Armour Energy – Hearing Transcript

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10 March 2017

Darwin Convention Centre, Darwin

Speaker: Luke Titus

Luke Titus: My name is Luke Titus. I am the Chief Geologist with Armour Energy.

Hon. Justice Rachel Pepper: Thank-you. Yes?

Luke Titus: Okay, thank-you very much for having me today to talk to you. Armour Energy is a junior hydrocarbon explorer in the Northern Territory. Our company was listed on the ASX in 2012 and we operate out of Brisbane, Queensland. Armour's tenements both granted and under application in the Northern Territory, cover the Borroloola and McArthur River regions. An area south with a total approximate land coverage of about 120,000 square kilometres. Armour also operates tenements in Queensland and Victoria as well.

Armour's Northern Territory acreage contains multiple geologic basins being the McArthur Basin, the Georgina Basin, the Carpentaria Basin and the South Nicholson Basin. These basins include proven petroleum systems and we believe the overall potential of the area is significance in terms of potential gas.

Armour's Northern Territory on shore shale gas reserves are estimated at approximately 24 trillion cubic feet of prospective resources. Even only a small portion of these numbers are ultimately developed. They will provide a significant amount of energy to various markets.

Armour's acreage is also close to infrastructure which provides it with good commercialization opportunities and Armour also understands that local communities and other external stakeholders have questions about hydraulic stimulation. These questions need to be answered through an effective consultation with external stakeholders.

So we have submitted a letter to the panel and Roger Cressey is not here today but he sends his regards.

So the proposed use of hydraulic stimulation. Armour has carried out hydraulic stimulation in Queensland and of similar geologic rocks and formations under their acreage in ATP 1087. The same type of rocks do exist within the McArthur Basin that we are looking at doing similar activities in.

Our experience outlined in the submission is based on our Queensland experience with hydraulic stimulation and associated activities, as well as other experiences we have with stimulation with our own personal experiences.

To date, Armour has not carried out any hydraulic stimulation in the Northern Territory. However, the target formations for exploration involve unconventional oil and gas as well as conventional. In order to make tight gas or oil reserves or gas reserves, commercially viable resource hydraulic stimulation may be required in some cases.

Armour is also exploring for conventional gas and oil which does not require hydraulic stimulation. The technologies associated with hydraulic stimulation, as you know, have come a long way and it's been around for about 60 years and as the SANTOS gentleman just talked to you about, they've been successful with hydraulic stimulation since about 1967 in Northern Territory with no major issues reported.

So in no particular order in our submission, we wanted to talk about a number of environmental outcomes and impacts of hydraulic stimulation. And some of the questions that we get and we did receive when we were consulting in our Queensland block on hydraulic stimulation were a couple of these.

What does increased traffic do for posing risks? Yes, there's large volume of traffic involved with any hydraulic stimulation operation. Traffic is typically semi-trailer trucks and light vehicles which are common in the region of the Northern Territory acreage that we currently operate on. Armour implements traffic management plans to address any increase in traffic and to manage and mitigate associated risks. Such issues are appropriately managed on all sorts of activities and projects of different types across the globe.

Does hydraulic stimulation impact our beautiful landscape? Exploration for oil and gas involves drilling wells before any stimulation takes place. Armour only clears the minimum land required to safely perform its operations. The selection of locations for well pads is done to minimise the amount of cleared vegetation. Any land clearance is only carried out after obtaining native title approval, landholder agreements and cultural heritage clearance.

Hydraulic stimulation generally requires the construction of ponds or dams for water and fluid management. Those ponds or dams are lined to avoid any contamination or soil and water courses. Fluid that flows back to the surface, following hydraulic stimulation operations is stored in these lined ponds or dams then treated to remove contaminants. And we'll either do that on location through reverse osmosis or we will take and transport that to a location for treatment.

After wells have been hydraulically stimulated and placed into production, the area surrounding the well, including the ponds or the dams, are all rehabilitated so that only a small area immediately surrounding the well head remains for the operation. In order to assess whether or not there are any impacts as a result of our field operations, baseline environmental data is gathered prior to drilling and hydraulic stimulation activities. This is compared to the data obtained during activities and monitoring activities through the remainder of the tenement licence. Baseline data is collected in respect of water quality, quantity and the same for soils.

Do the chemicals used for stimulation contaminate aquifers? Not containing ... contaminating aquifers is a key objective. As part of a drilling process and before hydraulic stimulation work starts, the well has cement pumped into the annulus between the outside of the steel casing pipe and the well bore, thus isolating all aquifers from the well so no contamination occurs. In addition, the design of the hydraulic stimulation operation is such that the stimulation of the rock does not extend beyond the boundaries of the target formation. This design prevents contamination of aquifers.

The hydraulic stimulation process involves pumping a mixture of water, proppant and some chemicals at high pressure into a target rock formation. Typical hydraulic stimulation fluid make-up could be about 96% water, 3.5% proppant and 0.5% of chemical additives. The chemical additives used these days are generally found in some form of household items. An example of these chemicals used on the hydraulic stimulation programme in Queensland has been provided to the panel in Appendix 1 of our submission.

The fluid mixture is pumped down the well bore inside steel casing pipe to below any aquifers and into the target formation where the hydraulic stimulation occurs. Of the stimulation fluid, which is pumped down the well bore, an industry rule of thumb suggests around 60% of that fluid flows back to the surface. Some of the remaining fluid may come to the surface over time, during gas production, and the rest will remain contained in the formation. Fluid that comes to the surface during production is contained and treated to ensure no contamination of ground water and other soils.

Another question that we get quite a bit, can hydraulic stimulation penetrate and therefore damage aquifers? The design of a hydraulic stimulation operation is done that the stimulation of the rock does not extend beyond the boundaries of the target formation. This keeps the hydraulic stimulation fluid contained within the target formation and the well bore, thus keeping it away from other rocks and formations. Also target rock formations for tight and shale gas are usually much deeper than the aquifer and the source rock for the surrounding hydrocarbons, and there's impervious rock layers between the hydraulic stimulation and the aquifer.

Armour's target rock formations are approximately 1500 metres to greater than 3000 metres below the earth's surface. Aquifers, in our areas, are typically no more than 300 to 500 metres deep. And generally most of the

shallower aquifers are double lined cased. This means that typically at least 500 metres or usually more of impervious rock exists between the hydraulic stimulation and the aquifer. The likelihood, therefore, of a hydraulic stimulation penetrating any aquifer is extremely low or negligible.

Another question that we get quite a bit, does water used for hydraulic stimulation deplete aquifers? Where proper water management is not implemented there is a risk of depletion of aquifers. Proper water management includes hydrological studies to understand the relationship between the surface water and the ground water, baseline studies on water quantity and ongoing monitoring of water levels.

Armour recognises the importance of water management particularly in the dry regions such as the Northern Territory and Armour will carry out a proper management procedure. There's potential for recycling of water. This provides opportunities to minimise the quantity of water to be used and obtained from ongoing hydrological activities and for hydrological, excuse me, hydraulic stimulation activities.

Armour recognises that other industries, land users and communities require water and they rely on their existing water supplies. For hydraulic stimulation, water sources would include existing water courses, dams and bores where the quantities obtained would be limited to ensure no impact to other users. Other sources would potentially include bores, assessing aquifers not currently used by other parties. And these aquifers would likely be deeper than those traditionally drilled by communities and grazers for water supplies.

As part of water management activities, ongoing monitoring of water levels and quality in existing water courses, dams and bores provides an understanding of whether or not water being sourced from hydraulic stimulation is causing impacts on water levels on those various existing water sources, including aquifers. Water obtained for hydraulic stimulation is limited from existing water sources used by others so as not to impact other users.

So those are some of the main bullets that we get when we talk to communities. There are more, but we do recognise the beauty of the landscape and the remote parts of the Northern Territory where we have tenements. We strive to maintain our social licence to operate and we do, must respect the environment and the communities in the regions that we work. Whilst the population in the area for our tenements is relatively low, we do provide employment to local companies and indigenous people in our early exploration activities. And we plan to continue to do this in the future. Locals know the land the best.

There is significant interest by a range of companies in exploration of the Northern Territory as you've heard. This provides the people of the Territory with an opportunity to benefit from the investment by this industry in multiple ways, whilst ensuring the environment is protected. Benefits range

from creating many jobs, providing a very significant additional revenue stream for the government that can be used for building roads, schools, hospitals, et cetera. The benefits can be significant if properly managed. They can be delivered in a transparent and sustainable way.

In the process of exploring for development the potentially large energy resources across our tenements, Armour will ensure its activities meet legislative requirements and industry best practises, while we also provide transparency to our stakeholders, ensure the local communities benefit from our activities, which we respect cultural heritage and minimise our impact on the environment.

Thank-you.

Hon. Justice Rachel Pepper: Thank-you very much. Questions? Yes. Prof. Priestly

Prof. Brian Priestly: I'm a little confused about, or perhaps you can give me some information on the relative proportion of the water storage facilities on the footprint of a well, a pad. We've heard comments about the very large volumes of water required for fracking, some things along several Olympic-sized swimming pools. So presumably the water storage problem, on site, is quite a large one. To what extent is ... how is that managed in your operations?

Luke Titus: Okay, so in our well, for example, in ATP 1087 we had three ponds. Those were all lined and water was brought in and used for the stimulation activity and for the flow back operation. And then that, at the time, and then that water was managed in such a way that we had an agreement with Mount Isa Mine and we brought that water to a certain chemical composition that they agreed to take it at and it was transported to the mine. And then the dams were rolled back up and everything was reclaimated back to around the well head.

Prof. Brian Priestly: Okay, thank-you.

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

Dr. Vaughan Beck: You mentioned that Armour Energy has carried out some hydraulic fracturing in Queensland. Can you kindly give us some details on the extent of that exercise? And you mentioned then that the same rocks exist in the McArthur Basin. Can you also then describe the geology of those rocks, please?

Luke Titus: Sure, sure. So I'll put the geology first, if that's okay?

Dr. Vaughan Beck: Sure. That's fine.

Luke Titus: So the geology that we are looking at in North West Queensland, the rocks are of similar age. They're 1.5 billion year old Proterozoic rock. They are a algal source rock and the hydrocarbons that are trapped in them are within a shale, right, the source rock. Those rocks are equivalent in age,

chronostratigraphically, to rocks that are in the McArthur River Basin so the line, the state line between the Northern Territory and Queensland is ... those geologic formations are of similar age across that line.

The hydraulic stimulation that we did in Queensland, at that time we had a couple of well bores that were drilled by Comalco, a fellow named Bruce McConachie in the late 80s, early 90s. We acquired the tenement and based on some of the results of that guy's wells, and we determined that from his data that we would be able to twin a well and that we would be able to perform a hydraulic stimulation in the source rock to see if we could move hydrocarbons to the surface.

So we moved to within a hundred metres of the existing well and we re-drilled the vertical portion of the well and then we kicked back up the hole and, after logging it, we ran image logs, we ran what they call a CMI CXD which is an image log and a cross-dipole log. We determined the stress field that sat around the well bore, to determine the optimal direction to drill the horizontal well. So we looked at drilling into the minimum horizontal stress which was back to the southwest, to ensure that when we attempted to stimulate, that we were perpendicular to the maximum horizontal stress which allows the stimulation to grow into the natural fractures or the rock, and try to bring hydrocarbons back to the well bore.

We did successfully do that and we moved hydrocarbons back to the surface of about 300 MCF a day. That was a technical success. It's not a commercial success.

Dr. Vaughan Beck: Mm-hmm (affirmative). Right. And how long was the horizontal well?

Luke Titus: It was a 600 metre lateral.

Prof. Barry Hart AM: Thank-you. A question relating back to reducing the amount of water used. So focusing on the recycling. So what's your experience as to proportion that can be recycled, and what are the factors that determine the amount?

Luke Titus: I can't remember off the top of my head the amount of water that we used in Queensland. But what's coming back to the surface is basically the fluids that we pumped down in there which is the water. So we would, in a case of re-stemming, we would try to use as much water, much as that fluid again to re-stimulate with again, as long as it was of the same rheology that we needed to put down the bore. So I would say that you could do that as often as you wanted.

Prof. Barry Hart AM: 100%?

Luke Titus: Well, you'd probably have to bring in some to help dilute a little bit. But that's a good question.

Prof. Barry Hart AM: So can you address that in your submission?

Luke Titus: Yes, I can look into that for you.

Prof. Barry Hart AM: Just the general parameters I'm interested in. Thank-you.

Luke Titus: Yep.

Hon. Justice Rachel Pepper: Any other questions? Yes, Dr. Jones.

Dr. David Jones: Just one question. It kind of relates to what Prof. Hart was talking about in terms or water management, but we hear about wet and dry gas and I think the difference between them is whether some oil and so on. There presumably is difference in risk management with respect to those two types of water that might be produced, once you're getting separate hydrocarbons coming up that flow back water then introduces a new dimension to the water management issue and also perhaps to the reuse issue as well.

Luke Titus: All right. So our hydrocarbons, we have compositional analysis on from separators and it's dry gas so it's all methane. We haven't moved any condensator LPG or oil to the surface in these tenements.

Dr. David Jones: Okay, it's just that I was reading some, getting some indications in the Beetaloo Sub basin, for example, there could be some contained hydrocarbons in there as well which might come up. So ...

Luke Titus: I'm not familiar with their gas compositions in the Beetaloo.

Dr. David Jones: Okay.

Hon. Justice Rachel Pepper: Any further questions? Thank-you very much for coming today.

Luke Titus: Thank you.