Senate Standing Committee on Environment and Communications
References Committee
ANSWERS TO QUESTIONS ON NOTICE
CSIRO
Inquiry into Oil and gas exploration and production in the Beetaloo Basin
02 08 2021

QUESTION 1: Hansard page 40 – Chair

CHAIR: Would you be able to take it on notice to provide a bit of a list of what you've spent money on in the Northern Territory, for us to have a bit of an understanding?

Dr Barrett: Absolutely.

CHAIR: I think that would be helpful.

Dr Barrett: Yes, we can take that on notice.

Ms Zielke: Chair, just so you're aware in the meantime, the annual report for GISERA is available on its website. I was actually just rereading it in preparation. The lists are all available in that, just in case you need it before we come back.

ANSWER

Northern Territory committed research investment by topic

Program	Total investment	Percentage contribution
Surface and Groundwater	$2,665,929	53%
Greenhouse gas	$1,617,276	32%
Terrestrial biodiversity	$319,520	6%
Agricultural land management	$249,829	5%
Socio-economic	$194,308	4%
Total	**$5,046,862**	**100%**

Northern Territory committed research investment by contributor

Partner	Total investment	Percentage contribution
Federal Government	$2,445,034	48%
CSIRO	$1,096,423	22%
Northern Territory Government	$669,734	13%
Santos	$355,830	7%
Origin	$302,546	6%
Pangaea	$123,438	2%
Charles Darwin University	$53,858	1%
Total	**$5,046,862**	**100%**

Breakdown of research projects

					Contributions					
Research program	**No.**	**Research project**	**Status**	**TOTAL PROJECT AMOUNT**	**Santos**	**Origin**	**Pangaea**	**Federal Government**	**Northern Territory Government**	**Charles Darwin University**	**CSIRO**
Surface and groundwater	W16	Baseline assessment of groundwater characteristics in the Beetaloo Sub-Basin	Complete	$410,550	$51,319	$51,319	$0	$102,638	$102,638	$0	$102,638
	W17	Environmental monitoring and microbial degradation of onshore shale gas activity chemicals and fluids	In progress	$291,964	$29,196	$29,196	$29,196	$65,692	$65,692	$0	$72,991
	W18	Characterisation of the stygofauna and microbial assemblages of the Beetaloo Sub-Basin	Complete	$346,891	$29,303	$29,303	$29,303	$65,932	$65,932	$53,858	$73,258

					Contributions						
Research program	**No.**	**Research project**	**Status**	**TOTAL PROJECT AMOUNT**	**Santos**	**Origin**	**Pangaea**	**Federal Government**	**Northern Territory Government**	**Charles Darwin University**	**CSIRO**
	W20	Improved approaches to long-term monitoring of decommissioned onshore gas wells	In progress	$352,436	$35,244	$35,244	$28,195	$130,401	$35,244	$0	$88,109
	W24	Onshore gas water lifecycle management options framework	In progress	$409,833	$5,246	$5,246	$1,844	$280,162	$14,877	$0	$102,458
	W25	Fate of HF fluids/chemicals and geogenic hydrocarbons in surface facilities and in the subsurface	In progress	$854,255	$73,404	$70,000	$0	$540,000	$0	$0	$170,851
Total (water)				**$2,665,929**	**$223,712**	**$220,308**	**$88,539**	**$1,184,825**	**$284,382**	**$53,858**	**$610,305**
Agricultural land management	L10	Putting land management knowledge into practice	In progress	$249,829	$3,198	$3,198	$1,124	$170,783	$9,069	$0	$62,457
Total (Ag)				**$249,829**	**$3,198**	**$3,198**	**$1,124**	**$170,783**	**$9,069**	**$0**	**$62,457**

					Contributions						
Research program	**No.**	**Research project**	**Status**	**TOTAL PROJECT AMOUNT**	**Santos**	**Origin**	**Pangaea**	**Federal Government**	**Northern Territory Government**	**Charles Darwin University**	**CSIRO**
Terrestrial biodiversity	B7	Understanding and managing impacts to biodiversity from roads and pipelines in the Beetaloo	In progress	$319,520	$4,090	$4,090	$1,438	$218,424	$11,599	$0	$79,880
Total (Biodiv)				**$319,520**	**$4,090**	**$4,090**	**$1,438**	**$218,424**	**$11,599**	**$0**	**$79,880**
Socio-economic	S16	Mapping future transport passages and volumes for improved planning and operation	In progress	$194,308	$2,487	$2,487	$874	$132,829	$7,053	$0	$48,577
Total (social)				**$194,308**	**$2,487**	**$2,487**	**$874**	**$132,829**	**$7,053**	**$0**	**$48,577**
Greenhouse gas	**G5**	Baseline measurement and monitoring of methane emissions in the Beetaloo	Complete	$305,297	$0	$0	$0	$0	$305,297	$0	$0

					Contributions						
Research program	**No.**	**Research project**	**Status**	**TOTAL PROJECT AMOUNT**	**Santos**	**Origin**	**Pangaea**	**Federal Government**	**Northern Territory Government**	**Charles Darwin University**	**CSIRO**
	G6	Mitigating fugitive gas emissions from well casings	Complete	$238,249	$1,316	$1,316	$1,382	$137,508	$37,164	$0	$59,562
	G7	Offsets for Life cycle GHG Emissions of Onshore Gas in the NT	In progress	$417,884	$5,349	$5,349	$1,880	$285,666	$15,169	$0	$104,471
	G8	Methane emissions quantification of hydraulic fracturing processes in Beetaloo sub-basin	In progress	$655,846	$115,678	$65,798	$28,201	$315,000	$0	$0	$131,169
Greenhouse gas (total)				**$1,617,276**	**$122,343**	**$72,463**	**$31,463**	**$738,174**	**$357,631**	**$0**	**$295,202**
Total				**$5,046,862**	**$355,830**	**$302,546**	**$123,438**	**$2,445,034**	**$669,734**	**$53,858**	**$1,096,422**

QUESTION 2: Hansard pages 41-42 – Senator Sterle

Senator STERLE: … What about if these chemicals get into the water?

Dr Barrett: … We're going to be conducting this work also for the waters of the Cambrian limestone aquifer in the Beetaloo, and, again, we'll be able to make a definitive statement along these lines in the coming 12 to 18 months.

Senator STERLE: So it's not the end of the year? I thought you said it was the end of the year in the first part of that. That's just the soil, is it?

Dr Barrett: Sorry, the project goes into the new year, so it will take 12 to 18 months for full completion of the project.

Senator STERLE: Will that information be out before the completion of the project?

Dr Barrett: There are a number of progress reports and points along the way. We report the progress of the work that we're doing. Where we have something definitive to say, we put that into our progress reports, and that goes on to the CSIRO GISERA website, which is available for public use and interrogation. But I can make a point of following this up for you if you would like.

Senator STERLE: If you could do that through the committee structure, that would be great, thank you.

ANSWER

Fate of hydraulic fracturing fluids/chemicals and geogenic hydrocarbons in surface facilities and in the subsurface

CSIRO's GISERA is currently completing a Research Project – *Fate of hydraulic fracturing fluids/chemicals and geogenic hydrocarbons in surface facilities and in the subsurface*.

This project will provide a systems-based approach to understanding chemicals and their lifecycle during hydraulic fracturing, in flow-back water produced after fracturing, and in tanks and ponds in industry facilities in the Northern Territory.

In particular, this project will improve understanding of the degradation and transport of these chemicals within the subsurface. In addition, this study will examine flow-back water and provide insights into the biodegradation of these chemicals and naturally occurring (geogenic) hydrocarbons in flow-back water as well as in holding tanks and ponds in industry facilities.

This project addresses key recommendations of the Scientific Inquiry into Hydraulic Fracturing in the Northern Territory and will provide key information for assessing chemical risks associated with hydraulic fracturing.

Submissions made during public hearings and community forums related to the Scientific Inquiry into Hydraulic Fracturing indicated community concerns about hydraulic fracturing. Of those recommendations aimed at addressing these concerns; this project will provide specific information towards Recommendations 5.5 and 7.10.

For Recommendation 5.5 this project will provide information on the concentrations of chemicals of 'high concern' after adsorption, degradation and biodegradation has occurred. These data will be critical in determining the management practices required for safe disposal.

For Recommendation 7.10 this project will:

- provide information on the identities of the current uncharacterised geogenic hydrocarbon fraction in the flow-back water, tanks and ponds and their degradation in flow-back water, tanks and pond settings.
- provide information on the abiotic and biotic degradation of key compounds identified as of 'potentially high concern' in the qualitative (screening) environmental risk assessment of drilling and hydraulic fracturing chemicals for the Beetaloo GBA region report.
- provide information on the subsurface migration, adsorption of chemicals of high concern.
- provide information on options and methods for using microbes to degrade organic components in the flow-back, storage tank and pond settings.

This project was authorised on 1 July 2021 and is expected to take eighteen months for completion. At this point the project is in the planning stage.

Environmental monitoring and microbial degradation of onshore gas activity chemicals and fluids

CSIRO's GISERA is completing research project *Environmental monitoring and microbial degradation of onshore shale gas activity chemicals and fluids*.

This project aims to achieve two objectives:

- Establish microbial community baselines in aquifer waters and soil samples of sites proximal to prospective unconventional gas activities in the Northern Territory (using wells previously sampled for GISERA water project - Baseline monitoring of groundwater properties in the Beetaloo Sub-basin).
- Understand the microbial degradation of a range of chemicals likely to be used in unconventional gas activities, in both the five major soil types of the region and in relevant aquifer environments.

This project is part of an effort to reduce the environmental, social, health, cultural and economic risks associated with unconventional gas production in the Northern Territory.

In particular, this project will develop complimentary microbial community profiles for aquifers examined in the previous GISERA project and also the five major soil types of the Beetaloo sub-Basin. The second objective of the project will develop an understanding of the potential for microbes to degrade the common chemicals used by industry in the development of the shale gas resource in major soils of the region and representative aquifer samples.

This project is on track with five of six tasks completed as planned and results available later this year.

QUESTION 3: Hansard pages 42 – Senator Sterle

Senator STERLE: … Will salt be a major by-product of fracking, as we've seen in Queensland? While we're having this blue about the Great Artesian Basin being destroyed, there were mountains and mountains of salt all hidden behind a bunch of trees, and no-one even wanted to talk about it. What about up there at Beetaloo?

Dr Barrett: … I can get the estimates for you on notice as to what we might expect to be the produced water. Flowback is another source of water from the formations, following hydraulic fracturing. Again, I can get estimates of what the amounts of flowback might be over the lifetime of projects in the Beetaloo Basin.

Senator STERLE: That'd be great. Thank you.

ANSWER

As the onshore shale gas industry is in early stages of exploration and appraisal significant uncertainty surrounds the performance of wells in relation to flowback water (water that returns to the surface after hydraulic fracturing) and produced water (water that accompanies the gas to the surface during production operations).

The volume of water required to hydraulically fracture shale gas strata can be an order of magnitude larger than that for coal seam gas depending on well depth and extent of horizontal drilling. Conversely, the total volume of produced water in shale gas operations is orders of magnitude less than the total amount produced during coal seam gas operations. While initial extraction of water for shale gas operations will be significant, shale gas operations will not be faced with the ongoing disposal and subsequent replacement of large volumes of produced water as is the case for CSG operations. (Key finding 23 of Cook et al 2013 https://acola.org/saf06-energy-unconventional-gas-production/)

The amount of water used in shale gas developments is in the order of between 5 and 20 megalitres (ML) per well, and is likely to vary depending on local conditions. The relative quantity of produced water to flowback water is quite low in shale gas resources. For a 6000-well development, a cumulative total of 45,600ML of flowback water and 1,710ML/year of produced water might be expected over the life of a project (Cook et al., 2013; Huddleston-Holmes et al 2017).

The 6000-well development scenario proposed by the NT Department of Primary Industry and Resources provided to the Scientific Inquiry into Hydraulic Fracturing in the Northern Territory was based on potential supply, rather than demand.

Industry estimates suggest a combined development over the next 25 years that could result in some 1,000 to 1,200 wells, associated with approximately 150 well pads. The development scenario proposed by the petroleum industry will require an average of 2,500 ML/y (up to 5,000 ML/y at peak demand) of water for well drilling and hydraulic fracturing, or a total of 20,000-60,000 ML from the aquifer system over 25 years (Scientific Inquiry into Hydraulic Fracturing in the Northern Territory, section 7.3.1.4 Possible development scenarios).

References:

Cook, P, Beck, V, Brereton, D, Clark, R, Fisher, B, Kentish, S, Toomey, J and Williams, J (2013). *Engineering energy: unconventional gas production.* Report for the Australian Council of Learned Academies, www.acola.org.au. https://acola.org/saf06-energy-unconventional-gas-production/ Huddlestone-Holmes….

Huddlestone-Holmes, C.R., Horner, N., Apte, S., Day, S., Huth, N., Kear, J., Kirby, J., Mallants, D., Measham, T., Pavey, C., and Schinteie, R. 2017. *Assessment of scientific knowledge of shale gas and shale oil impacts*. EP165346. CSIRO. Australia. https://publications.csiro.au/publications/publication/PIcsiro:EP165346/SQhuddlestone/RP1/RS25/RORECENT/STsearch-by-keyword/LISEA/RI8/RT35