GROUND AND SURFACE WATERS

GISERA | Gas Industry Social and Environmental Research Alliance

Understanding the integrity of Queensland's coal seam gas wells: Cements, steels and microbial activity

This project will bring together information on materials used in cements and casings in coal seam gas (CSG) wells, and subsurface microbial prcesses, to improve the community's understanding of well integrity in Queensland.

Key points

- Growth in the GSG industry in Queensland has seen a significant increase in the number of wells drilled for petroleum exploration and production.
- Communities and landholders have concerns about the integrity of the wells, especially the environmental risks from leaking reservoir fluids and aquifer contamination.
- This study aims to address knowledge gaps in the community's understanding of steels, cements and microbial processes.
- This desktop study gathers information from completion reports for wells largely drilled in the Bowen and Surat basins. Information will be translated to more accessible forms, and we will hold two community meetings.

The growth in the CSG industry in Queensland over the past two decades has seen a significant increase in the number of CSG wells drilled in the state.

Community and landholder groups in QLD have concerns about potential failures in the integrity of CSG wells, and the possibility of failed wells contaminating underground aquifers and leaking gas. Communities have asked for more information on the integrity of CSG wells.

CSIRO's Gas Industry Social and Environmental Research Alliance (GISERA) has undertaken a study bringing together knowledge about well integrity, including information on cements and steels used in well casings, and the microbial processes that may damage CSG wells.

Research objectives

This research project aims to improve the community's understanding of well integrity. GISERA researchers will capture current and historic information on steels, cements and microbial processes that may impact CSG well infrastructure in Queensland.

This is a desktop study, based on data from well completion reports. Information on the composition of cement and steels used in CSG wells is contained in well completion reports submitted by the operating companies. Because most of the CSG wells in Queensland are drilled in the Surat and Bowen basins, the information will be largely gathered from well completion reports in these two basins. Researchers will then identify trends in cement and casing materials used in CSG wells over time and, where necessary, recommend further studies.

The study will synthesise and summarise the findings in a report that is accessible, and easy to understand. There will also be a community meeting to present the findings.

A coal seam gas well head in the Surat Basin, Queensland.

CSIRO | Australian Government Department of Industry, Science and Resources | NSW Government | Supported by Government of South Australia | Queensland Government | Northern Territory Government | origin | Australia Pacific LNG | QGC | Santos

The Bowen and Surat basins of QLD

South-east Queensland hosts the largest CSG producing fields in Australia. The key reservoirs are Permian coals of the Bowen Basin and Jurassic coals of the Surat Basin. While there is contingent CSG in the Galilee Basin, this research project will focus on the Bowen and Surat basins.

The number of wells in Queensland is expected to reach 22,000 by 2050. Understanding any potential risks associated with gas development activities requires detailed knowledge of CSG well integrity.

Basics of CSG well infrastructure

Coal seam gas is extracted through wells drilled into coal seams. CSG wells are typically designed with multiple barriers to maintain well integrity, and to prevent the coal seam fluids from contaminating the groundwater resources or escaping to the surface. CSG wells are fully lined with steel casing, which is cemented in place to isolate aquifers overlying the target coal seam.

Cement casings and steel

The environmental integrity of CSG wells is heavily reliant on the performance of casing and cementing material used in completion and decommissioning.

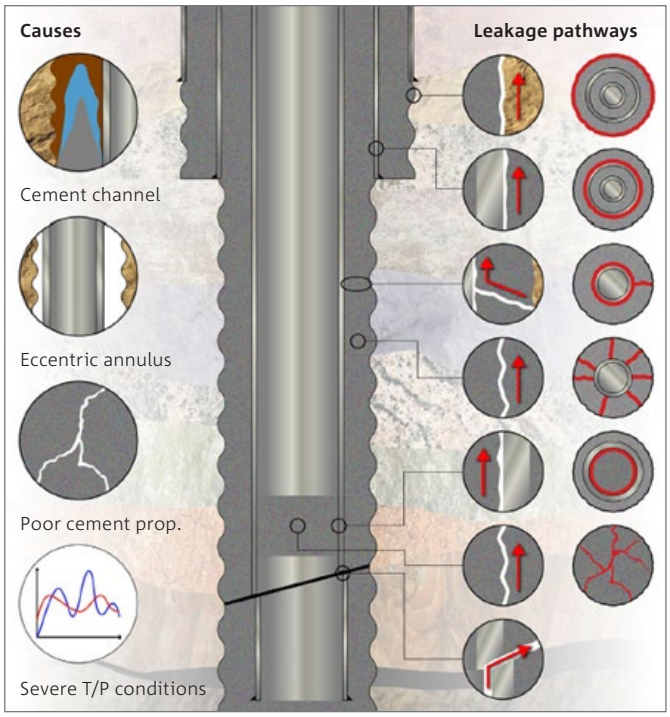
Cementing of a well including the casing is one of the crucial jobs performed during its completion to maintain integrity of the well. Cement quality and poor cementing practices are some of the common causes of well integrity failure. Cement must form a strong bond with both casing and rock formation and withstand downhole environment to prevent any leakages from the well. Oil and gas operators have undertaken significant research and development to optimise cement slurry composition and cementing techniques to lower the risk of fluids escaping from the well.

The use of steel, and the type of steel used in the casing, is another key part of a well's integrity. This study will analyse the particular steels used now, and in the past.

Microbial activity

This project will also compile data on Australian subsurface microbiology, centred on those organisms with capacity to damage CSG well casings or cement.

Previous CSIRO research demonstrated a large diversity in microbial communities in CSG reservoirs with, potentially, differing capacities for degradation of chemicals prospectively used in the construction of wells. Currently, however, the capacity for microbes to act as mitigants of compounds used in the construction of gas wells worldwide is unknown.



(Side view) (Top view)

Schematic of potential leakage pathways in petroleum wells (Liu, 2021).

Project methods and outcomes

In the first phase of the project, researchers will acquire information on the composition of casing material and cement slurries from at least 100, and potentially up to 200, CSG well completion reports from Queensland wells.

In the second phase, researchers will understand, summarise and report on the properties of materials used for cementing and casing the CSG wells. We will analyse data on which materials are used under certain conditions, noting any changes in materials over time. We will synthesise our findings in an easy-to-understand report.

In phase three, we will compile data on Australia's subsurface microbiology, centred on organisms with capacity to negatively impact well casings or cement.

All results will be publicly available on GISERA's web site.

More information

Read more about the project.

Read about other GISERA projects based in Queensland.

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