



## ***Halliburton – Hearing Transcript***

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**10 March 2017**

***Darwin Convention Centre, Darwin***

***Speakers: Diana Grantham, Ian Adams***

Diana Grantham: Madam Chair and Panel, thank you for the opportunity to appear for this inquiry. I've been working with Halliburton and the Production Enhancement Product Service Line. My background is engineering and chemistry, so this will be a little more technical focused and sort of on the regulation legal side of things. My role for Halliburton involves working with the companies or operators oil and gas clients on the production enhancement techniques, including hydraulic fracturing.

I'll briefly run through our presentation to introduce Halliburton and our expertise in hydraulic fracturing. To overview the unconventional gas industry and the hydraulic fracturing process and talk about technological advances that are continually improving the economic viability of gas production and minimising its environmental impact. In other words, through hydraulic fracturing wells that would not have otherwise been economically produced now become viable.

Halliburton is one of the world's leading providers of services to oil and gas industry. Well not and operator of oil and gas projects in our own right, we provide a range of services to operating companies across the full world life cycle. From drilling through to completion. Including production enhancement.

Halliburton has been operating in Australia since 1958 and employs around 600 staff across the country. In terms of its direct economic contribution to the country, in 2016 the company spent almost 43 million dollars sourcing goods and services from around 600 suppliers in Australasia. Halliburton is also active in training Australian engineers and is involved in collaborations with scientists and engineers at the University of Adelaide. Around the world, Halliburton has undertaken hundreds of thousands of hydraulic fracturing treatments, over the last 60 years. We are the market leader in hydraulic fracturing in Australasia. Having performed over 5,000 treatments in country. In the northern territory, this includes hydraulic fracturing treatment as recent as 2015 and around 20 to 30 treatments in and around Marinee in the early 2000s.

The protection of ground borders central to all gas extraction operations, including those involving hydraulic fracturing, the main component in achieving this objective is well construction and well integrity. The industry has decades of experience in well construction and operates in accordance with highly detailed global and Australian standards in this regard.



As the inquiry has set out in its issues papers hydraulic fracturing is the use of pressurised fluids to create a pathway in the rock, also known as fractures, for oil and gas molecules to flow into the well wall. This pathway created remains open after hydraulic pressure is removed due to the use of small granular solids of propene's, like sand. The economic production of hydric carbons within the shale formations and enhanced recovery methods such as hydraulic fracturing is required.

Around half a percent or so of a hydraulic fracturing fluid comprises of chemical additives that perform a variety of functions, like increasing the viscosity of fluid, preventing bacterial growth, preventing corrosion. Less than 5% of the fluid comprises of propane and chemical additives the rest is water. Many of these chemical additives are also found in food and household products, such as ice cream, shampoo, cosmetics, I'm sure you've heard the range. You will see reference on this slide to the FracFocus website. This is an independently managed online hydraulic fracturing chemical disclosure registry that is successfully operating in the US and Canada.

Halliburton has commended a system of this type to policy makers in the Northern Territory and elsewhere in Australia to provide chemical information to the general community on a well by well basis.

This graph here relates to the Barnett Shale formation in the US. The blue line at the top shows the depths of ground water sources. The coloured lines towards the bottom show the height of fractures in the shale. This data is taken from micro seismic technologies which is a technology used to verify fracture height growth during a treatment. The key takeout from this slide is the hundreds, sometimes thousands of metres that separate ground water and rock fractures associated with gas extraction.

So, each year Halliburton spends hundreds of millions of dollars on research and development. This is critical to the technological innovation that increases the productivity of gas formations as well as minimising environmental footprint of gas extraction activities. Advanced drilling and storage techniques have significantly reduced the number of wells required in shale gas project. Cleaning fracturing fluids derived from natural substances improve well clean-up and eliminate or reduce insoluble residues. Other advanced fluids enable recycling of produced water reducing demands on fresh water. Some chemicals like biocides have been replaced all together with other technologies. Another technological example is dry blending of additives on site which eliminates the need for liquid hydrocarbon carry fluids. Equipment has also been developed to run off natural gas thus reducing greenhouse emissions.

Another major technological advance of recent years is the use of single well pad to drill multiple horizontal wells. In combination with hydraulic fracturing, horizontal drilling reduces the footprint of natural gas operations up to ten times that versus the traditional vertical walls. As you can see here the number of wells, for vertical wells on a pad versus the horizontal wells, the footprint is much smaller there. To cover the same reservoir.



Advances in hydraulic fracturing have been a driving force and major boost in the US oil and gas production in recent years. And the benefits the US have seen have been very substantial and are of wide economic significance.

So, this is good news for Australia as there is substantial on shore gas around our country including in the Northern Territory. While there is a lot more exploration and technical analysis to be undertaken in the Northern Territory it seems clear that there is potential gas resources. And expanding gas industry can help bring employment revenue and energy security for the territory.

Halliburton has participated extensively in various independent inquiries, undertaking into hydraulic fracturing, and unconventional gas over the recent years. This includes the 2014 Hawk review which presented an in-depth evidence based analysis of risks, benefits and other impacts to the territory. Halliburton also participated in consultations leading to the introduction of the 2016 petroleum regulations.

So, I'd like to conclude by saying that Halliburton would welcome the opportunity to provide this inquiry with any additional industry and technical information that would assist these deliberations.

Hon. Justice

Rachel Pepper: We'd encourage you to provide whatever information you think appropriate. No doubt if you've been following at all the work of the inquiry for the past week you'll know that many of the community have significant concerns about water use, water contamination, well integrity, the chemicals that are used in the fracking process and so on. It's obviously in your interest to provide the inquirer as much information as you possibly can. But I'm got to start off with what's techs and questions in terms of ... Could you tell me more about dry blending to reduce chemical spills? What does that entail?

Diana Grantham: We have a unit or a piece of equipment that we use on the trailer, a trailer mounted equipment. So, what we do with that is we actually have the dry gel, pull water on board into a tank and mix the gel into that in a 70 barrel, sorry I don't know what the conversion of that is. To just blend in situ a small volume that then will be further diluted or just pumped into the wells. So you're not having to premix larger volumes, have additional waste or volume left at the bottom of the tanks and that sort of things. It allows you to mix the chemical on the fly, as we like to call it.

Hon. Justice

Rachel Pepper: For their information can you about the recycling of fluids?

Diana Grantham: I'm sorry, I'd have to actually pass that one on to the operators or APPEA with that as far as our job in this section of the hydraulic fracturing is we go out there and pump into the well and once the fluids come back out that goes through flow back and that's not an area that we're actually, well certainly I'm involved in.

Sorry, with regards to this equipment-



Hon. Justice

Rachel Pepper: Yeah, the recycling of the fluids and produced water. Referring to your fifth dot point on one of your slides.

Diana Grantham: I'm with you, sorry.

So, there is technology and equipment that we have that allows basically the fluids that come back, it has the capability to knock out hydrocarbons and what else, the clean wave?

Ian Adams: It basically works on electro flocculation. And it goes through up until, I believe it's based on molecular size. It can actually bring out other chemicals that would be in it. Some of the small things that it doesn't remove are salts. It's really one of the earlier things that would need to be done afterwards. We can provide documentation on exactly what that unit-

Hon. Justice

Rachel Pepper: Yes, please. Absolutely. The more technical information really that you can provide the better. Given that I have a handle of scientists at my disposal and this is a scientific inquiry.

Yes Dr. Jones, I think you had a, I'll work my way up, you got a question?

Dr. David Jones: A matter you raised here about what are recycling. What you're commenting on I think was probably clean-up of that water so that could be reused. I didn't realise you'd clean it up. I think that is what you're talking about and certainly that was an issue which I have as, whereas, water treatment so that would be important but the question I was going to ask you was about disclosure and one of the really key concerns about the community is being what's in this stuff that goes down the hole? And they're really concerned about it and up 'till now, I and many others have been ... When you ask that question, we're told it's all propriety information, it can't be provided. This seems to have been a bit of a turnaround in terms of now the ability of the industry and Halliburton being one of major providers, disclosing some of this.

And I understand there's a difference between providing a list of chemicals and the formulation and I presume you're talking about disclosure of the list rather than the blend.

Diana Grantham: Right. Halliburton fully supports disclosure of chemicals and with that obviously if there are proprietary constituents or additive within that blend we would like the assistance of the regulators to allow that stuff to remain proprietary with any chemicals that are imported or used in the country that goes through a rigorous process for importation with NICNAS, so it's actually fully disclosed to them anyway. But with that we do have fully disclosable fluid systems as far as being able to advance technological innovation and that sort of thing, should propriety information not remain confidential what ends up happening is that the technological advances ... those chemical don't get used. We would go back to



something that can be fully disclosed so that everyone is happy with what they know, what's going in it. It's not to say that proprietary chemicals are hazardous or any more hazardous or provide any more risk, but they do have ... they are proprietary, it's part of what sets each company apart from another.

Dr. David Jones: You use a risk profile of this kind of thing. I'm sure you as a company are also working towards a lower risk profile in terms of the chemicals you are using.

Diana Grantham: Yes. Halliburton will be happy to assist with operators and regulators with regards to information that is required for assessment of the chemicals that are involved.

Hon. Justice

Rachel Pepper: So, you'd perhaps have less difficulty with the concept of full disclosure to the regulator but not necessarily public disclosure. Is that correct?

Diana Grantham: For proprietary information. That's the standpoint Halliburton has, yes.

Hon. Justice

Rachel Pepper: Yes, Ms Coram.

Ms Jane Coram: I have a couple of questions around the actual fracking process, the moment of fracking. The first one, it was suggested to us this week that depleted uranium was used for the explosion to make the fracking? Is that correct?

Diana Grantham: I am not an expert on wire line and perforating. I don't know exactly what they use in that service but in order to access from the well wall through to the reservoir there are different options to do that which perforating is one of them. What they use in their explosives, we can probably get some, certainly pass on some information with regards to that. But there's also ways of doing it through shedding with a high-pressure fluid or not actually having to do that at all and change the way that the completion in the wells runs, so instead of running just neath steel casing all the way through you can offset it with sleeves that slide and open and already have that access to the formation as such.

Ms Jane Coram: Thank you for that.

And my second question is related. We've heard a lot about, a lot of concerns around the integrity of well cement and we've also heard evidence around how that integrity is insured that point of placement. When the well is fracked and assuming whatever the pressure sources that manages to frack the shells, how sure can you be that the placement of the cement seal isn't actually damaged, and do you do testing again following the fracking to ensure that the cement is sealing, and if it isn't how can you rectify it?

Diana Grantham: So again, I apologise I am sort of very specialised in what we do, however I know that prior to a fracturing treatment taking place, operators will run what is called a CBL or a cement bond log with electric line, wire line tools to verify the integrity of the cement job, of the cement casing that's in place and they then can do that post



frack as well to see what the damage is, or if there's damage or what that looks like after frack treatment has taken place.

Ms Jane Coram: So, is that done routinely?

Diana Grantham: I would have to differ that to the operators on that one.

Prof. Barry Hart: Could I be, a question about controls? You guys are a contractor so you would undertake a contract of SANTOS or Origin. Can you give us a vivid idea of what the SANTOS and the Origins require you and how do they check that you've done your job? Who checks you?

Diana Grantham: Who checks us? Well with regard to the full operation or-

Prof. Barry Hart: Just take the drilling and the fracking.

Diana Grantham: So, with regards to the fracking, to be a contractor for any of the major operators is actually a rigorous process that they through, checking our environmental standards, our safety management plans, go through our systems and processes to verify and be confident with the standards that we have in place before they bring Halliburton or Schlumberger or anyone else on board to perform the operations that they require. And with regards to execution of any of the operations, there are checks from both sides prior to with regards to programmes and making sure that everyone is following what's set out to be performed.

Prof. Barry Hart: The protocols.

Diana Grantham: Yeah.

Hon. Justice

Rachel Pepper: If something goes wrong, who's responsible? So you do a fracking, it goes wrong, who's responsible? Let's say for example SANTOS contracts you, you're subcontracted to SANTOS, who bears responsibility for the malfunctioning frack?

Diana Grantham: Depends I guess in what way you're saying it goes wrong in terms of not being able to execute the job.

Hon. Justice

Rachel Pepper: That's a fair response. I'm talking about I guess the legal chain of responsibility. That's a fair response.

Diana Grantham: But we can certainly take that on notice and get back to handle on that if you'd like. Or more mention-

Hon. Justice

Rachel Pepper: Credits to you, you can't take on others what hasn't been properly articulated.

Dr. Vaughan Beck: Maybe I can try. For example, if you witness a cement bond log to take the theories, not adequate bonding between the casing and the cement; what avenues





do you have to then go and rectify the problem you've detected with cement bond log?

Diana Grantham: Prior to a fracture treatment?

Dr. Vaughan Beck: Yes. Sorry, that's a good point. Pre-and post.

Diana Grantham: So typically, and again I don't want to speak out of turn here being as whether sort of the last part of the puzzle. In my experience, what we've seen is there are concerns with cement bond log, those walls don't get fracked or there will be remediation on the cement treatment prior to making that decision to go ahead and frack. So, we've definitely had wells planned to go ahead, the cement bond log has been ran and found to have poor cement and those walls have been targets of them being moved to the side. What the operators do after that I can't recall instances of whether they've come back on as fracked targets or whether they've just been dealt with and otherwise.

Dr. Vaughan Beck: So, it's an expensive job if you have to go and drill another hole completely?

Diana Grantham: Could be, yeah. There is certainly remediation treatments out there with being able to go in and put more cement in there to squeeze and make sure that isolation is good. But that would be up to the operators as to what they want to do if there are issues. I've definitely seen plenty of times where the cement bond log has been bad and there has not been a frack treatment done on it.

Hon. Justice

Rachel Pepper: So, who's responsible for this bond log legally?

Diana Grantham: The operators would actually. We're, was service provider so we have the capability to perform most services?

Hon. Justice

Rachel Pepper: Let's say you perform one of those services and it's performed negligently but that negligence isn't found out until sometime later on. Who bares the legal liability for that failure? Is it you? Is it the operator?

Diana Grantham: I'll have to differ that one. I'm not entirely sure.

Hon. Justice

Rachel Pepper: Because one of the criticisms that we heard during the past week is well you know, the operator may subcontract to Halliburton and Schlumberger, something goes wrong, Halliburton and Schlumberger are long gone, the operator doesn't take any responsibility and passes the buck down to the subcontractors and at the end the day we're left with either inadequate remediation or no remediation with everybody pointing the finger like this and the land holder meanwhile is left with a problem.

Diana Grantham: Understood, I'll take that one on note.



Hon. Justice

Rachel Pepper: Yes, Professor Priestly.

Prof. Brian Priestly: There are two aspects to the chemical composition of the water that's involved here. One is the water that goes into the well which is the composition of the fracking fluid and so on that you put in there. And then there's the water that comes back up afterwards, the product water which is likely contained the residues of the fracking fluid plus anything that might be extracted out of the shale. It's that product water which possibly has the greater potential for contamination of the surrounding area through spills or that sort of thing. Do you have any data on the chemical composition of the product water?

Diana Grantham: That one, can I differ that one to an operator on that for sure. That's-

Prof. Brian Priestly: We'd be quite interested in that if you had that information.

Dr. Vaughan Beck: Just a couple of questions in I may. You were talking before about FracFocus, which is the system that operates in the United States. I'm just wondering can you get us pretty close to why that's not being used in Australia?

Diana Grantham: Not entirely sure why or why not.

Dr. Vaughan Beck: That's all right. And in terms of FracFocus, what's the situation if Halliburton are using some proprietary product, does that get under FracFocus or is those details retracted from the information that goes on to the web?

Ian Adams: It's based on each state individually. So, each state requires different levels of disclosure. My background, I actually worked in Texas and Oklahoma. And for both of those states they did allow confidential bids. As is information to apply on what we call the GWPC Report which is what's on FracFocus that you guys can all see. From that the general composition names were on there however the composition information was not. As in like the exact recipe inside each one of the chemicals.

Dr. Vaughan Beck: So, you identify the chemicals but not the quantity.

Ian Adams: And which chemical they went to, but the chemicals were provided. A generic chemical compound name was provided.

Dr. Vaughan Beck: Yes. And do you know what other states would require, would they be more stringent or less stringent?

Ian Adams: Some states are more stringent I believe and again, this is what I believe about it. I believe California is actually a full disclosure state. So, all of the work that's done there has to be fully disclosed.

Dr. Vaughan Beck: So, with proprietary products it's the quantity and the type of chemical.

Ian Adams: For full disclosure states, we have different chemicals that we would use. But yes, the full composition ...





Dr. Vaughan Beck: I understand. Right. Thanks very much.

Dr. Vaughan Beck: Could I just, if I may I got a couple more of subsidiary questions. As I understand it, in Australia at the moment there about four or five drilling and fracking rigs which is Halliburton and Schlumberger combined. Is that about the right number?

Diana Grantham: Four, yeah.

Dr. Vaughan Beck: Okay. So, I'm just trying to get an understanding of how quickly that number can be increased by presumably importing rigs from the North America. So, if all of a sudden there was a moratorium was lifted in Victoria in the States that's in ten rigs. What period of time could that be ... how could Halliburton respond to a ramp up in rigs in Australia?

Diana Grantham: To get official numbers for you, I'll definitely have to get back to you. But I would suspect it's somewhere in the six to twelve months.

Dr. Vaughan Beck: Thank you very much. I'm sorry to keep going. I just got another couple of-

Hon. Justice

Rachel Pepper: Is this what happens when you feed the panel is-

Dr. Vaughan Beck: You talked about reduced greenhouse gas emission. Can you elaborate by what you mean on that? Because that's on that fracturing technology slide.

Diana Grantham: Correct. So, if I could go back to that. Some of the equipment that we use actually has the capability to run on natural gas. So, some of the pump units and I can't really identify them from this picture, it's quite small. But it has the capability to run on either diesel or natural gas. Natural gas just being a cleaner fuel will reduce greenhouse emissions.

Dr. Vaughan Beck: So, in order to do that you're using gas that's coming out of the particular well or are you using it from pipelines that are in the vicinity?

Diana Grantham: A lot of our equipments fuelled up by a tanker that comes up. Where that comes from I don't know.

Dr. Vaughan Beck: That's fine. Okay thanks very much for your help.

Hon. Justice

Rachel Pepper: Doctor Jones.

Dr. David Jones: I'd like to get back to one of my integrity questions if I may. We've been told the latest and greatest multi well head drilling technology, so it takes having quite a few up, well head assemblies around the landscape which in itself is a good thing but one of the things that's been on my mind is if you have multiple wells going down from a single vertical and its fracked multiple, multiple, multiple times, is there a possibility of cumulate of risk of or an increased cumulate of risk of damage occurring to that assembly?



Diana Grantham: Let me just find where the slide is. So, with that, as you can see here. These aren't necessarily multiple or one well head that feeds a number of wells.

Dr. David Jones: I was looking at that left hand one which kinda implies that there's a single vertical and multiple well-

Hon. Justice

Rachel Pepper: And then you've got multiple frack stages.

D. Grantham: I'll get back to you on that. I don't know exactly what, how detailed that picture is whether there it is one single vertical or whether that's multiple verticals as well.

Dr. David Jones: But it's a very important question in terms of repeated stress.

Hon. Justice

Rachel Pepper: Again, because concern that's been expressed with. You may have a very low risk if any risk, damage to the well and then compromise to the well integrity with one or two fracks if you're engaging in say eight or nine fracks then you know, ultimately what is that doing to the well integrity? And that just raises a concern that has been expressed to us through the public consultations.

You mentioned in terms of the economic benefits that 43 million dollars, based on 2016 figures, 600 Australasian suppliers, how many Australian suppliers of the Australasian suppliers?

Diana Grantham: I'd have to get back to you, that was just a breakdown that let us split into the region.

Hon. Justice

Rachel Pepper: And then I guess perhaps finally, that you'd be aware of the criticism of the ... perhaps there are legacy issues in Queensland as a result of the CSG industry there and has been a number of instances. A number of people have come along and given presentations to the inquiry and indeed during the consultations of just things that have gone wrong in Roma and one of the criticisms that has been made as well look that's really the fault of companies such as Halliburton and Schlumberger and they'll be the same companies that would be vying for operation in the Northern Territory. Do you have any comment on that?

Diana Grantham: I don't which incidences they're referring to.

Hon. Justice

Rachel Pepper: Fair enough. Any further questions?

Yes, Ms Coram.

Ms Jane Coram: A very small follow on Doctor Jones' question. Referring back to this diagram here I'm just thinking, and this is probably one you may have to take on notice too. With that sort of array of vertical drilling, if that what you go to through a less stable are such as a fault zone, you know a she zone where the rocks actually, the



competence of the rock is different; is there anyway to test the actual integrity of the rock around the drilling? So, I'm looking here sort of like it looks sort of spraying a number of different drills in between those drill holes, is there any way to ensure the ongoing integrity of the rock in between the drill holes?

Diana Grantham: We'll get some facts on that.

Ms Jane Coram: Thank you.

Hon. Justice

Rachel Pepper: Lots of homework.

Thank you very much for, if nothing else, staying the distance and coming tonite and presenting. Mostly we raised lots of questions and look forward to your further information in due course. Thank you.

Diana Grantham: Thank you.