AUGUST 2018

WATER RESEARCH FACTSHEET

Groundwater contamination risk assessment

Improving the understanding of water contamination risks due to hydraulic fracturing in coal seam gas extraction.

KEY POINTS

- This project provides information on the contamination risk profile at a geological basin scale.
- It identifies key factors that increase or reduce the likelihood of contamination pathways from hydraulic fracturing and wellbore delamination which could allow naturally-occurring chemicals or hydraulic fracturing fluids to reach aquifers.
- The hydraulic fracturing study provides information on theoretical maximum fracture lengths in the Surat Basin, which can help operators determine appropriate setback distances and best practice operations.
- The wellbore delamination modelling shows the risk of contamination to overlying aquifers is low for the Sydney and Surat basins.

Image: A well undergoing hydraulic fracturing in the Surat Basin

Australia's gas industry has a history of low well failure rates however concern continues over environmental impacts to groundwater resources due to hydraulic fracturing* and wellbore delamination*.

This project assessed water resource risks due to hydraulic fracturing activities and wellbore delamination associated with coal seam gas (CSG) wells for the Sydney Basin, NSW, and Queensland's Surat Basin.

Hydraulic fracturing has been used in about 10% of CSG wells in Queensland to date, and in 75% of wells in the Camden Gas Project in the Sydney Basin, the NSW focus area for the study. The proposed Narrabri Gas Project in NSW is outside the study region and hydraulic fracturing has not been proposed for this development.

In this study, mathematical models were used to estimate a likelihood of potential contamination using regional CSG data under conditions of maximum hydraulic fracture growth and wellbore delamination scenarios.

These scenarios provide advice that can be used to review state government regulation, to determine appropriate setback distances and ensure risks are kept low and ongoing high operational standards are achieved by industry. The quantification of risk magnitude and the associated uncertainty can be used to formulate risk management plans that minimise residual risk and inform community discussions.

*These are further explained below

Hydraulic fracturing

Hydraulic fracturing, involves the injection of a fracturing fluid into a target geological formation to increase the formation's permeability. Increasing the permeability improves the flow of hydrocarbons such as gas from the target formation into the wellbore. The wellbore casing in the zone to be fractured is perforated then hydraulic fracturing fluid is pumped into an isolated wellbore zone.

The hydraulic fracturing pressure increases in the isolated wellbore zone until it reaches a threshold known as the breakdown pressure. It then flows through the rock creating hydraulic fractures or reopening existing small fractures.

This modelling study found that across the Surat Basin, there is an 83% likelihood that the maximum fracture length would always be less than 500 metres, and that 74% of fracture heights would always be less than 100m.

These measurements should not be taken as an exact measure of the maximum fracture length or height under field conditions. Fracture growth during hydraulic fracture operations are monitored and fracture growth is suspended or abandoned when conditions indicate pressures cannot be maintained in a well. For this reason, fracture lengths in practice may not reach the maximum lengths reported. However, this information can be used to determine setback distances and best practice operations to guide operators.

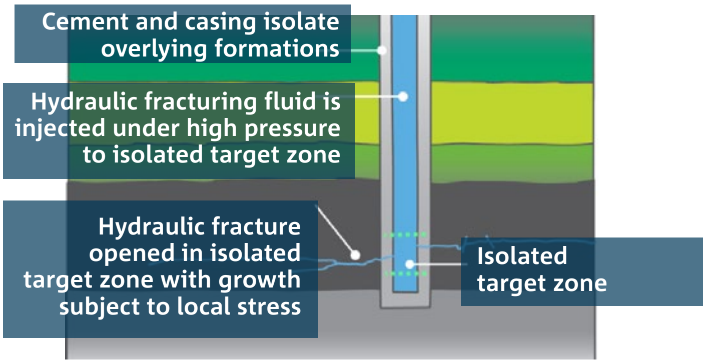


Diagram of hydraulic fracturing process in a targeted zone such as a coal seam.

Wellbore delamination

Wellbores are deep holes drilled into the earth to extract natural resources such as oil, gas or water. They are designed to prevent unintended fluid movement between different geological layers. It is critical to maintain well integrity to ensure safe operation of the well and to protect the environment.

Once a well is drilled, steel casing is run into the wellbore and cemented into the ground. The cement fills and seals the space between the steel casing and the surrounding rock, or between one steel casing string and another. The cement barrier maintains the wellbore integrity by:

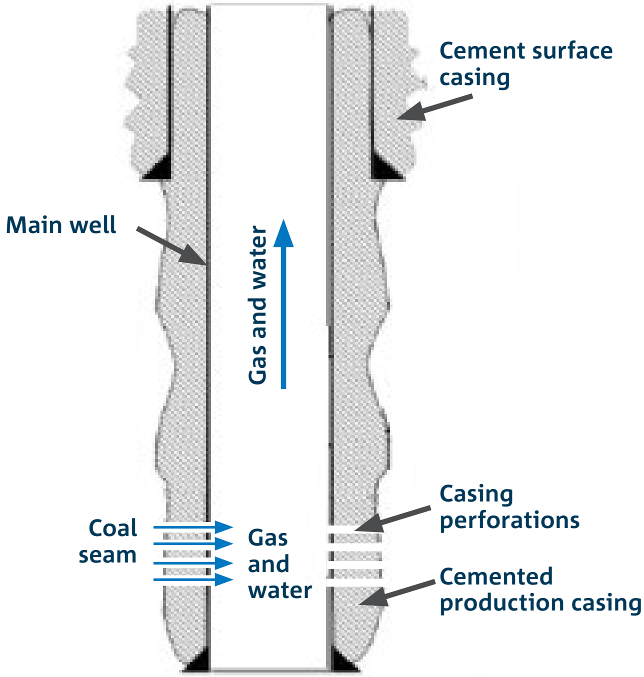
- preventing fluid movement up and down along the outside of the wellbore between different geological layers;
- protecting the steel casing from corrosion from formation fluids, and
- providing mechanical support for both the casing and the formation.

Wellbore delamination is where pathways are created between the layers of cement, steel casing stings, or surrounding rock which could compromise the integrity of the well.

This study looked at the potential for pathways to form under pressure from hydraulic fracturing and after decommissioning. The wellbore delamination model found that the risk of contamination to overlying aquifers was low for the Surat and Sydney basins. The model predicted that any potential crack created from natural pressures after a well was decommissioned would be less than 50 microns (with a micron equalling a millionth of a metre).

This study also investigated conditions where a microannulus (crack) grew from the hydraulic fracturing zone up the wellbore between the cement, casings or surrounding rock. The study predicted that any potential gas leaks from correctly constructed wellbores were negligible and would not result in any significant contamination due to hydraulic fracturing activities.

The results can be used to evaluate the potential for contamination from planned or existing wells and can be supported by detailed site specific studies.



Typical coal seam gas well design.

Find out more

Read more about the project at https://gisera.csiro.au/project/groundwater-contamination-risk-assessment/

ABOUT CSIRO's GISERA

The Gas Industry Social and Environmental Research Alliance (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, 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. Visit gisera.csiro.au for more information about GISERA's governance structure, projects and research findings.

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