



LAND AND INFRASTRUCTURE

GISERA | Gas Industry Social and Environmental Research Alliance

# Laboratory-based evaluation of cement degradation processes in CSG wells in Queensland

This project will investigate the potential for cement degradation and related processes in coal seam gas (CSG) wells in Queensland's Surat Basin.

### Key points

- Community and landholder groups in Queensland have expressed concern about potential failure in the integrity of CSG wells.
- To address this concern, this project will investigate the potential for cement degradation within CSG wells.
- This project will be laboratory based, and will use ageing experiments to evaluate the extent of potential cement degradation.
- Cement samples will be exposed to conditions – pressure, temperature, groundwater chemistry – that would typically be encountered in the region.
- The project results will improve understanding of the potential for long-term cement degradation and the associated implications for well integrity.

fluids under downhole conditions and analysing the cement for changes. The work builds on a previous GISERA project – Queensland CSG Well integrity: cements, steels and microbial activity (2024) – which focused on reviewing Well Completion Reports (WCRs) for a randomly selected set of wells in Surat, Bowen and Galilee basins.

### CSG in southeast Queensland

The Bowen and Surat basins in southern Queensland host the largest CSG producing fields in Australia, with production commencing in the Bowen Basin in the 1990s and in the overlying Surat Basin in 2006.

Approximately 80 per cent of current CSG production in Queensland is derived from coals with the Walloon Coal Measures of the Surat Basin. These account for the majority of CSG produced in Australia.

The development of these resources has seen the drilling of over 14,000 CSG wells to date. A commonly raised concern in the community is about the long-term integrity of these wells, including whether integrity failure may provide a pathway for contamination of groundwater resources or unintended release of methane gas.

This project, conducted through CSIRO's Gas Industry Social and Environmental Research Alliance (GISERA), will evaluate the potential risk to well cement integrity within CSG reservoirs.

Researchers will conduct a series of ageing experiments on cured cement samples, subjecting those samples to formation



## Project objectives

This project aims to address community concern about potential failures in CSG well integrity, and provide assurance as to how the construction of wells ensures their integrity.

CSG wells are typically designed with multiple barriers to maintain integrity and prevent the unintended flow of fluids (such as water or gas) into, out of or along the well bore.

The two main structural barriers are multiple levels of well casing, usually made of steel, and annular cement. Casing is cemented into the well to provide support to the casing and wellbore and to create a seal between the casing and the surrounding rock.

The key characteristics of the cement are:

- that it is strong enough to maintain mechanical integrity (so that it doesn't fracture),
- that it is impermeable so that fluids cannot flow through it, and
- its ability to form a seal against the rock formations (cement to rock) and the casing (cement to casing) so that fluids can't move along these interfaces.

A potential mechanism for well integrity issues is through the degradation of cement through time. Degradation may be caused by the pressure and temperatures and the formation fluids to which the wells are exposed.

In this project, researchers will look at processes that may cause cement used in CSG wells to degrade, and will use laboratory experiments that replicate *in-situ* conditions the cements are exposed to.

The project will incorporate data collected in a previous GISERA study regarding the cement class type and the types of additives employed in CSG wells.

Geochemical modelling will be performed to analyse the experimental results and investigate the potential for long-term cement degradation.

## Project methods

This project will enable the assessment of degradation processes in cements used in CSG wells in Queensland.

Using the cement compositions that are representative of those used in CSG wells in this area and subjecting them to the environmental conditions (pressure, temperature, groundwater geochemistry), the project will provide data about the long-term durability of cement.

This begins with a discovery phase, reviewing literature and field data to design laboratory experiments.

The cement preparation and curing phase involves producing samples using standard formulations and curing them under simulated conditions. Pre-experimental characterisation then establishes baseline properties through advanced analytical techniques.

In a static batch reactor experiment, cement samples will then be aged for several months in formation water. A second batch of samples will be subjected to an accelerated thermal ageing experiment at an elevated temperature to enhance the degradation process. Changes in water chemistry and cement are monitored throughout.

The post-experimental characterisation phase repeats all analyses to assess structural and geochemical changes. These findings will then feed into geochemical modelling, using thermodynamic and kinetic approaches to project long-term behaviour.

The final interpretation phase evaluates whether, how, and at what rate cement degrades, informing implications for well integrity.

### More information

Read more [about this project](#)

Learn about [other GISERA research in Queensland](#)

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



**Further information | 1300 363 400 | [gisera@csiro.au](mailto:gisera@csiro.au) | [gisera.csiro.au](http://gisera.csiro.au)**

GISERA is a collaboration between CSIRO, Commonwealth and state governments and industry established to undertake publicly-reported independent research. The purpose of GISERA is to provide quality assured scientific research and information to communities living in gas development regions focusing on social and environmental topics including: groundwater and surface water, greenhouse gas emissions, biodiversity, land management, the marine environment, and socio-economic impacts. The governance structure for GISERA is designed to provide for and protect research independence and transparency of research.