

# Deeper groundwater in CSG extraction

Understanding the effect of hydraulic fracturing fluids to deeper groundwater during coal seam gas operations is the focus of a new CSIRO report.

The report *Deeper groundwater hazard screening research* complements the *National Assessment of Chemicals Associated with Coal Seam Gas Extraction in Australia*. The Assessment looked at chemicals used in drilling and hydraulic fracturing for coal seam gas within a sample time period to develop a stronger understanding of the chemicals used in the industry and what risks they may pose to coal seam gas workers, the public and the environment.

The additional report examines the risks to deeper groundwater and delivers new research providing insight into the conditions that are required to limit those risks.

## Research methods

Deeper groundwater refers to water bearing aquifers, including coal formations, generally confined by an impermeable layer. The potential chemical contamination source for deeper groundwater is several hundred meters deep in the coal seam formation targeted for hydraulic fracturing.

The deeper groundwater research was based on case study areas in New South Wales and Queensland and involved:

- Spatial analyses of the distance between CSG wells and receptor locations, including water bores, groundwater dependent ecosystems and socio-cultural assets, identified in two case study areas.
- Using conceptual models of possible pathways and simplified calculation tools for estimating the degree of dilution and breakdown of chemicals prior to potentially reaching receptors.
- Assessing information on chemical or biological degradation, geological processes and flow-related processes (travel time/dilution/dispersion) for a selection of characteristic coal seam gas chemicals.

## Key findings of this research

- Maintaining good well integrity is the key to minimising many of the risks associated with hydraulic fracturing and unconventional resource extraction; bore integrity, well spacing, and using chemicals with shorter half-lives were found to be key to minimising risks to contamination of deeper groundwater.
- The majority of ecologic, economic and socio-cultural receptors were at large (km) to very large (tens of km) distances from existing or planned CSG wells.
- Where connections between existing receptors and coal seam gas wells did exist, the travel time through groundwater was determined to be very long, from hundreds to tens of thousands of years.
- For the large travel distances a significant decrease in chemical concentration can be expected (for both organic and inorganic chemicals).

## Strengthening knowledge of the chemicals used in coal seam gas extraction

This research significantly strengthens the level of knowledge about chemicals used in coal seam gas extraction in Australia, and what risks they may pose to the public and the environment. This information directly informs our understanding of which chemicals can continue to be used safely, and which chemicals are likely to require extra monitoring, industry management and regulatory consideration

## Applications of the findings elsewhere

The overall conclusions from this study suggest that the risks arising from contamination of deeper groundwater by hydraulic fracturing chemicals are likely to be very small under conditions such as those found in the two case study areas.

While only a limited set of chemicals was tested, the methodology is sufficiently generic to be used across a broad spectrum of chemicals used in the industry.

Development and “proof-of-concept” testing have been conducted using data in two separate study areas. The tools developed are uniquely placed to provide insight in the dominant processes and conditions that govern fate, mobility, persistence, and ultimately exposure.

## Industry regulation

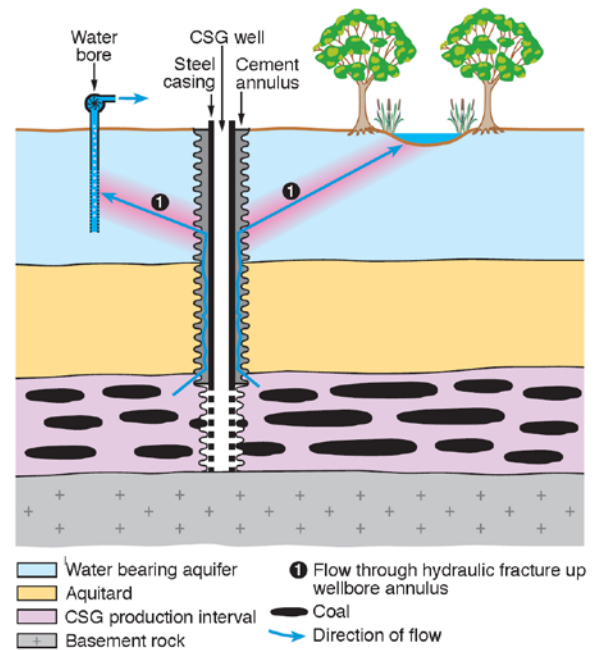
This research supports Australia’s existing framework of government regulations and industrial best practice which aims to protect people and the environment from adverse effects of industrial chemical use.

For coal seam gas extraction, there are existing laws, regulations, standards and industry codes of practice that cover chemical use, including workplace and public health and safety, environmental protection, and the transport, handling, storage and disposal of chemicals. CSIRO is actively engaged in a range of research relating to onshore unconventional gas activities to enhance our understanding of the opportunities and impacts associated with this energy source.

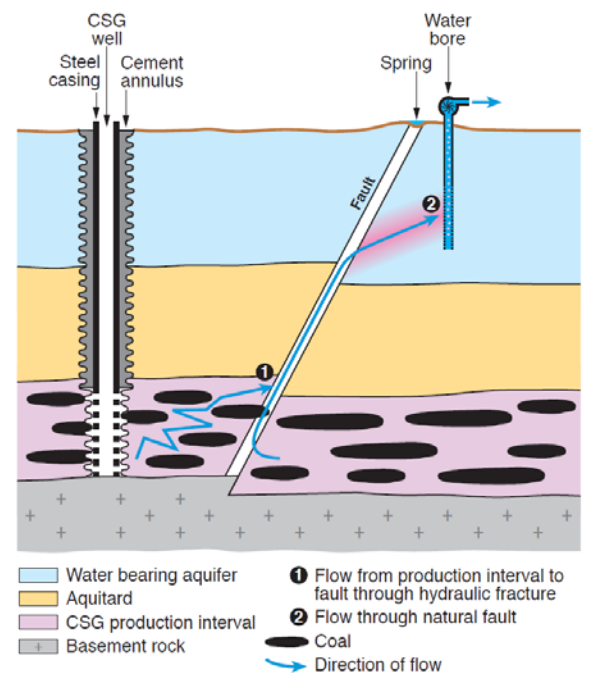
## Reference:

D Mallants, S Apte, J Kear, C Turnadge, S Janardhanan, D Gonzalez, M Williams, Z Chen, R Kookana, A Taylor, M Raiber, M Adams, J Bruce, H Prommer (2017). Deeper groundwater hazard screening research, prepared by the Commonwealth Scientific and Industrial Research Organisation (CSIRO), Canberra.

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*Plausible fate and transport release pathways investigated. Top: flow up wellbore annulus (loss of well integrity); Bottom: flow through hydraulic fracture to fault.*



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