Fact sheet: Water Quality

Key Points

- Conservation and protection of groundwater is a top priority during all oil and gas activities.
- The use of chemicals during drilling, cementation and hydraulic fracture stimulation of wells is strictly regulated and carefully managed to minimise environmental risk.
- Studies and decades of practical experience show the risk of groundwater contamination is low.

See also Water volume fact sheet

Drilling and well construction

Oil and gas wells are designed and built to the highest standards on order to protect aquifers during drilling, well construction and production processes.

In constructing the well, steel casing is positioned in the wellbore. Cement is injected down the centre of the casing and returns to the surface between the outside of the casing and the adjoining rock. The cement sets and holds the casing in place. It also forms a barrier between the outside of the casing and the rock. This seals potential pathways that could allow gas and formation fluids to move between the target gas reservoir and any adjoining aquifers. The cement also helps prevent corrosion of the well casing by blocking off intersected aquifers.

Oil and gas drilling is regulated by legislation in all Australian jurisdictions. Strict compliance and monitoring procedures oversee the use of chemicals and water for both general drilling and hydraulic fracturing.

Chemicals used during drilling and hydraulic fracturing

Drilling fluids are used to lubricate drill bits, return rock cuttings to the surface and provide pressure control in the well. They are typically water-based and must meet the requirements of an associated environmental licence. Common chemicals used include bentonite, a natural product formed from the breakdown of volcanic ash and guar gum, commonly used in making ice cream. These chemicals are mostly returned to the surface for disposal or recycled for reuse in another well.

Fluids used in hydraulic fracturing (fraccing) are about 99% water and sand. The remainder is made up of chemical additives needed to reduce friction, remove bacteria, dissolve some minerals and enhance the fluid's ability to transport sand.

Chemicals used in Australian fraccing operations include sodium hypochlorite and hydrochloric acid (both used in swimming pools), cellulose (used to make paper), acetic acid (the active part of vinegar), calcium chloride (used in sports drinks) and small amounts of disinfectants. The chemicals placed hundreds of meters beneath the surface are used in similar concentration to those used in swimming pools.

Additives are used in such diluted forms they are a very low risk to the environment. Nonetheless, 40-60% of fraccing fluids return to the surface as the well is flushed and cleaned. These fluids can then be disposed of, or recycled. Over time the ongoing fluid flows to the well during normal production of oil and gas ensure that most chemicals will be brought to the surface for proper processing.

Geology, aquifers and soils

Australia's oil and gas deposits are typically significantly deeper that the freshwater aquifers that are usually about 300m below the surface.

The vast majority of oil and gas deposits are separated from the freshwater aquifers by impermeable rocks. These rocks form efficient natural barriers between fresh water and gas resources.

Oil and gas wells have several layers of steel casing and cement that form a continuous protective barrier between the well and the rock. Millions of oil and gas wells have been drilled through aquifers without causing problems.

Typically there are hundreds if not thousands of meters of rock between a fracture stimulation and any sensitive aquifers such as those used for domestic or agricultural purposes. This can be monitored with seismic or tracer technologies to verify the models for fluid travel.

Protecting groundwater

Numerous inquiries, studies and reviews in Australia and overseas have found that with careful regulation and industry best practice, fraccing can be done safely.

The United State Environment Protection Agency, the biggest organisation of its type in the world has found fraccing poses minimal risk to groundwater sources. Following a comprehensive review of more than 950 sources of information, including technical reports, published papers and peer-reviewed science, the EPA concluded: "We did not find evidence that these mechanisms have led to widespread systemic impacts on drinking water resources of the US."

The Australian Council of Learned Academics (ACOLA) has published a summary review of the risks associated with fracture stimulation and concluded that there is no evidence of hydraulic fracturing fluids moving up in the earth from a fraccing operation to a surface aquifer.

Up to 80% of the fluid used in hydraulic fracturing can be recovered. Most of this can be recycled and reused for additional hydraulic fracturing or other beneficial uses, such as irrigation of nearby crops. Water that cannot be recycled is placed in specially designed ponds for evaporation. The residue from this process is tested and, if required, removed to a licensed disposal facility. At no point does this water contact or contaminate groundwater sources. Over the life of a well – which may be decades – the pressure gradient towards the well ensures that any chemicals that may be freed up over time are swept to the well and up to the surface for proper processing.

Industry in Australia and overseas continues to monitor aquifers and water quality while contributing to research that updates and improves our understanding in relation to drilling activity.