Darwin – Lock the Gate Alliance

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Darwin Convention Centre, Darwin

Speakers: Naomi Hogan

Hon. Justice Rachel Pepper: Welcome to day two of the second round of the consultations, the public hearings in Darwin. I omitted to do this yesterday, for which I apologise, but I wish to acknowledge the traditional owners of the land upon which we meet today, the Larrakia people. I pay my respects to their owner's past, present and future.

Again, I wish to introduce the panel. We have, starting on my left, Dr Ross Smith, Ms Jane Coram, Professor Brian Priestly, Dr Alan Andersen, Dr Vaughan Beck AM, Professor Barry Hart AM, myself and Chair, Justice Rachel Pepper, Dr David Jones, Dr David Ritchie and Professor Peter Ashworth.

As I indicated yesterday, there will be a 10 minute warning, a five minute warning, and then a zero minute warning, during the course of presentations. Thank you very much, could you please announce your name and who you're appearing for?

Naomi Hogan: Thank you chair, my name's Naomi Hogan, I'm appearing on behalf of the Lock the Gate Alliance. I'd also like to acknowledge that we stand, or sit on, Larrakia Country here today, and pay my respects to their elders and their people here in Darwin, and also extend that respect to any Aboriginal or Torres Strait Islander people here today or listening online.

Thank you for the opportunity to present, and thank you for the interim report; I've read it in detail. Today, I'd like to go through the chapters of the interim report where I've got some further information to add, or clarifications. I'd like to answer some of the questions that you've sent me via correspondence in regards to the submission that Lock the Gate made, provide some suggestions for further work or clarity on some of the questions re: risk assessment moving forward, and provide additional evidence and peer review data and collected data that I've found since we last had the hearings.

My key messages today are that well integrity issues continue to be a major concern, and I'll go through that, that there are more studies needed here in

the Northern Territory, around surface water and ground water and the interaction between the two. That health impacts need further assessment, are perhaps understated in the interim report. I'd just like to bring up some occurrences where I feel that industry has provided some information that might not be fully there, or comes with their own bias, and we can go through that.

So I'd like to start with chapter five, which is shale gas development and management. One point that's made in here is well integrity, and the Chair sent me a specific question around whether or not I was still of the opinion that the problems with well integrity persist and that have not actually improved with time. You sent me a note here by King and King, a paper that talked about well integrity having improved. You also quote in the interim report a paper by Jackson, and state that the improvements in past decades in well integrity and well testing are considered to have substantially reduced well integrity risks for contemporary installations. Now I reread the Jackson paper, which I cited in my submission, and I can't find anywhere in that paper where it does say that. In fact, the article points to research that shows the opposite, and actually tries to figure out why newer wells are having such violations.

Further, I've read a more recent report, a ……. paper that's just come out for publication in the coming months, which I absolutely recommend to the Chair and panel. I'd like to just read some small extracts from that, to give further information on well integrity. So, the start of the abstract goes through that volatile markets and harsh locations and down hole conditions pose severe challenges for insuring safe and long lasting well conditions. Failure of well bore integrity leads, not only to negative financial consequences, but also potentially to significant environmental impacts, such as groundwater contamination, gas leakage to the atmosphere, and fluid spills and seepage at the surface. To understand the barriers to well integrity, what is required to sustain it is a holistic study encompassing a wide range of issues, is highly required.

So, this recent paper, which isn't going to press until September of this year in the Journal of Natural Gas Science and Engineering, is pointing to the need for further studies and holistic studies. It talks about the consequences of well integrity and fluid migration, it talks about the impacts of cement carbonization, casing corrosion processes, fluid migration in situ conditions, and the cement and casing mechanical properties. It talks about cement being a physical barrier, and it does talk about there being a primary and secondary barrier.

However, it talks about the secondary barriers, and the dynamic pressure and temperature conditions during drilling and production exert a cyclic load on cured cement and sometimes initiate cracks in the cement. These cracks have the potential to act as a pathway for fluid migration, in addition to hydraulic barriers, mechanical barriers such as casing, casing shoes,

connection sealants packers, well head risers, and blowout preventers, do provide extra safety layers. But then they go on to say that because of the materials that these are made of; steel, sealants, rubber, polymers, the nature of these materials makes them vulnerable to reaction with various chemicals present down hole, which often leads to their progressive corrosion and degradation. These issues ultimately compromise well bore integrity by providing fluid leakage pathways at the cement casing interface. So, I would like to stand by my comments that it remains an issue and stand by my comments that further research is absolutely required into this field, to better understand it.

I also went back to the King paper to try and understand why he came to that conclusion. I noted that the King paper was one of the few papers that APPEA links people to on their reference links for well integrity. I also went to the website and found that George E King is actually a consultant of 40 years to the oil and gas industry. He provides a business in trying to improve people's well integrity issues. He has a website there where you can download many of his presentations. I took out some slides from his presentations where he talks about the way in which, and you mention it in your report, that additional cementing and pressure testing can provide assistance in these matters. He talks through the objectives of doing that and how he does it, but even in his own presentation he admits that there's usually about a 50% success rate on this squeeze cementing that he does to try and fix these wells, and he offers some suggestions on how that 50% rate can be at least met.

So, I do feel that there are significant issues with well integrity as I've mentioned, and the assumptions that were made in the report about it improving over time, I went back to his slides and saw that they were only using wells from 1994-2000 to try and make that assumption. So it wasn't looking at shale gas fields, which is the issue that we're talking about here, and that other studies have said actually have a far greater risk of well integrity issues than conventional wells. I also want to note that in Pennsylvania at the moment, I went back to the research, they've currently got 287 confirmed cases of water supply contamination, that they have linked, the operators and the regulators have linked to oil and gas activities, and there are still 2000 determination letters that are yet undealt with by the regulator. So, they are dealing with a severe backlog of water contamination cases, which they are failing to be able to work through in a way. And families are needing water shipped to them, and the issues continue there, in those shale gas effected areas.

Another case that's made in chapter five, is talking about flow back fluid and waste water treatment. I was recently at the Darwin show and I was chatting to some of the people in the APPEA tent from Origin. They were mentioning that, yes they accept that waste water treatment and the waste water itself is very difficult to treat, difficult to manage, and it was going to be expensive and risky for them to be tracking the fluid to Queensland all

the time, which is what they're proposing that they might have to do. In fact, he would rather see an irrigation system in the Northern Territory where they take the waste water and they're able to dilute it and treat it and put it out onto the farms.

Now, I went and looked at where they've trialled some of that recently in Gloucester in New South Wales, and after two years of an irrigation trial there, the EPA had to stop that trial because the regulators found it left unacceptably high levels of salt and heavy metals in that community. The media release and the statements from the EPA go on to say that they were concerned about the levels of salt and some heavy metals, and the presence of these made the long term viability of the programme unsustainable. Meanwhile, AGL said in their press release that they had successfully completed the two year trial and the water was beneficially reused, and they were really happy with the results from the ……..irrigation programme, despite the fact that EPA had to shut it down.

Now, local people there were saying that it should never have been approved by the EPA, because of those risks, and it was never anything but a short term and cheap option for disposing of water. I think that's an important case when we're dealing with the Northern Territory, which is a high cost environment. If the operators are looking to cut costs and use these irrigation systems instead, I think we should be clear that there are risks with that, that potentially haven't been identified. I don't know if Origin have even mentioned to the panel that they would think about using irrigation as one of their options, but they flippantly mentioned it to me at the Darwin show on the weekend.

I'd note that also in the Gloucester case, and I remember this well because I was there at the time, in Newcastle where the operator was using transpacific trucks to take the waste water and dump it into the sewers of Newcastle. They were caught out doing that and it was a big splash over the papers there. The water that they were dumping contained benzene, toluene, ethyl benzene and …… which were banned but had come up through that waste water. It's an issue that we find in shale as well, that flow back fluid can contain those heavy metals and naturally occurring radioactive materials that are found trapped in that shale rock.

So I think there's some work that could go into that chapter five looking at waste water treatment, and I also would like to make the point that no where in there does it actually talk about what the waste options are and what the final product will be and how that will be dealt with. I think it's a massive issue for this industry.

So, moving onto chapter ... Oh sorry, and this is just a slide that I took just a couple of months ago on Facebook following some communities in the US, where they're dealing with re injection there, which I note that the panel has said isn't a good option, but is widely used in the United States because

waste is so difficult to dispose of. That's just an example of what happens in their community with hundreds of waste water trucks going through to try and dispose of the huge volumes of flow back fluid that they don't have a solution for.

So, chapter six, Shale Gas in Australia and the Northern Territory. There are big discrepancies that you've outlined in your report around the scale of the development and different operators saying different things in terms of the numbers of wells. I note that it's interesting that the Northern Territory government is still using figures of over 6000 wells, which was the rate that we'd all been talking about until this inquiry was called, and suddenly it seems that Origin, Santos have scaled back their development proposals in the numbers of wells that they're talking about. But, even so, and this is a photograph that I took at the Darwin show on the weekend, the scale of the development that they're talking about is only one small square in their total exploration licence. They're absolutely out there talking to their investors and the financial press and financial analysts about developing that entire exploration licence to make the most of the shale gas that they believe is there, but they've only really put forward to the panel a small square of that in terms of a development proposal.

So, I'd also like to commend Origin for trying to do some work, as we'd asked them, to put forward what a well scenario might look like in terms of the footprint on the environment, and they've provided you with this information here. They didn't put much information about where they found these photographs on this site, but it's in Ohio. I went and actually had a look for more information about this shale gas field and what we can learn from it.

So, it's the Utica Shale Development and there's a very helpful information source online where you can go and look at the blog, and look at the development profile of this Shale gas field, and that's part of the area that they've done there. So I went and had a look, and in 2013 this is what that gas field looked like. So literally, only a few wells that were being developed there, very much in early stages of the Shale Gas Development. In 2014, there were more wells starting to spread across that area and in 2016 you start seeing more wells, and they're mapping the underground hydra horizontal fracks that they're undertaking.

I make this point because the gas industry requires to get all of the shale out of the ground to make these things profitable. They can't have big gaps in between wells. So to show you the footprint of a gas field that's only three years really into production, isn't going to give you the full idea of what that final product is going to look like when they go back and do in-field drilling, so I'd like to commend Origin for starting to put forward some idea of a footprint, but I think going back and having a look at what we're actually looking at here, it's not a complete picture of a gas field that's in full production and has been operating for sometime.

And I also note, and this is something that I found quite interesting when I was on the site of the Ohio government, basically they have a page here for violations, investigations, and reports. And because of the nature of the shale gas industry, they actually have a whole section on where people can click and download reports, and I just want to read out some of the questionnaires that local residents are being encouraged to fill out if they believe their domestic water has been adversely impacted by oil and gas. There's a groundwater contamination disruption questionnaire, a groundwater decreased supply and siltation, groundwater contamination presence of gas, groundwater contamination presence of oil, and groundwater contamination presence of salty water.

Now clearly it's an issue if they're having to come out with fact sheets and questionnaires for people to download. Perhaps it's not. I've looked, and the last time that a journalist was able to extract that information, was in 2013. As we've seen, the development has happened a lot since then and if you are talking to regulators around the world, which I know that you have mentioned some, I'd be very interested to know what the more recent stats are from communities that have filled out those and made complaints, as that information isn't available publicly. So, it would be interesting to see how many people are utilising those questionnaires.

So, going on to the chapter of water, I'll go through surface water and groundwater. Now, to start off with surface water, I note that you say in the report that there doesn't seem to be much surface water in the Beetaloo area where your case study is happening, and so you don't think that there will be much of a risk, in fact, it's a low risk because there's not much surface water.

It's hard to see on that one, but clearer on this one here. I went and just did a satellite look at the Beetaloo and the waterways and surface water that you can see there, and it's actually quite interesting that the whole areas quite green at the moment, based on satellite. And you can see the river systems that flow across that area. You can see the rivers that flow into the Longreach Waterhole, and the Lake Woods Conservation area there. And so, I tried to do some more digging around and there's not a lot of information available. But it seems, from local people that are talking about it, that from the Limmen Bite, water can flood right over that region and go into those waterholes, and rivers, and flow right across that landscape.

And they've also said that for the last seven out of 10 years, Lakewood has had permanent water in it there. So I tried to find out more about Lake Woods, it's just on the edge of the Beetaloo but it seems that all of the water that goes into that lake is sourced from that Beetaloo area surface water. And it turns out that Lake Woods is actually, according to the Northern Territory government, a site of conservation significance and it's actually internationally significant. Birdlife Australia make mentioned that it is a key

area to be protected with Ramsar qualities and it's one of the significant bird migration places in central Australia.

I also note that there's bird like the Yellow chat bird, there's only two locations in the world where these birds go apparently, there's less than 10,000 in the world and they go to Lake Woods. So, I think it deserves more investigation by the panel in terms of the surface water, how insignificant is it. If there is a lack of other water holes across that Beetaloo area, then potentially their quite important to the bird life that is around that area. I think there's also need for more study. When I was talking to people in the NT government, they couldn't make a strong case or they hadn't decided whether or not there was grounds to consider surface water, ground water interaction and whether or not Lake Woods was actually recharging in part from ground water and there's more studies to be done there.

I note that Consolidated Pastoral Company who own the pastoral station around that area have commissioned water studies as part of their conservation covenant and they say that those studies are happening now so I don't think we can jump ahead and say it's a low risk area. I think there are studies undertaken now that will help the deliberations into the future and certainly there are some qualities there that need further investigation in regards to bird life.

In terms of ground water, I think it's very important to do further research. I understand you're looking at the Beetaloo as a case study but there are exploration licences granted right up to the edge of Mataranka for example, which is a very important area in terms of ground water discharge. This is a map from your interim report and those blue arrows showing ground water flows. Now from hydrogeologists that I've been speaking to, it is very significant. Not only those places there in terms of surface water falling on the surface, recharging that ground water that goes into, not only the Mataranka hot springs but the recharge area of like that discharge is the head waters to the Roper River and that's an incredibly important place for whether it be tourism, fishing, for the traditional owners of that area.

I went to a study to try and better understand what some of the impacts might be if you saw some of the impacts that have been listed in the interim report and peer reviewed science in terms of ground water contamination or spills on the surface that then could leak down into the ground water into those recharge areas and I found an 1998 study done in the Northern Territory by government and it's quite interesting. It's just nearby in terms of the Katherine River and they go and they put dyes, non-toxic dyes, coloured dyes to try and understand how ground water moves in those ……. environments and they basically put the dies down a sinkhole that was 2.8 kilometres northeast of Katherine River. And three days later that, those die traces were found in the Katherine River. Now these guys are telling me that, that means that this ground water travels at about 1,000 metres a day, which is extremely fast-moving for ground water.

So, I think we need to look carefully at those …… limestone environments in that area to better understand how quickly ground water moves and if there was a contamination impact on the surface through a spill or any other activity to do with shale gas extraction what the impacts might be and that hasn't been looked at the interim report to date and I think it's a gap there. I know that you're looking at the Beetaloo but this is right next door to the Beetaloo and this is an extremely important area for Territorians. Moving back to the Beetaloo, in the report you use references from APPEA, Origin, and Santos that say that basically there can't be any risk to those near surface ground aquifers because of how deep that shale is and they make that point quite strongly.

So I went and had more of a look at what they are actually saying to the public, so again they are saying here on there show stalls that they physical distance between the …. formation, which is there target shale and the Tindall Aquifer, basically making an impossible for those migration pathways and that there are aquitards there. Now I think that, that it in itself needs further investigation but one point that I thought was very interesting was actually a newspaper article in The Australian on the 20th of July, so very recently and I'd like to read from that where they say, the shale play that was tested known as the……. formation and holding the world's oldest gas source rocks extends over 17,000 square kilometres on Origin's ground and it gets better.

Slightly shallower than the 2.4 kilometre deep, 1.4 billion year old …….. sits another younger play known as the …… formation at just 1.1 billion years old. It is not been horizontally drilled, the technique that make fracking shale in the US commercially viable but recent testing of samples have given the surprise indication the liquid shale has properties that can be fracked. So I went to the Origin map that they've provided you that's in the interim report and I had a look at where that …… formation is and as you can see it sits far higher then the ……. shale that there talking about and so there arguments there around distance to aquifers start to break down when you look at the fact that there actually considering these stacked plays where they go and for not just one seam but different seams depending on what they can get.

And they're also talking about potential oil there so I'm just bringing this up because again I feel like all this information isn't coming to the panel. They are saying one thing in their reports and then they're out there talking to the business press, financial analysts that oh wait we could be sitting on something completely different. And I think this is something we've seen across Australia and the world. You hear one story, you hear you'll only see one well here and one well way over there. You hear that we'll only target this formation and yet when push comes to shove and they're looking at how they can most money out of this thing they'll find something else and they'll go for it and it wouldn't have been considered by the regulator and it wouldn't have been considered by the scientific panel. So I just want to put

that information forward because I think it's really important that you consider it.

I also want to make the case that there are some other things in the water section that could be further developed so again, it makes the case there that induced seismic activity so the seismic activity that's actually caused by the fracking process itself probably won't be an issue to those surface water aquifers because of how deep they are. But I think the report fails to discuss the whether or not it will induce hydraulic conductivity between that fracked zone and the overlying ground water systems and that becomes very important when you're looking at pre-existing faults. So I don't think there's been enough investigation in terms of how that induced seismic activity may react with induced, with pre-existing faults and potentially cause an impact to those near surface aquifers.

In terms of knowledge gaps and next steps, I just want to make a few recommendations for things that I think are important that you consider. So I think we need to request more information from the department around the current practise on the containment on site of fracking waste water and evaporation ponds because I've seen different methods there, some ponds are lined, some ponds are not lined. It's not clear where they're flow back fluid. I think we need to request data on that Cambrian Limestone aquifer recharge mechanisms. The total aquifer storage, the sustainable yield in the region, as you mentioned there. I think just put those questions to that section around knowledge gaps and next steps so that there not lost in the phase of the work.

And I think we need to find out more information around the hydraulic data to do with that 1,000 metre low transmissivity aquitard to determine whether or not fracking through that aquitard will actually change the nature of the connectivity between the deeper geologies and that overlying Cambrian Limestone aquifer.

One final point in terms of water in this chapter. On page 56, you make the point that the interaction with the soil zone will reduce the concentrations of the contaminants of flow-back fluid or spills. So you're basically saying, if there is a spill on sight, the soil will help that disperse, and it won't be as much of an issue for the underlying groundwater aquifer.

This is a handwritten note by a person that went out to test the groundwater under a Santos pond in the Pilliga Forest a few years ago. This is a note that was found through Freedom of Information requests, and there's a little note there that says UR, for uranium, 350 UG per litre. This was the note that sparked an investigation by the New South Wales EPA into a groundwater contamination incident in the Pilliga after a pond that was holding Santos flow-back fluid was leaking and leaked down into the aquifer below.

Now, the EPA did a site research a few months after that contractor found that pollution there, uranium which was 20 times the safe drinking water standards. They went out there and they did a report on it, and they spoke to Santos. They say that uranium is apparently naturally occurring in the area but the company suspects that the saline water has assisted the uranium to leech out of the clay soil and leech into the groundwater aquifer.

So I'm interested in getting more information around why you think that putting this salty flow-back fluid into the soil will somehow disperse those contaminants and mean that they don't go into the aquifer. Because what we've actually seen in real time, very recently, in the matter of coal seam gas in the Pilliga, was that those heavy metals and that saline water actually brought uranium out of the clay soil and into solution in that groundwater below. That was the EPA's take on the matter, and that was Santos's take on the matter. So I think it absolutely deserves further investigation. It can't sort of be put to the side here. It's an important matter.

So in terms of emissions in chapter nine, the chair has asked me a range of questions in regards to the sorts of things that you would recommend in terms of baseline testing. I will get to that, but I first want to get to the figures that are used in the report there. I was hoping that there would be an appendix or something, where I believe it was Professor Sandra Kentish that did the chapter. Whether or not that could be made publicly available in terms of the methodology to get to the 2% leak rate suggestion that's made in the interim report, it would be good to see that in order to determine whether or not that seemed a solid approach. So if that could be made available, that would be very helpful.

And I just wanna make one further point in regards to some of the other information that was put forward to the panel. So I note that Santos submission 276 was where they flipped you a media release written by APPEA about a CSIRO report on CSG and emissions testing that had been done over there. And so, the media release from APPEA basically says, you know, "a new report showing low methane emissions from CSG well completions". They go on to say that "this means that it's a totally low emissions technology and that it shows that the environmental concerns about CSG raised by various activist groups do not stand up to scrutiny".

So I read that media release when it came out and I went directly to the report by CSIRO 'Methane emissions from CSG well completion activities'. I would just like to read part of the report. So it does go through and talk about when CSIRO were there with the gas companies doing their well completion the emissions weren't that great but then they say that "they actually were there and there was a well work-over going on and so they measured that as well. Emissions from the well work-over were much higher than the completions totalling more than 21 tonnes of methane over the duration of the work-over. Most of this gas was released during the clean out phase of the operation, which in this case involved injecting compressed

air into the well during the process. The operation lasted for 24 hours resulting in a substantial release of gas all of which was vented into the atmosphere". They say in the report that "the sample size is very small and hence the results may not be representative of the industry overall". And they mention that "however, we've only measured emissions from the completion itself and other well construction processes including drilling and hydraulic fracturing have not been examined here. Hydraulic fracturing and subsequent liquid flow-back period have been identified as one of the main emission roots from unconventional gas production in The United States".

So it was a good report by CSIRO, it went through the issues in detail and actually did point to an area where there were 21 tonnes of methane vented into the atmosphere. But APPEA mentioned none of that in their media release and then Santos sent it to you as if it was evidence for the panel to look at the low emissions. So I'm just trying to make the point that there are far more studies needed, CSIRO admits that. And before we go into deciding what methodologies would be required for baseline and testing here in The Northern Territory, I would say that we need to do more work in Queensland to better understand what's going on with emissions there.

Why would we start this experiment here when CSIRO admits that far more research is needed to better understand the actual emissions coming off CSG fields, that they've only done very limited studies, that they are mostly done with the gas industry right there showing them how they do things and perhaps surprise visits, more aerial surveys and other things might be useful to get a better indication of what the actual methane emissions are from there.

So I have looked through the questions that you've specifically asked me. And I've gone through the risk table. I'd like to provide the written feedback on that if that's okay because I'm still considering it.

Chapter ten, Public Health. So again the interim report makes some assumptions or suggestions that I'm just interested in exploring further. So page 82 of the interim report says that "the chemicals used in hydraulic fracturing are low toxicity based on a Stringfellow report from 2017". But I went back to the original paper and again I couldn't see that it actually did say that they were low toxicity and the paper actually brings up all sorts of risks. Potentially to aquatic systems as well that the interim report doesn't talk about. So I couldn't see that that paper actually gave it a low toxicity rating.

You also go through the WA health report and look at the drinking water supply testing that they did with The Western Australian Department of Health. But I note that in that report that there were 96 substances found in the flow-back fluid that were not used in the hydraulic fracturing fluid. And 28 were found to be listed by regulatory agencies as known or suspected carcinogens. So while the study looked at chemicals that were not part of

the hydraulic fracturing fluid, it demonstrates that the issue of toxicity and lack of knowledge in the mixtures were created is on-going issue. So I think we need to see more work what happens when you mix those fracturing fluids and chemicals together, what happens when you put them under high heat and high pressure underground. What happens when you mix them with the shale gas, layers and rocks there and then bring them back to surface. What are the health risks of that flow-back fluid and that's the information that we haven't got in front of us now.

I note that you've quoted the Colorado Health Review, which is a balanced assessment. But one of the key things in that report was childhood blood cancers was an issue there that they actually did raise. But it seems like the initial feedback from the interim report was that there's not many people in The Northern Territory so it's not something to worry about. And I think for the people that are living out where these potential gas filled developments may occur, it is something that they may like to see more information on. So I think that the issues on what happens when you mix those chemicals together and put them under high heat and pressure. And the other point was around endocrine activity that a lot of the health reports and peer-reviewed papers, that I have read, have brought up are worthy of consideration.

I also want to point you to another more recent May 2017 report that came out in The American Economic Review. I think it's valuable because it is so exceptionally detailed. So here the researchers actually ended up looking at 54809 water samples taken over five years in Pennsylvania all within ten kilometres of a well pad. So it's an extremely detailed survey. And they do find that if you take your water from a kilometre of one of these gas wells, you do see an increase in contaminants in your water. And they found that that was surprising because it was actually municipally treated water that they were looking at. So there's a lot more work to do and again they say we need more work but I commend that report to you because it's so exceptionally detailed in terms of the work that they've done and there aren't many reports out there that can point to that sort of detail.

One of the other things that hasn't been brought up to date in the inquiry, even though Schlumberger have reported to you and put forward information, was that they have recently been fined over radiation exposure where one of their workers using their radioactive materials in the bore-logging process for coal seam gas in Queensland actually had his leg burned. That was prosecuted in court recently and Schlumberger was found guilty and had to pay costs there. But I just note, and it's frustrating I guess when you're looking at this stuff all the time, it's not until something is proven in court or comes out in the media that people find out about it and I think there's a lot of stuff going on behind the scenes that the companies could be more upfront about talking about the risks, the impacts that there have been, things that have gone wrong. They're just not being really upfront about that.

And I actually wanted to ask one other question that I meant to bring up earlier. Around Schlumberger and they make a point that's made in the inquiry interim report about recycling of water. And you link there to saying that, there was a submission that they made it was submission number 321 but I can't find it available on the website. So I'm not sure, I think that was a follow up one so I just wanted to say that it'd be good to find out what data they're using to talk about water recycling and waste water management. I again talked to the Origin guys on the weekend and they had a little crocodile facts thing, which I found quite cute. And they were talking about water recycling rates and I asked them "Oh that's, you know, great. Where did you get that from?" And they just said "oh that's data from the US". They hadn't referenced it, they couldn't tell me anything else about it. So I'm just more interested to find out because I think it's an important one when we're talking about volumes of water needed by the industry. Getting some evidence on the water recycling is going to be important.

So on the social impact assessment chapter. I just want to share some information in regards to the studies that Coffey are doing at the moment. I've had some stakeholders contact me with a few concerns about how the discussions have been going to date that I just wanted to be able to raise with the panel. So one concern or interest I had is that the guys out there seem to be talking about a 25 year timeframe where 25 well pads are needed. It seems like a low development scenario and I just wanted to cross-check that that was in line with what the panel is looking at. The other thing that then crossed my mind was "well could they use the same development scenario as ACIL Allen". So ACIL Allen are looking at the economics and they're looking at, you know, a thousand wells and heaps of gas coming and high gas prices or whatever they're modelling but the social impact guys that are out there talking to people about what the impacts on ground, talking about 25 well pads in 25 years. The two aren't going to match up and there was a concern raised that in fact the Coffey guys hadn't had a copy of the development scenario that ACIL Allen are using so I thought that was something to raise to the panel.

The other thing is that for the Coffey stakeholder engagement sessions apparently Origin have provided a visual aid in terms of what they are talking about when they're talking about fracking gas fields. But the visual aid shows a few bulldozers, a small amount of pipeline, no well pads, no wells, a few other bits of random equipment that do not give a sense of the scale of development proposed, at either exploration or production phase.

I just wanted raise that again with a panel, I'm not sure if you've seen the consultation materials that they're using, but I think it's important that we're all on the same page here, and that people in communities are able to access the best, up-to-date information that you are.

That's certainly been an issue in community consultations to date, and I know that that's dealt with in detail in the interim report. I think there are

many stakeholder groups or regulatory bodies that have been of the opinion that they were giving good information about what shale gas fracking means, and what a gas field is, and what the risks might be, whether it be through traditional owner engagements or otherwise.

But the evidence is changing all the time, and you have the benefit and the time to look at all the recent studies coming out, so many new peer reviewed studies have been coming out in 2017 that people out there haven't had the chance to look at, and haven't had the chance to sift through. I think ... You've mentioned that it's something that you're looking at into the future, for improvements if this industry is to take place. I cannot say strongly enough how important I think that is, but I think it's important we get it right, right now. If Coffey are out there, giving these consultations, and not giving good, thorough information about what a 25-year timeline might actually look like ... And the discrepancies between what's being described in the Australian financial review and The Australian, when Origin flew them out there to give them a media hoo-ha, compared to what's being told to people on ground, is very different.

In terms of regulation, I just want to make the point that, again, it's difficult to talk through what we think best practise regulation is going to look like when we've heard for so many years that it's world's best practise. That when AGL were dumping watered-down flowback fluid onto those irrigation fields in the Gloucester Manning Catchment, the chief scientist had said that that was world's best practise at the time, there.

It's very frustrating to have to deal with this scenario, and then try and ... People, and myself, certainly, who's been looking at this for the last six years, it's difficult to say, "This is what we think will happen," when we have no faith in the regulator to do that work appropriately, and that constant information is flowing from the industry that is only showing part of the picture.

I want to provide a recent example of why there's some concern that the regulator or the approval body don't always get it right. This is one that's very recent for the Northern Territory. It was the Department of Environment and Energy's final briefing note on whether or not they were going to approve the Northern gas pipeline which was called in under the EPBC Act because of the potential impacts on threatened species.

We, through a request for the statement of reasons, were able to obtain the final recommendation report, and the justification of why that was approved, which I've got here. Around that Northern gas pipeline by Jemena, past Tennant Creek to Mount Isa

The federal government received hundreds of submissions by concerned community members that this pipeline was going to be enabling infrastructure for the shale gas industry and therefore the risks of both

industry and the pipeline needed to be considered by the federal government. In their formal report that they used to recommend the project to proceed, they talked about the hydraulic fracturing moratorium, and they say in point 16, "The proponent is not currently contracted to transport gas from any new unconventional gas sources, and states the proposed action will not involve hydraulic fracturing for exploration or extraction of gas. The proponent further states that the proposed action can proceed without a guarantee of future development of unconventional, on-shore gas reservoirs in the Northern Territory."

The federal government took the company at their word, approved the project, and decided to put aside all of the concerned citizens who had raised this in submissions.

Just after they got their federal approval and their approval from the Northern Territory government……. and Jemena report in the media that the Jemena gas pipeline needs fracking for sustainability. This ABC report from earlier this year talks about the construction of the Northern gas pipeline connecting, expecting to get underway mid 2017, which it has. Matt Doman from APPEA said, "Even though off-shore gas could be made available to that pipeline, as well as sources of gas in central Australia, fracking would still be required to sustain it for the long-term viability of the first pipeline, let alone the construction of the second pipeline, which was flagged by the federal government, we must be able to proceed with the use of fracking to produce identified resources of shale gas in the NT."

It's a very recent example of where the company says one thing to get an approval, and literally weeks later are saying, "Hang on a second, we absolutely need fracking of gas to sustain this pipeline." Yet the federal government has just signed off on a list of recommendations that clearly says, "Don't worry, the proponent says they won't require fracking, it's got nothing to do with that."

I'm just raising that as an example of why there is concern, but even with the best information, the strongest regulations, the environmental protection laws, the right thing doesn't always happen by communities, and the gas companies will say what they can to get away with in order to get an approval. I feel that some of the gas companies have been doing that just in regards to this process with the inquiry to date. I continue to stand firmly and strongly in my opinion that the peer-reviewed science does point to risks of this industry, and further research that's needed for Northern Territory context.

I believe that the industry is not safe, because of the studies that I've read and the impacts that I've heard from people that have lived in this industry. There is far greater work that's needed in regards to surface water/ground water interaction, Beetaloo Basin, Roper Catchment, the entire Territory in regards to ground water, and well integrity. I think the issue of well integrity

into the future is of huge concern to people, and there isn't a single report out there by peer-reviewed science, or the gas companies themselves, that will prove that ... Or state, with any assurance, that well integrity can be assured into the future. It's a big impact, and a big concern for people.

I want to note that your report says that you shouldn't do fracking in the wet season, as that would pose risks to flooding and overflowing ponds. But even in media done by Origin post- the interim report coming out, they're already stating that they could get around any suggestion that they would not operate in the wet season. I just feel like they're already posturing to get out of the regulations that you've proposed here.

I can't understate how concerned people are that the Northern Territory government and our Chief Minister won't be able to make the decision that's required in the best interests of Territorians, because of the vested interest that we see coming out of previous work and previous interactions.

Our ex-Chief Minister here is now working for Gina Rinehart. He was the one that approved Hancock Prospect and Jacaranda Minerals for their Mataranka licences for hydraulic fracturing. He's now got a job with her company.

Paul Henderson, who was the previous Chief Minister before that, now heads up Bespoke Territory, which is a lobby group for the oil and gas industry here in the NT.

There are concerns, and there are suggestions that we actually need more participatory democracy going forward. We need to see community members able to use the information that you've put forward in the inquiry, and either go to citizen's juries for local communities, in terms of whether or not they should proceed with this industry, whether it go to a referendum, something that gives the decision to community members that are actually going to be impacted. Let's get the final report, let's have a look at it, and let's have people decide that are going to be impacted by this industry.

Hon. Justice Rachel Pepper: Thank you very much, Ms. Hogan. That's been, as ever, most useful.

Just let me note a couple of things. In terms of the scale of the development, we have noted the discrepancy between what the department's saying on the one hand, and what industry's saying on the other. We have requested that explanation, I guess, from the department as to that discrepancy, because it concerns us also.

Again, we've written to the department asking for further information on the storage of flowback water. We have directed Coffey to use the same modelling as ACIL Allen, so, again, we are concerned by that. We will certainly raise with Coffey, and have a look at the consultation materials that are being used.

We are also ... We recognise, and we'll be doing some additional work on well integrity, and, in particular, on de-commissioning of wells. Again, we're alive to those issues, also.

Those are the things we're noting, but, again, thank you very much for raising the matters that you have raised.

We'd very much be interested to get hold of the Consolidated Pastoral Company, I think you said water studies, if they have actually been ... Do you know if they have been completed?

Naomi Hogan: They're just undertaking them now, so they havn't finish it.

Hon. Justice Rachel Pepper: Also, are you aware of any material or research, test results, on the irrigation projects that have been happening in Queensland? I'm aware of what's been happening in New South Whales, through my position in New South Whales. But we recently toured Queensland and we spoke to a range of land holders, some of which were farmers who were using the water from the CSG production there, and they didn't seem to indicate that there were any problems, so again, I'm just wondering about this, are you aware of any research that's been done in relation to the irrigation projects in Queensland?

Naomi Hogan: I'm sorry, I probably need more information. I would also say that it's important to note that the flowback fluid is going to be different in different places.

Hon. Justice Rachel Pepper: Of course.

Naomi Hogan: And the technology's going to be different in terms of treating that. I guess what I'm saying is that we need to look territory-specific at what some of these flowback fluids are going to look like. But also, look to previous examples. Very happy to do more research on Queensland examples and see whether they are testing for heavy metals and other things.

Hon. Justice Rachel Pepper: Again, if you come across that research, then please, just direct it our way. But I think the point you make is an important one, that we have to be very careful about drawing from information and then ……from other jurisdictions, including Gloucester, South Whales, which, of course, is CSG, and it's going to be specific to that particular geography and geology.

Naomi Hogan: Of course, yeah.

Hon. Justice Rachel Pepper: That's about all I wanted to say. Anyone have fun?

Quite sure that there are many questions, because of the high quality of your presentation today. Yes, Dr. Beck.

Dr. Vaughan Beck AM: Thank you very much for your detailed presentation, particularly in respect to greenhouse gases. A couple of points, if I may. You raised the issue, the paper …… 2017, and we are very aware of that. We've undertaken a detailed review of that particular paper, and are aware of its strength and its omissions, which, as you clearly articulated and the authors reported on too. However, I should note that, in the actual chapter 9, the issue of omissions during completion have been taking into account, and they are included in the Appalachian estimates for both past practise and current practise, using the new source performance standards, which give a substantial reduction in emissions during completion down from about 20 or 30 tonnes per completion down to about 3 tonnes per completion. That is with flaring, not with venting.

Those issues have been taken into account in the report, and, furthermore, you raised the issue, the 2%. The issue of 2% comes from the study that was done by Littlefield 2017, which reported that, based upon the new source performance standards in U.S. fields, the mean emission rate is 1.7% with a confidence interval between 1.3% and 2.2%. That's the basis for recommending something below 2%. That's the genesis of where that recommendation came from.

Naomi Hogan: Sure, thank you. It would still be good to see the methodology, and I think part of the point I was trying to make is that if we are going to try and implement those sorts of regulations that the US are using and that they have used successfully there, lets try and see if they can work in Queensland, for example, which has the large-scale unconventional gas fields already. And if we can get them working here in Australia, then we can think about making them work here in the territory.

Dr. Vaughan Beck AM: And I should also point out that Professor ……. has been working with us in the area of looking particularly at methane emissions. But, her work is not as a separate report, it's been embedded in chapter nine so we've been working together and everything just one coherent chapter report.

Naomi Hogan: Correct, thank you.

Dr. Vaughan Beck AM: Thanks very much.

Hon. Justice Rachel Pepper: Anyone else? Yes, Dr. Jones?

Dr. David Jones: I like your reference to is your flowback water in the geo genic components that come up with it? Indeed, you can contain many more components in this prison in the unusual hydraulic pressure fluid, we can concur with that issue and indeed we recommend, will be recommending, that this particular account in the risk assessment and we've asked industry to supply further information in they can on the likely composition of that flowback water.

Hon. Justice Rachel Pepper: Yes, Professor Priestly.

Prof. Brian Priestly: Yes, if I could just add to that particular point I think we've recognised the importance of looking at the composition of flowback water and I think what you have raised is a further interesting and useful point is the effect of the interactions between the chemicals and that is something we will need to look at.

Naomi Hogan: Great, thank you.

Hon. Justice Rachel Pepper: Yes

Prof. Barry Hart AM: Thanks very much for your presentations as Dr. Beck indicated it was very detailed, it was great. 3 points, the 1998 study that you talked about the … Katherine, can you provide us with the details of that?

Naomi Hogan: Absolutely.

Prof. Barry Hart AM: I guess I am very much interested to look at it but I guess I question the relevance, to our situation. But we'll take a look at it, certainly. Relevance in terms of it's a different, I believe its' a different aquifer. It may be the Tindall, part of the Tindall Anyway, we can certainly

Naomi Hogan: Let's look at it in detail. I think its very relevant to the recharge area for that roper attachment because its similar sort of hydrogeology.

Prof. Barry Hart AM: A thousand metres a day surprises me.

Naomi Hogan: Is very fast

Prof. Barry Hart AM: But anyway, we'll have a look at it

Naomi Hogan: Have a look at it, its very interesting.

Prof. Barry Hart AM: Also, thanks for the information you gave us on spills and the potential for contamination. That's one of the areas that, where you pointed out what was said there, but we're certainly investing further. What is the potential? Your situation, which was Uranium and the potential for that to be helped through the soil profile by the salt, is one that we've got in mind, is obviously going to be some work done on that in the future, so thanks again

for that. The third point was, I just wondered if you had a comment on, we've spent a fair bit of time working through and thinking about the details of the risk assessment with, where we need to undertake as part of our terms of reference. Do you have any comments on, we think, its adequate?

Naomi Hogan: I'll provide more comments in written form, absolutely.

Hon. Justice Rachel Pepper: Thank you.

Naomi Hogan: I guess my off the cuff comment would be that we need to make sure that we've got all the information at hand before we can make decisions on the risk matrix and whether it is high or likely or you know the ... I just think its very important because as we know working with risk matrixes if you change one point on that from medium occurrence to likely or otherwise up and down the scale it can shift the whole outcome of your risk assessment and so I guess I'm more interested in taking the time to really delve into where we're at with the science and where we're at with uncertainties before we can make decisions on that.

So it seems sound but I think there are issues with risk assessments without sort of take everything that is a huge complex body of knowledge and work and future work as you've outlined is still a lot to do in terms of understanding these systems to then make a call on what the likely risk would be within a timeline that as I mentioned in my previous presentation I think is you're not going to be able to get all this information, have it at your fingertips in order to fill out those risk assessments adequately and I think that one of my strongest recommendations would be that potentially out of this is a body of work that needs to happen before any decision to lift a moratorium or otherwise can be made.

Prof. Barry Hart AM: Yep, thank you.

Hon. Justice Rachel Pepper: Yes, Dr. Ritchie.

Dr. David Ritchie: Thank you, wonderful presentation. I'm just interested if any of the groups that, your coalition, have given you, sort of first hand accounts of leaving with coffee consultants because some of the, I was very interested in what you were saying about the kind of information of what we're talking about, that's going out to communities and everything that you would like to elaborate on any of those points about how we, cause we haven't got that much time left, how we would improve that consultation?

Naomi Hogan: Absolutely, people have been contacting me about it, which is why it was raised because I certainly didn't reach out to try to talk to me or lock the gate formally. So some of the other feedback apart from the fact that they consultation materials weren't solid, other people have fed back that they

had an hour and a half conversation with these guys and they didn't take a single note of what they were saying. Which they thought was surprising for a consultation.

The other one was that they were wondering around town just hoping to sit down and talk to anyone that would about fracking. And I guess my comment in that is that many of the communities and some that you may have encountered already through the work of the reporting process, a tide of the 'hum bug' of talking about this stuff all the time, they've said no they've used their rights on the Aboriginal lands rights act to say no they don't want to keep discussing it. Yet they're engaging in this process in good faith because they feel that its important but now I'm getting phone calls about yeah there's this guy wondering around now trying to talk to us about fracking. It just continues some of the stress that you've outlined in some of the social impacts. It just continues, I think some of the other things ...

Sorry not related to that coffee thing, that was my close there, but in terms of the stress, moving to another point. I'm also getting feedback from people across the territory around the stress of the feeling that if we use our best knowledge to date and if I say, we shouldn't go ahead with this the risks are simply to great, its too expensive, its not worth it, why take the risk, that will continue to be bombarded by industry and even the federal government that's now said things in resent press around GST distribution being linked some how to whether or not you have fracking gas fields on your land and things like that. Its very unhelpful, its quite stressful. I've heard its stressful to bureaucrats working here in the northern territory that are looking at budgets. This is the length that the industry and their supporters are going to stress people out and I think its a really a very real issue that could be considered.

Hon. Justice Rachel Pepper: Yes, Dr. Andersen.

Dr. Alan Andersen: Thanks Miss Hogan for your excellent presentation. You didn't make any comments about the land chapter, I just wanted to check whether that's because you don't have any concerns of the issues raised or you just felt you didn't have time?

Naomi Hogan: It was mostly a time constraint issue to be fair. Last night when I was going through my slides too late at night I just scrapped what I thought I can't go there. I will make a written submission to talk a little bit about the land and stuff. But it wasn't the chapter that jumped out to me as the biggest one. I guess in relation to land impact I thought they had covered off on a lot of stuff, but I also wanted to bring it back to hat landscape impact of the well densities, how many wells per pad really is that the case? How are we going to make sure that these things don't just completely take over the landscape? But I thought the points on fire management, on weeds, were all extremely points that were raised in the interim report.

Hon. Justice Rachel Pepper: Anyone else? Thank you very much again Miss Hogan. Although I keep saying we will accept submissions up to any point in time, which is largely true, obviously for certain categories of stakeholders, lock the gate is one of them, sooner rather than later would be good. But take as much time as you need and be as detailed as you want. We would appreciate the help and we have appreciated the help to date. Thank you very much.

Naomi Hogan: Thank you.