a view about whether or not there were too many documents?

A. We really didn't come at that perspective, mainly because it was really starting to get into specific management operations. Our scope was really trying to look at causes of the explosion. Albeit in saying that, we still had to go through the documentation, so rather than it being an intent, it was a by-product, I think the concerning thing is with large numbers of documents it actually starts to lose value and it's probably more a case that you can have a large number of documents but it's about the focus on the critical documents that is a key element. So it was more a case of looking at some of those critical elements and forming a view on those and we found a lot of those were verbose and again really didn't cut to the important matters that needed to be addressed.

Q. But presumably you need sufficient documentation to deal with the hazards identified?

A. Yes.

Q. But not so many that you can't train the men and manage those systems?

A. That's correct.

Q. What levels of the company do you say should have input into the development of a health and safety system?

A. Well really it's a wide range and our typical response is to have a cross section depending on the nature of the documentation so it could be people from miner through to mine manager on different things. So it's a full scope. The comment I would hasten to add is that its problematic that its often left to the safety professionals and they're not the ones with the technical knowledge of managing these hazards.

Q. So those have to be developed by the experts or with substantial input from those with the required technical expertise?

A. Absolutely and they're the ones that ultimately own them. They're the ones that administer so certainly safety and safety health professionals need to be providing assistance and quality assurance as far as that's concerned, but the technical content needs to come from the process owner.

1740

Q. I'm just going to touch lightly on the explosion itself because I understand you're happy to continue consulting with the Commission's experts as to that aspect. The calculations were made with reference to the volume of air that was thought to be expelled out the portal is that correct?

A. That's correct.

Q. And the majority of the force of the air out the portal was expended in the first 30 seconds?

A. The bulk of it seems to be yes.

Q. But a figure of 30 metres a second in your witness statement was used for the whole of the 52-odd seconds. Would you accept that for the last 30 seconds of that explosion when there was less force evident through the portal video, a lower speed, for example 15 metres a second, could've been used?

A. Yes.

Q. And that would reduce the volume of methane that might be required?

A. That's correct.

Q. Were you able to model the amount of air that was expelled up the portal?

A. Well, not so much modelling but certainly calculating based on the duration and the velocities yes.

Q. Am I right in understanding that one of the assumptions was that the air expelled out the portal was equal to the air that was expelled out the vent shaft?

A. That's correct.

Q. So in other words you calculated the air out the portal and just doubled that?

A. Yes.

Q. There was no video evidence of the amount of air that went out the vent shaft of course?

A. No.

Q. Would you accept that it could've been a lesser quantity of air than that out the portal?

A. Yes, I do to a point but this is where we need to start discussing some of the potential ramifications of it. To some extent to do with pressures involved and length of the roadways but we're certainly quite happy to talk about just what's most likely to have gone out there and indeed, it would be nice to actually get some further calculation on some of the resistances in that particular area.

Q. I won't go through further, but would you accept that the volume of methane required could be less than that which is stated in the department's report?

A. Yes.

Q. And therefore, that it could've accumulated in a lesser length of tunnel than perhaps calculated?

A. Yes.

Q. And that the result of that may well be that the chance of an accumulation being a source of fuel is perhaps higher than stated?

A. Well it's, to me it's still an accumulation. There has to be an accumulation, it's just the location of that accumulation starts to be broadened.

Q. And even if the goaf scenario collapse is correct, that the accumulated methane is likely to have exploded as well, in other words the methane that was accumulated, if any, in the other headings?

A. Yes, quite possibly. And indeed that's what we allude to in case 3, or indeed case 2 is a combination, case 3 is very much looking at just those development headings being the source.
Q. If an explosion started as a result of an accumulation, for example the ABM heading, could that have drawn methane out of the goaf and in turn caused that to be diluted and ignited?
A. I don't know if it would actually draw methane out of the goaf. It would make sense that given that there's already a methane source coming from that return that there would be some interaction, certainly. Whether it also draws it out of the goaf itself is debateable, there certainly could be some interaction but there may well be some sort of venturi affect from that but that's certainly something we'd want to talk to others about and just see the likelihood of that.
Q. As I understand it the coincident timing, as you've referred to it, of the powering up of the pumps was seen as a relatively compelling factor in rating the goaf scenario as most likely. If we put aside that coincident timing, what are the other sources of ignition that you will consider to be reasonable?

1745

A. Just to add, there's a slight refinement of that. It was the coincident nature of that that prompted the expectation it was an electrically associated ignition of any of the areas, not just the goaf, but as far as other ignition sources –
Q. Yes, if we put to one side that coincident timing?
A. Sure.
Q. What then are the other ignition sources that you would consider reasonable?
A. Well we certainly haven't ruled out contraband. We haven't ruled out – we can't rule out totally spontaneous combustion albeit that there's no real strong evidence for it. We've largely ruled out frictional ignition, but that's not to say that there couldn't be a pump or something like that that's contributed in some way, but again, less likely. Diesel is probably the other one that's more likely to provide that sort of – a diesel vehicle,

sorry, is more likely to provide some form of ignition source. They're the main ones that we're left with.

Q. I take it data from tube-bundle monitoring up to the point of the explosion would've been of assistance in helping to rule spontaneous combustion more or less likely?

A. Oh, certainly, as far as spontaneous combustion's concerned and that's often the reason for it. It's about trying to pick up trends in carbon monoxide.

Q. Would the drilling of a borehole for example in the goaf help prove or disprove any of the possibilities?

A. It seems to make sense, I suppose, the problem is that it doesn't necessarily prove it. If it hasn't fallen then certainly you would assume that that's not been the driver of it. The problem is, it's quite difficult to see and certainly to see a great distance. The other thing is it's quite problematic to drill into a goaf. It's not something that you can easily do. It's not uncommon to drill into a goaf and actually lose the rods in the sense that they actually become caught, so it's not a simple exercise. The other aspect is that there's potentially better areas that would be more suitable to go and look for particular conditions. The other thing is that there's a hole relatively close to that area in the one cross-cut and it's not showing any significant damage as far as an ignition's concerned. It certainly still doesn't change the fact that if it's just a goaf push that's occurred that we haven't confirmed or denied it.

Q. Where would the better areas be?

A. Oh, well, some of the areas further inbye, there is still a certain amount of concern as far as proving the ABM panel or that six cut-through area in one west, or indeed even looking at some of the electrical installations to see if they've actually been arcing or some evidence there. The problem is, it's really a needle in haystack-type of work.

Q. So does that mean that you could drill a series of boreholes and perhaps rule out some possibilities but still be left with others?

A. Yes, yes, it's exactly right.

Q. Just finally, all the various scenarios that the expert team has come up with leading to a possible source of fuel, are they essentially all involving events that were foreseeable and controllable using existing techniques in underground coalmining?
A. Yes, you'd have to say, by and large, yes.

THE COMMISSION ADDRESSES THE COUNSEL – HEARING PLAN TIMING CHANGE

COMMISSION ADJOURNS: 5.51 PM