



LAND AND INFRASTRUCTURE

GISERA | Gas Industry Social and Environmental Research Alliance

Investigating Beetaloo Sub-basin shale formations to improve long-term integrity of decommissioned gas wells

This project will assess the ability of shale formations in the Beetaloo Sub-basin to self-seal or 'creep' over time after gas well decommissioning, creating a natural barrier to movements of hydrocarbon fluids. This phenomenon would significantly reduce the risk of contaminants entering the environment.

Community stakeholders have expressed concerns that decommissioned wells could become potential sources of contaminants in the long term (100 to 1,000 years).

Concerns arise from the perceived risk of connectivity between natural gas seams and surface aquifers after gas production has ceased and the well is plugged and abandoned.

This project aims to investigate the self-sealing competency (creep occurrences) of the Beetaloo Sub-basin shales and the potential to create a natural barrier that reduces the risk of contaminants entering the environmental systems.

Researchers will quantify the self-sealing competency (creep behaviour) of the shale formations in the Beetaloo Sub-basin.

These formations are hundreds of meters thick and sit between the deep natural gas seams and the shallow Cambrian Limestone Aquifer.

This information will be used to develop a simple leakage rate 'simulator' for the Beetaloo Sub-basin, which could be used in planning for decommissioning practices.

Beetaloo Sub-basin

The Beetaloo Sub-basin lies southeast of Katherine in the Northern Territory and spans an area of about 28,000 square kilometres. The estimated gas resources for the Beetaloo Sub-basin are of similar size to other major gas-producing basins in Australia, such as the Surat Basin in Queensland or the Bonaparte and Browse basins in Western Australia.

Key points

- The community's concern about decommissioned gas wells in the Beetaloo Sub-basin, NT, is that they could be potential sources of contaminants in the long term.
- This project will assess the ability of shale formations to self-seal or 'creep' over time after well decommissioning.
- Shale creep can create a natural barrier that would reduce the risk of contaminants leakage to the surrounding environment.
- A leakage rate 'simulator' will be developed for the Beetaloo Sub-basin, which could be used in estimating potential contaminant flow rates.
- The project will also investigate techniques to accelerate these processes in the Beetaloo Sub-basin.



Well integrity

Petroleum wells are plugged and decommissioned at the final stage of their lifecycle to prevent the migration of hydrocarbons to the surface and separate the movements of hydrocarbon fluids among different strata.

Plugging and decommissioning activities are complex technical well operations designed to ensure well integrity over the long term.

The integrity of plugged and decommissioned wells might be compromised due to the failure of individual or multiple barriers, creating potential leakage pathways for formation fluids. These fluids could be natural liquids and gases contained within the geologic formations.

‘Creeping’ as a potential solution

Data from other parts of the world indicates that shale formations self-seal over time. This gradual movement is known as ‘creep incidents’.

If natural shale formations in the Beetaloo did display creep characteristics, they may naturally self-seal decommissioned wells by forming a barrier and filling spaces behind well casings.



Project aims

Researchers will evaluate the mineralogy of Beetaloo Sub-basin shales and their mechanical properties to determine the potential sealing competency (creep rate) of this specific shale.

As natural creep rates may take decades to seal formation fractures or fill up the annular space in the wellbore, the project will also investigate techniques to accelerate Beetaloo creep processes through changes to well fluid chemistry.

This information will be used to develop a well leakage simulator specific to the Beetaloo Sub-basin.

The simulator will be based on Northern Territory decommissioned well components, including cement plugs, reservoir conditions, associated decommissioning strategies, and Northern Territory code of practice requirements.

The simulator will allow regulators and gas companies to analyse and quantify the contamination intensity due to the well leakage.

Methodology

As part of project activities researchers will:

- Conduct a comprehensive literature review.
- Develop a leakage rate simulator tailored to Beetaloo Sub basin shale.
- Estimate leakage rated through consideration of relevant factors.
- Determine the mineral composition of Beetaloo shale.
- Test the chemical, porosity and elasticity properties (chemo poroelasticity) of shale for swelling and shrinking responses to different chemical solutions in well fluids.
- Run laboratory experiments using cylindrical specimens comprising a steel rod and shale samples under stress conditions adapted to Beetaloo Sub-basin characteristics.
- Identify the effect of changing pore fluid chemistry on creep rates.

More information

Find out more about the [project](#)

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