



AGL's New South Wales hydraulic fracturing fact sheet and frequently asked questions.

AGL uses hydraulic fracturing to increase gas production of coal seam gas (CSG) from its wells. This fact sheet is to help you understand a bit more about this process.

Why is hydraulic fracturing used? CSG is produced through a number of steps. Firstly a well is drilled from the surface into the coal seam hundreds of metres below the surface. This well then is fully sealed off from all surrounding rock, groundwater and beneficial aquifers using at least four layers of high integrity steel pipe and cement. Next, the well is connected to a pump which removes water from the coal seam. Once the water is removed from the target coal seam (at the bottom of the well), the pressure in the well is reduced which allows the flow of natural gas through naturally occurring fractures in the coal seam (called cleats).

In some cases, a process known as hydraulic fracturing (sometimes also called fracture stimulation or fracking) is used to widen these existing natural fractures to allow otherwise trapped gas to flow more easily out of coal seams and thereby increase gas production.

What happens when a coal seam is hydraulically fractured? When hydraulic fracturing a coal seam, a fluid (the "frac fluid") is injected into the seam at pressures high enough to widen the existing fractures in the coal (a "frac").

Sand is then pumped in to hold

the fracture open, which creates a better path for gas and water to flow out of the coal seam and back to the surface.

Typically for AGL's operations, fractures are millimetres wide and extend for tens of metres into the coal seam.

The process is carefully managed so that there is minimal impact to the rock layers above and below the coal seam.

What is a frac fluid? The ingredients used to make up a frac fluid are determined by the specific characteristics of the target coal seam, such as the ability for water or gas to flow through the coal (permeability), the number of coal seams, and the coal formation's thickness, and stress or mechanical properties of the coal. The fluid used also depends on the desired length and direction of the fracture.

The design of a frac fluid' is designed to have a certain viscosity or fluid thickness. A low viscosity fluid, like water, tends to flow more easily and faster; while a high viscosity fluid, like honey, tends to flow less easily and slower.

Most frac fluids used by AGL are simply sand and water. Sometimes small amounts (usually less than 2% of the total



An aerial view of a Gloucester hydraulic fracturing operation

For more information about AGL, visit agl.com.au. Project specific information is available at:

- › agl.com.au/camden,
- › agl.com.au/gloucester, and
- › agl.com.au/hunter.

volume of fluid used) of commonly-used household chemicals are added to prevent bacterial growth, to make it easier to pump the frac fluid into the coal seam, and to thicken the fluid so that less water is needed to carry the sand into the fracture.

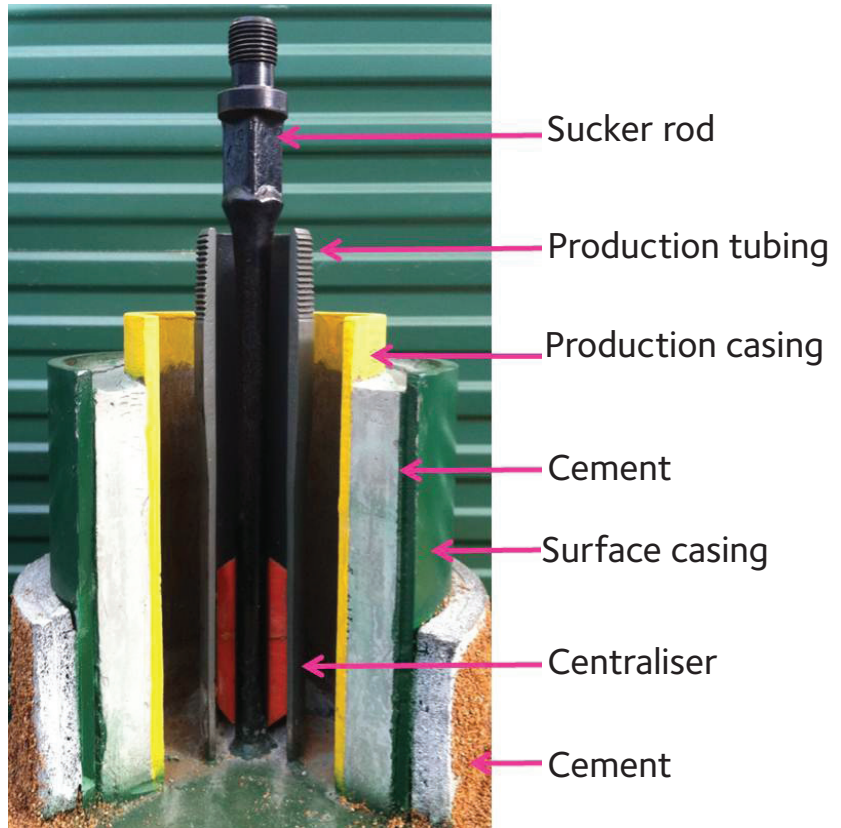
Are the frac fluids used in CSG wells safe? Yes. The chemicals used are highly diluted when injected into the coal seam and are then further diluted by the naturally occurring water in the coal seam.

No BTEX chemicals (Benzene, Toluene, Ethylbenzene and Xylenes) are used or have ever been used by AGL in any of its frac fluids. Any chemicals used must be disclosed to, and are assessed for safety by, government agencies during the application process and before the hydraulic fracture operation takes place. Under the recently announced NSW Code of Practice for Coal Seam Gas Fracture Stimulation, full disclosure is required of all additives used for fracturing in New South Wales. A human health and ecological risk assessment is conducted for every fracture chemical and their constituents confirming the use of a fracture fluid is of minimal risk.

Will AGL disclose the additives used? Yes. AGL will fully disclose all frac fluid additives on its website and this information will be shared with the project's Community Consultative Committee.

What happens to the frac fluid? The frac fluid comes back up the well through the 'flowback' and dewatering processes. Once back to surface, the fluid flows to tanks or to lined storage dams. The flowback water is then tested for water quality and then disposed of by truck to an approved waste water facility or reused.

Will hydraulic fracturing harm groundwater and beneficial aquifers? No. Hydraulic fracturing occurs within the targeted coal seam, hundreds of metres below the level of groundwater and beneficial aquifers. During the hydraulic fracturing process and subsequent flowback and dewatering stages, the frac fluid and water from the coal seam travels within the well back to the surface and this well is physically separated from all groundwater and beneficial aquifers by at least four layers of high integrity steel casing pipe and cement (see the cross section



The cross section of a well shows its 4 barriers

diagram of a CSG well in the picture above). AGL drills and completes all its wells to the strict standards required by the NSW CSG Code of Practice for Coal Seam Gas Well Integrity.

What do the NSW CSG Codes of Practice have to do with hydraulic fracturing? The New South Wales Government released two codes of practice for coal seam gas operations in 2012; one for hydraulic fracturing and one for well integrity, which establish best practice controls for CSG exploration and production operators. All CSG exploration and production activities in NSW will be subject to these two Codes of Practice so that water resources and the wider environment are protected. Failure to comply with the Codes of Practice can result in heavy penalties for license holder and the cancellation of petroleum licences.

How often has AGL used hydraulic fracturing? In New South Wales, AGL has used hydraulic fracturing on approximately 85% of the total wells it has drilled. The other 15% of the wells drilled have been horizontal wells, which do not require fracture stimulation.

Summary of AGL's use of hydraulic fracturing in NSW:

› **The Camden Gas Project:** Over the

past 12 years, 117 out of 144 wells have been hydraulically fractured as part of the Camden Gas Project. About 70 of the wells that were hydraulically fractured used only sand and water. The remaining wells that were hydraulically fractured used sand, water and diluted additives.

› **The Gloucester Gas Project:** In 2009, as part of the ongoing Gloucester exploration program, four wells were hydraulically fractured in May and June 2009. The hydraulic fracturing fluid used at Gloucester consisted of about 99.4% water and sand. The remaining 0.6% was made up of additives to increase the fluid's viscosity.

› **The Hunter Gas Project:** AGL has hydraulically fractured two wells in the Hunter area. In December 2004, Hunter-Bulga #2 was hydraulically fractured using water, sand and a clay stabiliser. In February 2005, Hunter-Bulga #1 was hydraulically fractured using only water and sand.

agl.com.au/upstream