VIQ SOLUTIONS AUSTRALIA PTY LTD
ACN 008 711 877

**T:** 1800 AUSCRIPT (1800 287 274)
**E:** clientservices@auscript.com.au
**W:** www.auscript.com.au

# TRANSCRIPT OF PROCEEDINGS

TRANSCRIPT IN CONFIDENCE

O/N H-1662050

**INDEPENDENT PLANNING COMMISSION**

**IAPUM MEETING**

**RE: NARRABRI UNDERGROUND MINE STAGE 3 EXTENSION PROJECT (SSD-10269)**

| | |
|---|---|
| **PANEL:** | **PROF MARY O'KANE AC**<br>**PROF CHRIS FELL AO**<br>**PROF SNOW BARLOW** |
| **ASSISTING PANEL:** | **RICHARD BEASLEY SC**<br>**STEPHEN BARRY**<br>**BRAD JAMES**<br>**PHOEBE JARVIS** |
| **DPE:** | **CLAY PRESHAW**<br>**STEPHEN O'DONOGHUE** |
| **IAPUM:** | **PROF JIM GALVIN**<br>**PROF RAE MACKAY**<br>**PROF NEIL MCINTYRE** |
| **LOCATION:** | **VIA VIDEO CONFERENCE** |
| **DATE:** | **11.01 AM, FRIDAY, 11 FEBRUARY 2022** |

PROF M. O'KANE: Good morning and welcome. And before we begin the discussion I would like to acknowledge the traditional owners of the land that we are variously on today and pay my respect to their Elders, past, present and emerging. Welcome to the meeting today to discuss the Narrabri Underground Mine Stage 3 Extension Project SSD-10269, which is currently before the Commission for determination. Details regarding the project can be found on the Commission's website. My name is Mary O'Kane. I'm chair of the Independent Planning Commission and of this panel. I am joined by my fellow Commissioners, Professors Chris Fell and Snow Barlow, and by Richard Beasley SC, senior counsel assisting the Commission. Also in attendance are Stephen Barry, Brad James and Phoebe Jarvis from the Office of the Independent Planning Commission.

In the interests of openness and transparency and to ensure the full capture of information today's meeting is being recording and a complete transcript will be produced and made available on the Commission's website. If you are asked a question and are not in a position to answer, please feel free to take the question on notice and provide any additional information in writing which will then be put up on our website. I request that all those here today introduce themselves before speaking for the first time and for us all to ensure that we do not speak over the top of each other to ensure accuracy of the transcript. So, now, I believe and, Professor Galvin, I believe everybody was sent the agenda. Is that correct? Yes, I gather.

PROF J. GALVIN: That's correct. Admittedly, it was only early hours this morning.

PROF O'KANE: We – sorry we didn't get you more notice.

PROF GALVIN: That's okay.

PROF O'KANE: It's all right. The – so there are really three big topics we want to discuss, but we're happy to hear any comments from you on this case and thank you for the material that you provided that was sent to us with the assessment report from DPE. It has all been very helpful and led us to think through a lot of questions. I guess we probably want to start on subsidence issues and we're particularly interested in reading that these are – these Longwalls are some of the biggest Longwalls in Australia and maybe in the world and wondered about what are the risk factors on, you know, several dimensions about that and then, you know, is it all going to be fine with this particular mine and what's proposed.

PROF GALVIN: Professor O'Kane, we did get the first set of questions a couple of days ago.

PROF O'KANE: Yes.

PROF GALVIN: And I was really miffed by why the IPC was asking those questions. I couldn't understand why you would ask them. To me there were no

issues there. Subsequently, yesterday – so we haven't seen – we hadn't seen the Department's assessment of the project.

PROF O'KANE: Right.

PROF GALVIN: So, yesterday, I thought, "Okay. We better have a read of that." So that came through yesterday as well and, to be honest, I haven't got all the way through it. However, I got to about page 2 when I found a paragraph which suddenly the light has come on that why you're asking these questions and then this morning when I've turned on the email I see that you've added a few questions on it. I think, if you don't mind, the way to deal with this is the way that we've done it before with other IPCs. Some of the questions you're asking are interrelated and I think probably a better way of dealing with this is maybe if I can just have a little rant for five or 10 minutes.

PROF O'KANE: That will be wonderful. We would be very happy.

PROF GALVIN: And I think that will put a lot of it to bed for you.

PROF O'KANE: Yes. No. You rant and that will be good.

PROF GALVIN: Okay. Now, my problem is I have so many documents open. Okay. There we go. All right. So let's stand back from this just for a moment. A lot of the questions you're asking did not fall within our terms of reference as a panel which would be the mining dimensions and gas. However, my role on the panel, apart from the chair, is mining and subsidence and I've managed underground coal mines and the questions you're asking are really just bread and butter for a mine manager. So I'm happy to provide those answers - - -

PROF O'KANE: That would be good.

PROF GALVIN: - - - as much as I can.

PROF O'KANE: Yes.

PROF GALVIN: Now, the – I want to do it in two ways. I want to deal with subsidence, but I also want to deal with gas and I can I think answer 80 per cent of what you're asking in both those areas if I just stand back from it. So what – I couldn't understand why the panel were asking questions about, you know, why the ..... linked to the Longwall influence gas make and how does it influence dilution with air and what's the risks and I'm thinking, "This – I don't see any issues there." And it's only when I look at the Department's report and paragraph 126 says:

> *However, there are two relatively unique features of the project which could lead to associated impacts. The first one is Longwall panel width and length and the panels would be some of the longest and widest in Australia. This*

*leads to relatively high levels of subsidence, a highly fractured zone above the mine workings and associated impacts on water recourses.*

The simply answer is it does. There's nothing unique about that. You can have those same outcomes with a panel that's 200 metres wide, you can have it with a panel that's 500 metres long or five kilometres long and I will explain that in a little bit more detail. So I don't – whilst there's certainly the proposed longest Longwall panels in the world, I don't think there's anything particularly unique about them, except they're longer than what other people have done to date. And the second point is gas content:

*A Narrabri mine is a relatively gassy mine which leads to fugitive emissions and, to date, the gas emitted from the mine has been very rich in CO2 and not amenable to flaring.*

It's probably a fair statement, but, in terms of mining terms, I don't think Narrabri is really considered a particularly gassy mine and in some of the information I've read the amendments to the application, etcetera, there's areas where they're not even proposing to do gas drainage. So it doesn't really – it's not up there with really gassy mines and that's really part of the problem that you're dealing with, with fugitive emissions. Frankly, it's not gassy enough to capture them and I will come back and explain that in laymen's terms as well.

PROF O'KANE: Yes. We really wanted to talk about that, too.

PROF GALVIN: Okay. So, when I got the first set of questions and I was really miffed why you were asking about width and length, in Australia we've had 400 metre wide Longwall panels probably for two decades now mainly at Ulan Mine, but there are a few in Queensland. And a lot of people have looked at them and there's various reasons why we – not every mine runs with them. Some don't have the capital, some don't have enough clear geology to be able to put such wide panels in and a basic consideration is that, when rock is loaded – soft rock is loaded, its strength is time dependent.

If you leave it loaded long enough it starts to – now, coal mines rocks are typically soft. The wider you have a Longwall face the longer it takes you to go up and down it. So the slower you retreat and, if you do hit bad ground, the – you know and the key is to move through it as quickly as you can, Longwall – wide Longwall faces are not conducive to that and that's a reason why a lot of mines decide they don't want to go too wide because of that.

Then I thought, "Well, the comparable to Australia is the US. We – Australia and US are the – really the only two today that are doing Longwall mining on a big scale in relatively flat topography. There's a lot in – was a lot in Europe, but it's very steeply dipping. It's not comparable. Now, the – I dug out the latest Longwall statistics from the US and I sent it to you simply because it shows predominantly in the US Longwall panels are at least 400 metres wide and typically four to five

kilometres long. So there's nothing magical about 400 or – wide, 500 metre – five kilometres long and, as I said earlier, there's also mines in Queensland that are not operating 400 metre wide faces, they're operating 300, but they are successfully extracting six kilometres long.

So sort of going to your question, subsidence – the amount of subsidence you get on the surface is the function of the mining height. It's fairly obvious. The bigger the hole you put underground, the more it's going to fall in it. And the other thing that's a function of is the width of the panel compared to its depth. It's the ratio. It's not the absolute number. So a 400 metre wide panel at a depth of 200 metres, that gives you a ratio of two, you will get the same per cent of your mining height as subsidence would come through if you had a 200 metre wide panel and a 100 metre wide department. So it's just the ratio. It's not the absolute length.

So with – to close that out for the moment, as I showed you in the US and lots of 400 metre wide panels, nothing magical. They're only coming in in recent years because of technology you need, things like multiple motors on your Longwall face to drive your conveyor belt and, before good computer technology and wireless networks and so forth, it was very difficult to synchronise those motors and to get them to all to start together and stop together and that we've come a long way. So things are getting longer – wide and the faces are getting wider.

Now, in terms of length, that really threw me because length has nothing to do with subsidence and it really doesn't have anything to do with gas because the amount of gas in a given area, length by breadth, is the amount of gas that's in that given area and it doesn't matter how wide or narrow you make your Longwalls, there's still the same amount of gas present. Where gas comes in - and I'll jump to gas for a moment - is, in simple terms this. That, if I don't do any drainage at all when I go into a coal seam, the action of crunching up the coal with the machine mining it causes gas to be liberated, but also, as I'm driving my roadways, I've got gas emitting from the sides of the roadways. Coal miners call it "ribs". You will hear "rib emissions" is what we .....

So you have two sources of gas coming into your ventilation system. Now, at standard temperature and pressure – and this is important for understanding later about burning methane. At standard temperature and pressure, methane is explosive in the range of five to 15 per cent. So by legislation in Australia and typically, you know, numbers are very close to each other wherever you go, once you have more than one and a quarter per cent methane in your airway, the equipment has – electrical equipment shuts down. So you can't mine. By law, at least in New South Wales, in my day, anyway, it was more than two per cent methane in your – remain anywhere in your return airway, that was the maximum limit.

So, if you don't do pre-drains, even just simply driving tunnels, if you go far enough, you will have enough gas seeping in from the sides of the roadway, but you will have to stop mining. So that's one consideration with very long panels is, "Well, how far can I go before I get gassed out?" So the solution is to pre-drain it and, if it doesn't

catch you in the roadways, it will catch you on the Longwall face because now we're really – orders of magnitude higher production rates and gas emissions. So that's why we pre-drain.

Now, post-drain, that's a different kettle of fish altogether because, when we Longwall mine, the rock doesn't cave vertically to the surface. It counter levers out of the goaf. So the rock that's counter levering off, the way that the rock gets put onto the Longwall face and that extra weight causes the floor to crack and, if there are coal seams under the floor and, when I say "seams", they may only need to be 150 millimetres thick, but if there's coal seams in the floor and we crack them, we now have new gas coming in and it's going into the goaf.

The other thing is that almost invariably we have other coal seams in the roof. So, when we cave, we break them up. They're a source of gas. So the goaf fills up with gas, quite lots of gas. That's a good thing. That's a good thing because, once it's above 15 per cent, it's not explosive. But because it displaces the oxygen, in a mine where you're prone to spon com and this mine is, if you don't – it keeps the oxygen out of the goaf. So you're not prone to spontaneous combustion. Also you're – you can guess out your goaf. You're not prone to explosions in the goaf. So, in Queensland, for example, when a Longwall panel is finished, by law they put seals in and then they evacuate the mine until the goaf fills with gas that's above the explosive limit. Once it's above the explosive limit, they go back in.

Now, where's the problem with – why do have all these bore holes from the surface which were part of the issue? It's simply this. If at the mining face my goal is zero methane, but I have to stop work at one and a quarter per cent and somewhere back in the goaf I've got 40 or 50 per cent methane, by definition somewhere I've got to go through the explosive range. There's a fringe of gas where its – the gas content has to be – will be in five to 15 per cent. And the last thing I want is that fringe to be at my Longwall face because, first of all, there's lots of potential sources of ignition, even though everything is flame proof, explosion proof, these things do happen from time to time and there was one in Queensland a couple of years ago and that mine has only just re-opened now.

So we don't want the gas fringe near the face because of the electrical equipment, etcetera, but we also don't want it in the area where the rock is still caving and moving because, if we've got rocks with high quartzite content, we can get enough friction and ignition to ignite the methane. So we're trying to keep that explosive fringe back in the goaf where there's not much movement and how we do that is put surface bore holes down and draw gas off through those bore holes in a such a way that, in the face area we're keeping the face area clear from gas and the in - - -

PROF O'KANE: Can I interrupt with a question?

PROF GALVIN: Yes.

PROF O'KANE: You're putting the bore holes down over the face?

PROF GALVIN: They're putting them down over the collapsed area. So the bore holes are over the top of a goaf.

PROF O'KANE: Okay.

PROF GALVIN: The caved area.

PROF O'KANE: Yes.

PROF GALVIN: Now, methane being much lighter than air, it's half the weight of air - - -

PROF O'KANE: It does - - -

PROF GALVIN: - - - it just wafts its way up to the bore holes and can find its way out or you can put them on suction if you need to.

PROF O'KANE: Can I ask you another question there? But aren't you trying to get the methane up in the goaf? Why are you – I don't - - -

PROF GALVIN: No. What you're doing – you're not – you're managing the bore holes closest to the face. You're focusing on them - - -

PROF O'KANE: Yes.

PROF GALVIN: - - - and you're trying to draw methane out of the goaf instead of allowing it to get to the face.

PROF O'KANE: Right.

PROF GALVIN: But, as you go further and further behind the Longwall where you've already mined - - -

PROF O'KANE: Yes.

PROF GALVIN: - - - as you go further into the goaf, all right, it's helpful to leave the methane there because it's in the inert atmosphere.

PROF O'KANE: Okay. Chris. Sorry, Jim. Hang on. Chris has got a question.

PROF GALVIN: Now – yes.

PROF C. FELL: In – you're talking much about safety. I think the panel is concerned about the greenhouse impact, if you like, of the methane. But the question I think about the length of the Longwall had to do with more surface exposure and the risk of more methane actually coming into the mine as a consequence of that.

Could you explain how you actually isolate sections of the mine to prevent that happening?

PROF GALVIN: You may not be able to. The reason I was going down that track, Chris, is because there's questions there about erosion on the surface and roadways and Longwall widths. And I was almost there. The point being that you have to have that many bore holes to manage the situation. Therefore, you've got to have that many roadways, but the point being that, if you went to 300 metre wide Longwalls instead of 400, you would have four Longwalls instead of three in the same distance, but you would have to put more roadways on the surface and, in fact, you're disturbing the surface more with narrower Longwalls and - - -

PROF FELL: That's helpful. Thank you.

PROF O'KANE: All right. Thank you.

PROF GALVIN: Okay. Coming to the gas and your fugitive emissions. As soon as we – so the Palaris report is quite consistent with my understanding and training about what gas levels you can flare at and what gas levels you can generate power with

UNIDENTIFIED MALE: .....

PROF GALVIN: You're the chemical engineer. You know that – okay. And so that I don't have any problem with. Now, in the given area, whether I have a 200 metre wide Longwalls or 400 metre wide Longwalls or, you know, Longwalls 10 kilometres long or two five kilometre, it's still the same amount of gas that I'm dealing with. And, in terms of fugitive, if you suck the gas out of the mine, well, we know the story from what Palaris is saying, whether you can flare it not, whether you can generate power or not with it.

The other issue, however, it's very contentious now for quite a few years is how high does connective fracturing go above the mine workings? Connective fracturing. And can that be a path for gas to find its way to the surface and the answer to that has to be yes. Because water finds its way into the mine through the same fracture network, plus we know on the south coast years ago when they were mining on the Cordeaux River people were going along and lighting gas bubbles on the Cataract River and, you know – and it was on the front page of the Sydney Morning Herald. Now, that gas was arguable didn't come from the mining horizon, but it doesn't matter. There was a fracture network that got to the surface.

So where to from there? Look, I think this is just emerging now with some of this drone technology and sensing technology, particularly in Queensland where people now are starting to get methane imprints concentrations above mine workings and at least what you read is saying, "Well, there's more fugitive emissions there than what we have been thinking we've had in the past." If you walk along the surface of these mines - - -

PROF S. BARLOW: Jim, it's Snow Barlow here. How are you measuring that methane on the surface? Is this, you know, just normal measurement on the surface of those mines or is this sort of the more recent aerial or infrared technology that people are using?

PROF GALVIN: But – as far as I know, we're not measuring it at all. This is still a research – it's still very much research - - -

PROF BARLOW: ..... Yes, yes. I agree with that. But how - - -

PROF GALVIN: I don't know. Look, that's not – you – one of your questions later concerns approval condition B16 and what do we think about that. We're not into fugitive emissions yet. That is another topic that will come under the panel, but we haven't' even appointed people in that area yet. So my input to you is it's still general knowledge, but I'm not seeing any measurements of fugitive gas emissions above fractured ground in mine workings yet.

PROF O'KANE: Should there be?

PROF GALVIN: If you want to control fugitive emissions, definitely. It's a fugitive emission. What you could do about it, I'm not quite sure. I would say if you've – repairing a lot of your subsidence fraction networks and you have a – you have enough soil – top cover that you will seal it fairly effectively. The basis for that is that mines that are prone to spontaneous combustion, mines are ventilated on a suction and negative pressure. So, if you've got cracking to the surface, they can suck air in from the surface into the goaf and that happens and it caused a spontaneous combustion. But keeping the surface, filling in the cracks, keeping it capped with soil is an effective control. So don't see why that wouldn't still apply to methane.

PROF FELL: If I might, Jim, the question, I guess, we asked was having very long Longwalls is not a problem. You have told us that it isn't and it doesn't increase the amount of greenhouse or anything else. Safety in terms of people moving or – etcetera, it's not a problem there?

PROF GALVIN: No. It is. Because, if I took you underground in a coal mine today, you would have to be trained in how to use breathing apparatus, the same as the fire brigades use now to go into a building and you are expected to rescue yourself and walk out of a mine and I think you would find it very challenging wearing that breathing apparatus to walk a 10 kilometre long roadway as opposed to a two kilometre long roadway. Now, as a point of interest, if you go to the EA for this project and you look at figure 2.9, so section 2, figure 2.9 – 2.10, they don't reference it in the report much. It's sort of hidden away, but they've actually got an alternative mine layout there and they've cut those Longwall panels in half.

PROF O'KANE: Can you just tell me what page, Jim? Have you got it there?

PROF GALVIN: Page 36.

PROF O'KANE: Thanks.

PROF GALVIN: 36. And I think – Mary, I think that is actual page number, not PDF page number.

PROF O'KANE: Right. Okay.

PROF GALVIN: It's figure 2.10 anyway.

PROF O'KANE: Okay. I will find it.

PROF GALVIN: Maybe it's worth looking at that because there's a couple of interesting things in that. Do you want me to put it up on the - - -

PROF O'KANE: Yes. That would be good. Steve O'Donoghue might actually know the page.

PROF GALVIN: I've written on this "page 36". I just – let me just have a quick look.

PROF O'KANE: Anyway, put it up, Jim, if you can.

PROF GALVIN: Yes. I will keep – well, keep talking there while I look for it, but the point I was going to make is that, when I first looked at their mine plan, I couldn't really understand why they had ventilation shafts halfway along the very long panels. I mean, you can do it that way, but it just looked a bit unusual. But, when you get to their alternative mine layout, it's exactly where they propose they could cut the Longwalls in half. So safety is one issue in terms of – or, if you're trapped inside – and there's different ways out for sure, but it can be a long way to walk. I said earlier that the strength of rock this time depended – it's – rock has got a – you've got to maintain the roadway for a lot longer to keep it open. You can do that, but it's a lot of work.

Going from six kilometres to 11 is a big jump and I have to say that I think the real risk to me is financial risk. There's a lot more at stake when you've got such a long Longwall panel and something goes wrong and you've got to – they access the panels from both ends, too. So that's really – in terms of distance, it's half that. You can go out one way or the other. So that's an argument in their favour. But I'm just suspicious when I see figure 2.10 that, you know, there's no doubts there anyway that they may need to shorten the panels.

PROF FELL: Presumably, the resource regulator will pick this up when the extraction plan is lodged.

PROF GALVIN: Yes. The extraction plan should be based on the actual mine layout that they're proposing to use. Yes.

PROF FELL: Okay. Thank you.

PROF BARLOW: Jim, Snow Barlow here.

PROF GALVIN: Yes.

PROF BARLOW: Back a bit. I'm sorry. I was letting us finish that safety piece first, but in – when we were talking about, you know, the subsidence, cracks coming to the surface, that, you know, not only a conduit for water down, but perhaps gas up as well and then I think in your report or panel's report you wrote that, with time, these things sort of fill in. You know, what is that timeframe when – presumably that's sort of soil gradually falling down those cracks and sealing them. Is that right?

PROF GALVIN: So what typically happens is that these cracks are monitored and this is pretty mature management now. It has been around for a long time. The cracks are monitored. You pretty much know where you're likely to get them and the big cracks get tended to pretty quickly. You get out there and you plough it, you infill it, you put clay in and you grade it, all the rest of it. Now, the smaller cracks or hairline cracks, it's usually just a matter of time between wind or rain and they just infill. People refer to it as "natural healing", but they normally just seal themselves. It's the big ones that are the concern because, apart from anything, if you don't get to them, then you've got – setting yourself up for a nice erosion channel. So they normally get dealt with pretty quickly.

PROF BARLOW: And what's the timeframe of that, Jim? You know - - -

PROF GALVIN: I mean, in Longwalls like this, particularly the longer ones, this is just set up to happen on a daily basis, if need be. It's - - -

PROF BARLOW: Right.

PROF GALVIN: You go out, you do your inspection, whatever that frequency is. It wouldn't be – unless it was critical infrastructure, it's probably not daily. In this case, it's probably weekly, something like that. And then next Monday out go the job orders to the crews to go out and do the remediation work – the remedial work.

PROF BARLOW: Okay. But I mean, you know, let's say that in the mine closure, let's say all this has been attended to, is there any issue after mine closure?

PROF GALVIN: Okay. So I didn't quite answer Chris' question on that earlier. So there is – there can be an issue and I will come to that. When these Longwall panels are finished, you seal them off and once you seal them off, in terms of gas, that – you will still get leakage out of them because the rock is fractured, the seals that you put in are not necessarily tight. So you will still get leakage of gas, but not anything

significant. So the gas is now confined in that panel. So how can it get out? Well, if – during the life of the mine, if a seal fails and sometimes they do, then it obviously can get out. At the completion though or – and if the seal is stable on completion of the mining, the only real way out is to percolate its way out through the fractured ground to the surface.

Now, this sort of issue has come to the forefront when this panel and I think – yes, I think the same panel members you're talking to now. Neil, Rae and Ann Young. were on it with me and everyone was worried about water going into Dam Drobian, but when, at the end of the day, the mine is sealed and the groundwater models all say, "Water is going to recover to the surface," we asked the question, "Will it recover until it hits the lowest point – hits the first valley and then why is it just not going to start and report to the surface then through the fracture networks? And we know rain gets in. So why can't water get out?" And that's the same with the gas.

Now, the sealing that we talk about with cracks and that, that's pretty effective for water. The cracks – so – there's a step missing and it's usually missing in most subsidence reports. Subsidence develops as a wave. So you walk along one day and let's say you're walking down the middle of a panel. You're walking along one day and you start to drop down into the subsidence trough. Well, the ground is stretched. So you see cracking there. But, when you come back a week or two later, that part of the ground has finished subsiding right down into the basin subsidence trough and, in theory, those cracks don't exist any more. The ground has closed up. Okay. And, to the large extent, that's pretty much the case. Hairline fractures, but they close up.

However, that's walking along down the long – the centre line of the panel. If you walk across the panel, you go down into the subsidence trough and then you start to rise up to go over the top of the pillar and you get more tension cracking as you start to go over the top of the pillar. Now, they don't close up. They may close up marginally, but they're the ones that are left in a permanent state of tension and that's where all this sealing of cracks and keeping water out is focused on those and, in the EA, it's – they keep going back to the – these tracks near the tension cracks and they will monitor the cracks and they will fill them. So it would be unusual - - -

MR R. BEASLEY SC: Sorry. Sorry to interrupt, Jim.

PROF GALVIN: Yes.

MR BEASLEY: Richard Beasley. Just so I can follow. When you're referring to the "EA", are you – is there any chance you mean the EIS?

PROF GALVIN: Yes. The EIS. Yes.

MR BEASLEY: Yes. And is the figure you wanted the panel – the - - -

PROF GALVIN: I've got it here. I can put it up.

MR BEASLEY: Is it PDF page 36 of the EIS? Which is figure 2.10?

PROF GALVIN: Yes. I've got it here. I can share my screen with you now.

MR BEASLEY: I think it's PDF page 36 of the EIS, figure 2.10.

PROF O'KANE: Put it up, Jim. That would be great.

MR BEASLEY: .....

PROF GALVIN: Can you see it?

MR BEASLEY: Yes. That's it.

PROF O'KANE: That's very clear.

PROF GALVIN: All right. So this is the original mine and then what they were propose and then we've got the extension to the panels and what you see here – see if I can blow it up. It doesn't want to let me blow it up. What you've got here that I can see on my paper copy is a whole heap of roadways across here.

PROF O'KANE: I can see that. Yes. It's clear on the screen.

PROF GALVIN: And, if you go back to the text, somewhere in there – well, if you find the reference here:

> *An alternative underground mining layout - - -*

PROF O'KANE: Yes.

PROF GALVIN:

> *- - - reflecting these changes is show in figure 2.10.*

Okay. And:

> *Potential changes in key impacts associated with the alternative layouts are assessed in attachment 11.*

Now, I haven't been to attachment 11, but clearly they are talking here about – here we go, blow this up. Now, I'm right:

> *The final layout in mining order of panels approved may include –*

blah, blah, blah, blah:

*If appropriate, additional workings could result in Longwall panels being split into two or more continuous panels which would be described in relevant future extraction plans.*

And then – and now you can see where they're – the roadways are there and this is my point here. This is an upcast and a downcast shaft. Now, there's one lot there, one lot there and then there's two up here. I think that's sort of a bit of thinking – forward thinking on their part that, if they find that this is too excessive for some reason, that this is sort of in an optimum position to split the panels into two.

PROF FELL: Well, that's very helpful. Thank you.

PROF O'KANE: Yes.

PROF GALVIN: Do you want me to leave that up?

PROF O'KANE: No. I think – back to talking and then we can put it up again if we need to.

PROF GALVIN: Well, look, I think – let me have a quick look at your questions because I think I've talked far more than I should have - - -

PROF O'KANE: No. It has been very good and we're happy for Rae and Neil to add anything they want to, too.

PROF GALVIN: So I just – while we're in – may as well do it this way. It's easier to share the screen and then I'm going to ..... Alzheimer's. I've got so many screens open. Okay. Can you see the words?

PROF O'KANE: Yes.

PROF GALVIN: Okay. So this is what I said two relatively unique which I could question that neither of them are relatively unique. The combination of the two features, very long and wide panels and the gassy nature of the mine means it needs – a need for an extensive infrastructure – ventilating infrastructure at the surface.

I would say to you that that need is there anyway. You're going to mine that area of coal. You're going to need bore holes put down to pre-drain the same coal. You're going to need bore holes to de-gas your goaf. You're still going to need ventilation fans, etcetera. So I don't know that there would be a significant difference in the amount of infrastructure you need. This mine, because it's prone to spontaneous combustion, when you ventilate coal mines typically, you have your downcast shaft and your upcast shaft that are reasonably close together and you pump the air in through a U and back out the other way and the air tries to sneak across from one roadway to the other. If there's any leakage path, it sneaks across and that's a problem with spon com because that's a little leakage of oxygen and it gets hot, but not – you haven't got enough air to get rid of the heat. So you get a fire.

In this sort of case, your solution to that is not to run with a U, but it's to run straight line. So you put your air in at one end of the mine and you suck it out at the other and you don't have differential pressures and that's – their mine plans is aiming to achieve that. It's to keep pressures, particularly across goafs, not to have pressure differences across goafs so you're not feeding them with oxygen for spon com. So I think at the end of the day I – I mean, you've got to remember this EIS is still, mine planning wise, quite conceptual, but I think there – extensive infrastructure would be the same, whether they split the panels, whether they don't and, if they narrow the panels, it could quite likely be more rather than less.

PROF FELL: Well, that's very help and thank you for that.

PROF GALVIN: Thank you.

PROF FELL: You talk about draining of the coal seams because that impacts particularly on ..... and we know that it's a difficult mine to drain, but I'm just wondering if you can give us some advice on that, particular underground draining because that would seem to be less invasive, if you like, from a environmental viewpoint. Is it possible to drain ahead of mining – well ahead and blend – drain gas to get beneficial outcomes?

PROF GALVIN: I'm not aware of that being done.

PROF O'KANE: But is it possible to – I mean, is it possible or sensible?

PROF GALVIN: Yes, Mary, I don't know. This is where you would want – I would want some specialist ventilation people now on the panel. I have the general working knowledge. If I was at a mine, by law I have to have statutory qualified ventilation engineer and that falls in their ambit. I wouldn't go there. The thing I would comment on what was just raised is that the trend in the industry today is to move to de-gas your mine – pre-drain your mine from the surface.

PROF O'KANE: Right.

PROF GALVIN: There's very fancy drilling technology now that you can bend holes and drill for kilometres and kilometres and you have a central drill pad on the surface and you radiate out from there - - -

PROF O'KANE: The applicant told us a bit about that. Yes.

PROF GALVIN: Yes. Well, that's the way the industry is moving.

PROF O'KANE: So how do you capture that gas, Jim?

PROF GALVIN: It's just brought out – suction. Put on suction and brought out into a pipeline. The same as underground. If you do do your drilling underground and there's always a need to do some drilling underground anyway, they will set up a

little recess somewhere and they will do a fan pattern. They will fan out in all directions. But the gas is on suction and it goes straight into a gas main and it's brought to the surface. Now, if it's up in Colliery or South 32, Wollongong area, because it's such high gas content – because this mine is – it's not a particularly high gas content, but if it was the southern coalfields, they feed that gas straight into diesel generators and generate electricity. But, once you get below this, you know, 30 or 30 per cent methane or you don't have the right combination of oxygen or too much carbon dioxide, then it's not feasible.

PROF O'KANE: So – but it does raise a greenhouse gas issue.

PROF GALVIN: Yes. Definitely, yes.

PROF O'KANE: So are there ways you can take it out through the surface and store it or keep it in some way - - -

PROF GALVIN: Yes.

PROF O'KANE: - - - so that it's not released?

PROF GALVIN: I guess, if you're prepared to pay for it, there would be, but I'm not aware of that happening.

PROF O'KANE: So what about, as you proceed with this mine and the methane content goes up a lot over the years to 2044, I mean is there a point of extracting the gas and getting the CO2 out so that you can use the methane?

PROF GALVIN: I guess that's possible. [redacted] [redacted] Those people don't realise the deepest coalmine in Australia is in [redacted] and that mine was put down in 1890s and, when they got down and went out under the harbour, they found that the seam wasn't as thick as they thought and it was very hot and the mine didn't go for very long. However, that mine for years, including both World Wars, was a source of gas for Sydney. It was tapped and supplied Sydney, vehicles particularly. However, again, I suspect, it must have been a very high concentrated – concentration of methane. It wasn't – there was no opportunity for oxygen to get into that mine. So I think it's probably pretty close to pure methane. So - - -

PROF O'KANE: But that's - - -

PROF GALVIN: Yes. It's done.

PROF O'KANE: It's done, but we're now in a different – you know, at the point in the Second World War they weren't so worried about the greenhouse gas effect and so what – I mean – and we're particularly now going to B - the condition – the proposed condition B18 where the mining panel, you know, would have a new role here looking and advising on the R&D program. How might you get to a point where you can get that gas - whether it's the mixture of CO2 and methane and then,

later, much more higher level of methane in it, how could you extract it and it sounds as though the extraction is relatively straightforward through the surface, but deal with it?

PROF GALVIN: Let's put that into context. It was only about six weeks ago that I got a query about, "Should we set up a second panel that deals with low emissions technologies?" and my view of that was it would be more effective to add that expertise to the existing panel because it seems to be working very well and probative is always an issue that people had stones thrown at them because they come from the industry and they're biased and all the rest of it. This panel seems so far, touch wood, to have credibility with all stakeholders and just, with my general knowledge and that's all it is in this area, but, as you know, from the Coal Innovations Board when we were both on it, that low emissions technologies were – came up there for research grants, etcetera.

I think the more sensible model is to keep the current panel and just add in a couple of – have on hand a couple of experts in this area and I would see, going back to some of our colleagues that were on that council and at least choosing one person from that space and one very good mine ventilation engineer from in the industry. So this is early days and, in fact, Neil and Rae are on the call didn't even know about this until they read it this morning and I didn't know that the Department had agreed to it. It was just a discussion I had six weeks ago. So we're a bit ahead of where we are.

PROF O'KANE: All right. Well, that doesn't – Chris, you go and then I will follow through.

PROF FELL: Extending this a bit, though, Jim. I mean, it's suggested in a draft condition that the – to quote, the mining panel would perhaps ratchet up the requirement to reduce the greenhouse impact and that, you know, we're familiar with the NGER process and baseline levels, etcetera, with the Commonwealth. So I'm just interested to know your thinking at this stage and, yes, it's embryonic and, you know, how might the mining panel do something like this?

PROF GALVIN: Yes. I don't know because – I will go back. So I will go back to the Coal Innovations Council which I think, when it was first established, I don't know what it was called, Mary. I think it was the Queen Coal Council or something.

PROF O'KANE: I'm sure Clay or Steve can help us on that.

PROF GALVIN: Anyway, it doesn't matter. The point is that the Government allocated many tens of millions of dollars to research into low emission technologies and that's where I saw the work being done, to answer your question, Chris. Certainly, our panel is not a research panel. Okay. We just bring in what we know to it and that's it and we don't have opportunity to problem solve. It's review the EIS, answer the questions that the Department gives us. I think, sort of looking for solutions is probably – it's certainly not under our current terms of reference.

PROF O'KANE: Jim, can we just go – sorry, Snow. You go.

PROF BARLOW: Just before we get out of this, with regard to the pre-drainage, you know, are the sort of sweet spots there, you know, if you do put a suction on but you can choose whatever suction you want so that you sort of perhaps slow down the airflow a bit to give you a high concentration – higher concentration of methane if you need to get to a particular concentration of methane that might be flarable? Is that feasible option, Jim?

PROF GALVIN: I don't know. I don't know, Snow. The part of the – a critical part of all of this is the permeability of the coal seam.

PROF BARLOW: Yes.

PROF GALVIN: And, if it's – you know, it's highly impermeable, you do need to put these in suctional and, if you put decent suction on, you get air leakage. There was at a time where we were hydrofracting those holes and that was a great help, but, I mean, that has become a bit of a dirty word at the moment. Nevertheless, there is hydrofracting done in the mines just using high-pressure water and nothing more sinister than that. It doesn't really matter if you're going to come along and mine that coal a little bit later that you fracture it. The miners don't like it, but the gas is released.

PROF O'KANE: Why don't the miners like it?

PROF GALVIN: Because of the ground control. Someone has gone and broken the ground up ahead of you.

PROF O'KANE: Right.

PROF GALVIN: But, in Queensland, there's a lot of gas companies. The gas companies are going in and de-gassing seams and commercially generating power with it and then the mines come in and they get left with the residual gas and it's a little bit what you're dealing with here is that they then get less with the gas content. There's gas there. They've got to manage it, but it's not of a sufficient purity any more to do much with and that's – I can give you a few points of reference for that, if you want.

PROF O'KANE: That would be good, if you would, please. Yes. Chris.

PROF FELL: Yes, Jim. It's very interesting. My concern is the surface drainage. Where – most of the mine that has high methane is situated under the Pilliga State Forest and surface drainage would become some problem, I imagine, in that area from environmental impact. Any comment about that?

PROF GALVIN: No. I'm not – because we didn't – we couldn't even do a field visit at the time because of COVID. So I know the area generally because I've got

family out there, but we haven't looked – we haven't done a site visit there. I don't know what they're proposing to do with the surface drainage once they – I know that they're saying they can't flare it, but how they're managing the gas once they take it to the surface, I'm unaware. So this wasn't in our terms of reference. It was only when I got your questions in the last 48 hours that it was even on our agenda.

PROF FELL: Mary, I'm concerned we've got a couple of other questions that are quite important and time is sort of running out.

PROF O'KANE: Can we extend the time, Brad?

MR B. JAMES: Yes. From our end. From the - - -

PROF O'KANE: Can everybody else extend the time for a little bit? Great. Thank you. That's great.

PROF GALVIN: Do we still have Neil online?

PROF O'KANE: We do. Neil, did you want to comment?

PROF N. McINTYRE: No comments, yet. I'm happy to be here for another hour, if necessary.

PROF GALVIN: Okay. I thought Neil might have had the time constraint. Mary, let me help you out there a little bit, perhaps. So, Professor Neil McIntyre, a civil engineer at the Sustainable Mining Institute, University of Queensland. He looks after the surface water. He has completely brought a fresh pair of eyes. Surface water was an area where always been weak in assessments and he has brought a hell of a lot of strength to it. But he has a lot of overlap in civil engineer, so has Rae Mackay. There's a lot of overlap between them in groundwater and surface water. So it's quite a powerful team.

Professor Rae Mackay and I will make his title up at the moment, but for want of a better word, he chairs the Victorian Government's Rehabilitation Board and he's focused on rehabilitating the Latrobe Valley Brown Coalmines. Prior to that, he was Commissioner for Rehabilitation and, prior to that, he and I were on another panel for many years and he was deliberated recruited from the UK because of his groundwater expertise and that's in the oil industry and waste – nuclear waste industry. So Rae looks after the underground side, but, frankly, they're sort of – the pair of them are a little bit welded at the hip. So, to answer what you've asked today, the brine really falls in Rae's court and anything to do with the surface, once I've cracked it and put the depression in, what does it mean, that falls with Neil. So - - -

PROF O'KANE: So - - -

PROF GALVIN: - - - you can direct your questions to them.

PROF O'KANE: All right. Let me ask them both and it's – we're very honoured to have you both here. I've heard of both of you for years. Could – do you want to comment generally on the questions and things there and then we will dive in a bit more?

PROF GALVIN: Well, I will throw the questions to them.

PROF O'KANE: You will throw the questions. Right. That's fine.

PROF GALVIN: Okay. So let's go through them.

PROF O'KANE: ..... ringmaster. Chris - - -

PROF GALVIN: The Longwall I think I've – I'm sick to death of that. Cracking on creek beds. Did you more on that or not? The simple answer is - - -

PROF O'KANE: No.

PROF GALVIN: - - - you just monitor it and you get in there and seal it quickly.

PROF O'KANE: No. You know, you can see where we were coming from.

PROF GALVIN: Okay. Ponding. Okay. Simple one with that is that we have this sign wave on the surface or wavy ground.

PROF O'KANE: Yes.

PROF GALVIN: And every now and then the water will pond. If we can, you get an excavator in. You trench in, you drain the water off somewhere else, sometimes you turn it into a wetland, only to find out years later – it has happened to me at YE that, when I went to mine the seam underneath, it actually had been declared a wetland and we weren't allowed to undermine our own depression any more. So there's a number of ways. There are a lot of dams in the area. I think Neil can add a bit on that for you. And then the next one is brine and that's very much in Rae's court. So maybe, Neil, you deal with the ponding and Rae deals with the brine.

PROF McINTYRE: Yes. Thanks, Jim. So there are a number of natural ponds on the streams in these areas and there will be new ponds due to the subsidence on the creeks and also extension in the length and the depth of the natural ponds. Now, the mining company can manage it so that the formation of the new ponds is reduced by draining them if they want, but I expect their solution will be, where natural ponds have been extended and lengthened, that they will probably just leave them, would be the best option. So I believe that that's quite normal in these mining environments.

The ponds will cause a reduction in the surface runoff from the catchment overall because water will be stored in the ponds, additional water, and then some of that

will be evaporated. So, as part of the EIS, they have done initial rudimentary calculations of the water courses which turn out to be around two to three per cent of the overall yield of the catchment in the mining area and the calculations are rudimentary, but I don't see any problem with these calculations. So, in terms of water loss, I can't imagine it's going to be a big problem.

PROF O'KANE: Yes. Snow.

PROF BARLOW: Neil, could I ask you a question there? If you look at the – you know, the proposed extension of this mine and, you know, in the yellow, if you like, as we talked to the considerable portion – it's probably the majority occurs under the Pilliga State Forest. Now, in ..... with farmland it's very easy to get an excavator in there, to get a grader in there. But we're talking about, you know, a forest here and I just wondered, you know, would you still have to do those major earthworks, you know, for subsidence cracking in there so requiring graders and excavators or you wouldn't do that or what would you do?

PROF McINTYRE: I might have to refer that back to Jim.

PROF GALVIN: Well, I might help you out there - - -

PROF McINTYRE: Yes.

PROF GALVIN: - - - Neil. I'm just going to share a screen again.

PROF McINTYRE: Yes.

PROF GALVIN: Get this mouse to behave itself. Where are we? Okay. So you're quite right, Snow. If you go and look at some of my legacies up at Angus Place in the Blue Mountains, we didn't go back into the State Forest, Newnes State Forest and fix all these cracks that I'm telling you we can do. They were just left to look after themselves. And, on this occasion, I think what's different – and, as I said, we haven't had the benefit of the site visit, but I think what's different is that they're putting these access roads in to get to all their bore holes and those access roads are close to where you would expect to get – it's a tension cracking that we're interested in more than the compression and those access roads from what I read is that they're close to where they're expecting and they will use those roads, take the benefit – advantage of those roads to identify the cracks and repair them.

In Neil's section of our report, Neil has expressed concern about the potential for erosion and that's simply because, when you look at this, that's a lot of roads being pushed into the Pilliga Forest and I see in the amendment now they're talking about some of them being reduced in width from 30 to 10 metres, but it's still a big disturbance and I'm not saying it's not done elsewhere, but I have to say I haven't seen a road network like this put into – I don't know if it's – it's a State forest. It's not – into a State forest before. Though it could have. I could be wrong there, but, anyway, that's the answer is that these roads are intended to give them access to fix

the cracking. And that's something that, if that come to us as an extraction plan, if that wasn't their intention, that's the sort of thing that we would recommend to the Department that they condition the extraction plan of.

PROF O'KANE: Thank you. Chris.

PROF FELL: All right. It's to do with surface water management plan and the potential overtopping of those newly constructed, particularly the brine pond, they've based it on historical rainfall, etcetera. Were you generally happy with that, Neil?

PROF McINTYRE: No. That was one of our recommendations that that should be improved ..... the water management plan. They had used re-sampling of historical rainfall to produce a very large number of realisations, but these realisations don't necessarily reflect what may happen in the future. So they've got some additional work to do there.

PROF FELL: Okay. But do you see a problem with potential overtopping of the brine pond because that will be the principal nasty, if you like?

PROF McINTYRE: Potentially, yes.

PROF FELL: Thank you.

PROF O'KANE: So, Jim, do you – your - - -

PROF GALVIN: I think, if you – there is a question there on brine.

PROF O'KANE: Yes.

PROF GALVIN: I think it's to do with the storage or that's how we interpreted it.

PROF O'KANE: Well, it was partly this one, but - - -

PROF GALVIN: Okay. Well, I didn't - - -

PROF O'KANE: ..... asked.

PROF GALVIN: Didn't - - -

PROF O'KANE: Chris, did you want to ask more on the brine and reinjection and so on?

PROF FELL: Yes. For Rae, particularly. Reinjection is not something that has happened, as I understand it, before in New South Wales. We're talking about putting about 260,000 tonnes of salt back underground and that's about 30 per cent of what Santos is doing just over the way and, although in principle the sum suggested is going to be okay because it doesn't raise the overall level of the salt

water in the goaf area or aquafer. It is I think over a limited extent of the goaf because there are only 20 bore holes suggested being used. Now, I'm just wondering if that is a potential problem post-the mine closing and, in fact, we mightn't be safer, for example, concentrating the brine in the RO and, in fact, recovering the salt as Santos is doing.

PROF R. MACKAY: Okay. Yes. So it's Rae Mackay. I guess the – there are a couple of important matters to sort of think about in terms of the long term. The first one is that you're injecting a relatively dense material into the goaf. That should be relatively straightforward and what it should do is generate a – if you like, a lens of higher salinity water that will find its own level in the goaf as it sort of spreads out. There's about three gigalitres or a little bit less of the brine that's going to be reinjected, which is a relatively small volume compared to the volume voids that have been created by the mine.

So the question then is what happens in the longer term. Well, the first period you're going to have post-the mining is a period of reestablishment of the groundwater conditions. So water is going to flow in towards the mine for a long period of time from above and laterally. So that will tend to mean that in the vicinity of this lens of higher salintic material it will tend to lock it in place for a reasonable period of time. Once you start getting to the stage where the flows are beginning to actually go through the mine and actually head towards surface and that's not surface immediately above. That's surface towards the Namoi, then, effectively, what you're going to be doing is seeing the fresher water actually moving over the top of this lens, they will be diffusion between the lens and fresher water and there will be a slow migration.

You can't get - because of the geology of this situation, you can't get that whole body of saline water moving up slow because the density gradients will be enough to actually hold it in place. There won't be enough flow going up to sort of drive it up. So it will stick pretty much where it is and so what you will get is basically a sort of – a depletion of that brine by diffusion into the flow of groundwater around there. It won't be flowing very fast and you might see in a few hundred years from now a little bit of an increase in salinity along one or two locations, but it really will be relatively marginal at that point. You know, we might be changing the salinities from 10 grams per litre up to 12 or - - -

PROF FELL: I just wondered, from a fundamental viewpoint, there's a fair osmotic gradient there and, in fact, that will assist the dilution and, once the dilution occurs, you can get transport more readily. There is one other aspect, but thanks for that - - -

PROF MACKAY: No. I agree with that, but – and I – including the diffusion processes in there. I – you know, I do see diffusion happening. I don't see it being a really strong osmotic effect, but I do see it as being a reasonable diffusion effect. The flow rates through this system are relatively low because, essentially, you've got

very low recharge capacity through this area and you've got relatively low permeability. So we're talking about fairly slow processes that are taking place.

PROF FELL: Okay. Thanks. So you feel that it's no problem?

PROF MACKAY: I thought about it for quite a while, came away with the view, no, this is not a problem. I wasn't comfortable with the concepts that were being put up in the story that we're in – was in the EIS around, you know, total mixing. That I didn't see as appropriate, but, when you start to look at where – how the groundwater system will interact with the brine lens that you have in there, I didn't see that you would actually end up with something that would be problematic in the long term.

PROF FELL: Yes. That's ..... Just one other question associated with that though. In the ..... west there's a very bad history and – well, ..... of reinjection of production water in coal seam gas causing seismic events in the locality. They've gone up substantially in recent years. Is there any risk in this reinjection doing that?

PROF MACKAY: I don't believe so and there are a couple of reasons for that. One is that we're dealing with a system which is actually going to have gas already in it. So this is a de-watered mine anyway. So, when you're injecting, you're not actually injecting to something that is going to re-pressurise substantively. Jim can probably refer to that, but there – you know, if you've got a gassy system, when you re-pressurise the gas can allow those re-pressurising to occur with relatively little pressure change. So, no, I don't see any risk of seismics in this - - -

PROF FELL: I guess I will ask one supplementary, if you don't mind, Mary. The salt is carbonate and they're a commercial product and I believe that Santos is looking at ways they might get beneficial use. Any comment about that?

PROF MACKAY: I don't have a particular comment. If they use the brine for a commercial – as a commercial feedstock, then I – and I would say anything you can do in that space is a good thing to do. But at the moment I'm just assuming it's a waste material. So, in the analysis I've done on it, I've assumed that people have looked at commercial uses and discounted that in the – in what they're planning to do.

PROF FELL: Thanks.

PROF O'KANE: Okay. Jim, any other comments? Because I probably have one more – I want to go back over one of the earlier questions.

PROF GALVIN: No, not really, Mary. I'm looking at the helicopter questions you sent us.

PROF O'KANE: I want - - -

PROF GALVIN: ..... know that I can add much to them. The draining and the flaring really is outside our expertise at the moment. That's a bit premature for the panel.

PROF O'KANE: Could we ask - Rae or Neil, did you want to comment on the draining and flaring at all?

PROF McINTYRE: No. That's beyond my expertise.

PROF MACKAY: No.

PROF GALVIN: They're not coal miners, Mary.

PROF O'KANE: No. All right. I – thank you.

PROF McINTYRE: I've started thinking about it a little bit, Mary, in terms of how gas can migrate back to surface, but there are 1001 questions that are sitting in my head from the basis of the discussion today that would need to be thought about a lot more before I actually commented further.

PROF O'KANE: Thank you. Because that was what – where I wanted to go back, Jim. I wanted to say – I want to have a better understanding of how – like, do the technologies exist from that - various things that have been done to extract the gas, whether it's heavy in CO2 or got more methane, because I'm particularly concerned about that period when the methane goes up? Can you – was I hearing correctly that you can get those gases to the surface, you know, and we did hear a very good description from the applicant about the way you can sort of put in very, very long drills and going, you know, horizontally and all over the place. Is it a matter then of capturing the gas and somehow sealing it somewhere or flaring it, if it's the – you know, concentrating it and flaring it? I mean, what I'm trying to understand is, while you don't want to say you're going to do R&D for the whole world, you've got to know what it is going to be particularly needed for this project in time for the time the mine meets that methane heavy stuff.

PROF GALVIN: Mary, I think where the industry is at and I'm probably – away from it for the last five years in this space, but it – I think really where the industry is at is pretty much what you're reading. Is that the high gas content, ....., everything is piped. It's not mixed with the mine ventilation area. It's kept separate.

PROF O'KANE: Yes.

PROF GALVIN: So wherever the source of the gas it finds its way to the surface piped and it's fed straight into their diesel - - -

PROF O'KANE: Yes.

PROF GALVIN: - - - generators for power.

PROF O'KANE: They use it.

PROF GALVIN: So that has happened. They've got 100 of these things on the surface. Right?

PROF O'KANE: Yes. And I've seen - - -

PROF GALVIN: The next one is, if you go to Central Queensland of a night, you see the flares burning.

PROF O'KANE: Yes.

PROF GALVIN: And that's burning the gas that the Arrow Energy didn't manage to get out - - -

PROF O'KANE: Yes.

PROF GALVIN: - - - before the miners got there. So – and that's just a view of, "Well, we will flare it." And if – and simply, frankly, if it's not capable of flaring, it's just released. Now, the one that's – I don't quite understand and I'm pretty sure it was in term on the Board with me that it was a very large research project funded at Mandalong on VAM on oxidising the methane content in the mine air.

PROF O'KANE: Yes.

PROF GALVIN: And what struck me with this project is that, when I look at the vast amounts of methane that are not being captured, VAM makes an insignificant contribution really - - -

PROF O'KANE: Yes.

PROF GALVIN: - - - relatively to what we're venting to the atmosphere. So, why is VAM – why were we not having a higher focus on the questions that you and Chris are throwing at me?

PROF O'KANE: Well, we are focusing on them.

PROF GALVIN: You are now, but why didn't we when we were on the Conservation Board?

PROF O'KANE: Years ago?

PROF GALVIN: Why - - -

PROF O'KANE: That's an extraordinarily good question, Jim. I'm sorry - - -

PROF GALVIN: I mean, we weren't the ones coming up with the projects, but I'm just questioning, well, you know, why weren't these issues we're dealing with then and - - -

PROF O'KANE: That's a very - - -

PROF GALVIN: - - - not 10 years later.

PROF O'KANE: Very good question. Yes.

PROF GALVIN: So I – so really I'm – I ..... going any further on.

PROF O'KANE: Okay.

PROF GALVIN: What .....

PROF O'KANE: Chris Fell wants to ask a question, desperately. He's probably going to explode if I don't give him a chance.

PROF GALVIN: I thought I stopped working for him years ago, but I can't escape him.

PROF FELL: No. It's a scientific question. There's absolutely no reason that carbon dioxide can't replace nitrogen in the thing you add in to make methane burn, if you think about it. That was one of the bases for how to have efficient coal seam generating. Is it a fear of explosion at the flare that prevents you from actually doing this and can't – I'm not a flare expert, although I taught the stuff once. Is it not possible to actually flare or oxidise this gas, right, with a high CO2 content safely?

PROF GALVIN: Okay. So that's treading back into the research that was funded on VAM at Mandalong Colliery in Morisset where the oxidising unit was set up and it was already to go and it never really got tested in anger because of this concern that, once you start playing around with the temperatures and the pressures of the methane and you know more about it than I do, but we're changing the explosive limits for it and there was always this concern that we get a back flash – a flash back and it would run down into the mine. So the mine was never prepared to have this live stream of ventilation air going to the VAM unit and - - -

PROF O'KANE: So they could have moved the unit further away, couldn't you, Jim?

PROF GALVIN: It's still – they still, Mary, without having – you had to – the mine – the company wanted to break – physically break the circuit. Right.

PROF O'KANE: Yes.

PROF GALVIN: So either take it out, store it in a - - -

PROF O'KANE: Somewhere.

PROF GALVIN: - - - and then take it out of there.

PROF O'KANE: And that makes sense.

PROF FELL: But, in the chemical industry, that is quite regularly done, but - - -

PROF O'KANE: Yes.

PROF FELL: - - - it's chemical industry.

PROF O'KANE: I mean, avoiding the flash back is important.

PROF FELL: I'm sorry. We're not here to solve - - -

PROF O'KANE: No.

PROF GALVIN: No. But I – reading between the lines in some of the responses you got to your questions, I think even like with the flaring and that concern in the back of people's mind is this flash back or if we just get mixed – playing with the mix, we find ourselves back in the explosive range again - - -

PROF O'KANE: Yes.

PROF GALVIN: - - - and then the plant itself is put at risk. So – but I – let's go a bit further forward with this. That – as I'm sure you're all well know, that the mining industry pays six cents per tonne of coal into a research fund, ACARP, and ACARP has various categories for things that they look at, of which this is greenhouse gas scenario is one. The questions that you're asking me, to me the standard stock answer I would give you is, "Well, we should be putting pressure on ACARP to fund the answers to these sort of questions you're asking." And, if the industry feels enough pain, they may not have to be even steered that way, that they - - -

PROF O'KANE: Yes. Then I think that's right, Jim, and – but it's not even pain. The industry is for – you know, could do it for itself. Anyway, that's – but that's right.

PROF GALVIN: Yes.

PROF FELL: These questions we were asking you have to do with the fact that your group will be actually monitoring the R&D that's being done and making decisions to advise Government, I imagine, on whether - - -

PROF O'KANE: Or recommendations, yes.

PROF GALVIN: Yes. Chris, we've been given no insight into that. My understanding of it was that they simply wanted people with this expertise to be on the panel to answer questions from people like you. I've had no – I've heard nothing about us monitoring or overseeing R&D.

PROF O'KANE: Okay. Just let me give Steve a chance because he might want to say something. Steve, did you want to add anything here?

MR S. O'DONOGHUE: Well, just on that, I don't think it's a question of overseeing R&D. I guess the way the conditions worked is really it's up to the proponent to come up with the ..... options, do their own work or get their experts in, come up with the fugitive emission minimisation plan which would go to the panel for review and inputting recommendations on basically what they're proposing. So it's not seeking the panel to do research, but it's more to look at the work that the company has done. The conditions require the company to look at what technology is available, overseas, in Australia. New South Wales, what has been done. Look at what solutions would work for them. Also, you know, climate – atmospheric science branch would be involved in the EPA in terms of their expertise and looking at it as well. So it's really the mining panel being part of that process with the suitable experts on there under a – in terms of reference that we – and we still have to discuss with Jim and, you know, providing input through that process.

PROF O'KANE: Thanks, Steve. Chris.

PROF FELL: Just ask, Steve, how do you see the ratcheting that you mentioned happening?

MR O'DONOGHUE: Well, that really – I mean that comes down to whether – that really comes down to what options are available to, you know, convert the methane into – to flare it, sorry. So – or generate electricity. So I guess, if abatement options are there and they can reduce the amount, the proponent would need to look at what their emissions intensity reductions would be and commit to, you know, realign with any developments or studies that are coming out that can meet a lower emissions intensity.

PROF FELL: Thanks.

PROF O'KANE: Thank you. All right. Any other questions? Chris, Snow, Richard.

PROF FELL: I'm right. Thanks.

PROF O'KANE: Any other comments from Jim, Rae and Neil?

PROF McINTYRE: Do you mean if I go back to the question Chris asked about the brine ponds?

PROF O'KANE: No. That would - - -

PROF McINTYRE: Just to clarify. The brine ponds shouldn't be collecting any of the catchment run off and, therefore, the risks of them overtopping due to climate conditions should be extremely low and should easily be managed by engineering or risk management measures. So as long as reasonable practice is followed, I wouldn't have any concerns about that.

PROF O'KANE: Great. Thanks.

PROF FELL: The idea that, if you captured the salt, you would avoid the need for them was one of the motivations for looking at it.

PROF O'KANE: Thank you. And I should have asked Steve. Did you want to add anything more?

MR O'DONOGHUE: No. Not from my end, Mary. It has been a – it has been a great discussion.

PROF O'KANE: Great. Thank you. All right. No one else. If not, can we say a really big thank you. That has been a great discussion. It's very helpful and given us all a lot to think about. So thank you.

PROF GALVIN: Thank you.

**RECORDING CONCLUDED** **[12.20 pm]**