FACT SHEET

QGC
A BG Group business

FACT SHEET NO. 4

Hydraulic fracturing

QGC Pty Limited, the wholly owned Australian subsidiary of BG Group, is developing coal seam gas in the Surat Basin of southern Queensland for domestic and export markets.

The development involves drilling many wells over about 20,000 km^2 in southern Queensland to extract gas trapped in coal seams deep underground.

Sometimes, when the natural rate of production from a well is low, companies use a technique called "hydraulic fracturing" or "fraccing" to improve gas flows.

This technique, widely used in the oil and gas industry since the 1950s, involves using high-pressure pumps to inject mostly water and sand back into wells to hold open tiny cracks in the coal seams.

Small amounts of chemicals may be added to the injection water, mainly to carry sand to help the spread of the fracture.

This fact sheet explains hydraulic fracturing and how the process is managed to minimise environmental impact.

Coal seam gas

Natural gas is trapped in coal seams typically 300-600 metres underground by water pressure and is extracted via wells drilled through the coal seams.

The water is pumped out, and the natural gas is released from the coal. The gas is then processed to remove water and compressed for injection into gas transmission pipelines.

Coal seam gas in the Surat Basin of southern Queensland typically contains more than 98% methane, with very small amounts of nitrogen and carbon dioxide

Quick facts

- Hydraulic fracturing has been widely used in the oil and gas industry since the 1950s. It involves using high-pressure pumps to inject mostly water and sand back into wells to hold open tiny cracks in the coal seams. The cracks allow the gas to flow more freely.
- When drilling wells, grout or cement is pumped between the well casing (a steel tube) and the hole back to the surface. This forms a barrier between the coal seams and any nearby aquifers.

A mixture of water and sand is pumped back into the well.

Increasing flow rates

Exploration and appraisal wells are drilled to determine whether a coal seam holds commercial quantities of natural gas.

These wells help us to understand the permeability of the coal, or the rate at which fluid or gas can pass through the coal, and gauge the production capability of a particular area underground.

Wells with higher flow rates of gas are typically more efficient and productive than wells with lower flow rates.

If the flow of water or gas to the surface is low, hydraulic fracturing may be used to stimulate production.

QGC uses high-pressure pumps to inject a mixture of water and sand back into the well. The coal seam water required for hydraulic fracturing is normally stored next to the well in temporary ponds that are about 2500m^2.

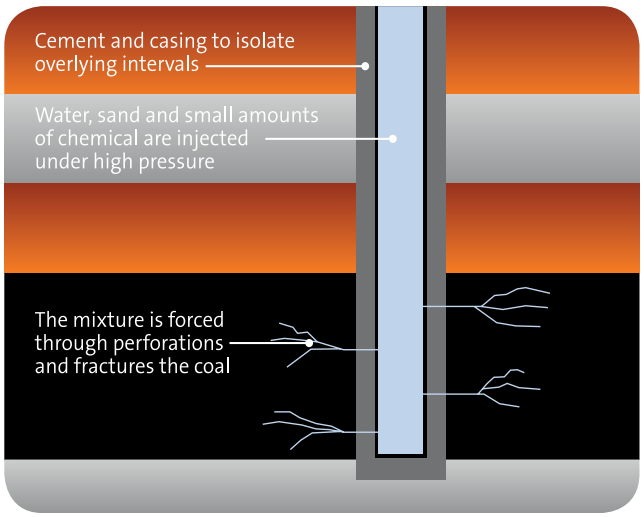
The force of the water makes tiny cracks in the coal which are then held open by the sand particles, allowing the gas to more freely flow to the surface.

This process can increase the productivity of a well by two or three times compared to production rates before fracturing.

A clear benefit from hydraulic fracturing is a reduction in the number of wells drilled in a particular location.

The United States Environmental Protection Agency has studied the impacts of hydraulic fracturing. In 2004, it concluded that while thousands of wells are fractured annually in the United States the technique posed little or no threat to underground supplies of drinking water.

A full copy of the EPA's report, *Evaluation of Impacts to Underground Sources of Drinking Water by Hydraulic Fracturing of Coalbed Methane Reservoirs,* is available via the agency's website, **www.epa.gov**



High-pressure pumps inject the fracturing fluid back into wells to open tiny cracks in the coal seam.

Minimising impacts from chemicals

We don't know of any deleterious effects anywhere from the use of chemicals in the hydraulic fracturing process.

This does not remove the need for us to be very careful and conservative. We are committed to applying caution when we do hydraulic fracturing near aquifers.

For example, in the United States diesel has been used in fracturing fluid to help carry some chemicals. The United States EPA has recommended against the use of diesel, so QGC has not used diesel in fracturing fluid.

We are extremely careful in the chemicals we use and how we manage them.

All chemicals are handled according to strict procedures by trained personnel and are used in concentrations so low as to cause no adverse environmental impact.

QGC supports the Queensland Government banning the use of benzene, toluene, ethylbenzene and xylenes, commonly known as BTEX compounds, in hydraulic fracturing of coal seams.

Also, QGC no longer uses naphthalene or heavy aromatic naptha, a product that contains benzene, in its fracturing operations. Naphthalene and heavy aromatic naptha have been used in the industry in low concentrations as a corrosion inhibitor.

QGC does not use phenantherenes, fluorenese and ethylene glycol in its hydraulic fracturing operations in the Surat Basin.

Water and sand comprise more than 99% of the fracturing fluid. This fluid is further diluted when it mixes with water already in the coal seam.

After it is injected, the fracturing fluid, along with the coal seam water, is pumped to the surface as part of normal gas extraction operations.

Rehabilitation

When the hydraulic fracturing is done, we are required under our environmental permits to rehabilitate the site, including any ponds, and to ensure nothing is contaminated.

Measures include soil sampling, reinstatement of top soil and revegetation.

Monitoring

QGC often uses micro-seismic and "tiltmeter" monitoring of hydraulic fracturing treatments to understand the dimensions, or the size and direction, of the fractures created.

This monitoring shows that the impact of the fracturing is confined to the target area within a radius of less than 200 metres.

Impacts at the surface relate to noise and vibration from water pumps. These are not usually noticeable beyond 200 metres of the well and cease at the completion of the work.

QGC uses tiltmeter monitoring to understand the dimensions of the fractures created.

Chemicals typically used in QGC's hydraulic fracturing operations*:

Additive function	Chemical composition
Diverting agent (rock salt)	Sodium chloride
Fracture propping agent	Silica sand, ground walnut hulls
Brine formulation	Sodium chloride, potassium chloride
Brine conditioning	Sodium hypochlorite with/without sodium hydroxide, tetrakis(hydroxymethyl) phosphonium sulfate, sodium thiosulfate
Gelling agent breaker (enzymatic)	Hemicellulase enzyme with/without sodium chloride
Low pH buffering agent	Concentrated hydrochloric acid, muriatic acid
High pH buffering agent	Sodium hydroxide, potassium carbonate, sodium carbonate
Gelling agent crosslinking agent	Disodium octaborate tetrahydrate, boric acid, boric oxide
Gelling agent breaker (oxidising)	Sodium persulfate, diammonium peroxidisulphate
Gelling agents	Guar gum, hydroxy-propyl guar, carboxy-methyl,hydroxy-propyl guar, hydroxy-ethyl cellulose

*Note: Not all the chemicals listed above are used in every instance. Composition of fracturing fluid varies according to the specific requirements of the job.

Aquifers

In all QGC wells, cement is pumped into the well to form a barrier between the coal seams we are fracturing and aquifers above or below the seam. This allows us to isolate the flow of water and gas from the target coal seam.

If a fracture were to grow upwards from the coal seam and towards an aquifer, cement could be injected until any fractures are effectively sealed. This may involve filling the well with cement where it passed through the coal seam and plugging the well for abandonment.

Around our operations, water bores can be placed in intervals overlying or sometimes very close to the coal seams from which we are producing.

If you are concerned that you have a water bore that might be affected by our operations, please notify us so we may help to evaluate whether our operations will affect your bore.

Typical solution used in hydraulic fracturing

About QGC

QGC is a leading Australian coal seam gas explorer and producer focused on developing world-class reserves in the Surat Basin and Bowen Basin for domestic and international supply.

Our headquarters are in Brisbane and we employ nearly 1000 people. In 2010, QGC produced about 20% of Queensland's gas demand. QGC is wholly owned by BG Group, a leading oil and gas company with headquarters in the United Kingdom and operations in more than 25 countries.

Our commitments

We seek to minimise the effects of our operations on landholders and make a positive contribution to the protection of the environment.

We run our business in accordance with all government regulations, industry standards and the access rules that we agree with landholders.

Our staff, contractors and consultants follow QGC's Code of Conduct, outlined in the 'Information for Landholders' booklet and available via our website: www.qgc.com.au

Contact details

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