



Frequently asked questions

April 2013

How will the NSW Government's Aquifer Interference Policy protect aquifers around coal seam gas operations?

The Aquifer Interference Policy clarifies water licence and impact assessment requirements for aquifer interference activities that occur anywhere in NSW, including CSG.

The Policy details the requirements for holding water licences under the *Water Management Act 2000* and the *Water Act 1912* for water taken through CSG exploration and production.

It also defines 'minimal impact' considerations for the NSW Office of Water's assessment of the potential for harm to an aquifer and its dependent ecosystems, culturally significant sites and connected surface water sources, as well as potential harm to existing water users. The aquifer impact assessment will consider potential impacts on water table levels, water pressure, and water quality in different types of groundwater systems. The minimal impact considerations in the Policy have been customised based on the productivity of the groundwater source.

The NSW Office of Water's assessment will consider the data and modelling required to be provided by the proponent, as well as any independent data it holds. The Office of Water will provide advice on the aquifer impact assessment to the relevant consent authorities.

What are the safeguards to protect drinking water in coal seam gas production areas?

The NSW Government is committed to protecting drinking water in NSW. It has banned the use of 'BTEX' chemicals - which include benzene, toluene, ethylbenzene and xylene compounds in fracking fluids.

Fracking fluid is around 97 to 99% sand and water with other compounds added in small amounts. The Australian Petroleum Production and Exploration Association has published a list of all compounds used in hydraulic fracturing which can be viewed or downloaded at www.appea.com.au/csg/about-csg/fact-sheets.html

The NSW Government will also require review of CSG proposals by technical experts from a number of areas or disciplines, including experts from the NSW Office of Water, the Environment Protection Authority and (where applicable) the Sydney Catchment Authority. The NSW Office of Water clarified its assessment considerations for CSG activities in the NSW Aquifer Interference Policy released in 2012.

Two codes of practice applying to hydraulic fracturing and CSG well integrity, also released by the NSW Government in 2012, have strengthened the controls on gas exploration and production. They can be found at www.resources.nsw.gov.au

The codes of practice establish conditions and best practice for activities such as fracking and CSG well design, construction, monitoring and maintenance to ensure that these activities are carried out safely.

Practices are used in the construction and operation of CSG wells to ensure that our aquifers and surface water resources protected. The methods used to prevent drilling fluid loss along with the rigorous standards required for casing and sealing wells prevent contamination of groundwater from gas or fracking fluids.

The pumping of a gas well that has been hydraulically fractured ensures that any remaining fracking fluid is pulled into the well and can not move into surrounding formations or groundwater resources. Gas wells

may be pumped for 20 years or more with a much longer period again before a balance in water levels is established. These measures minimise the chances of drinking water sources being contaminated.

Forty new positions have been created in the Division of Resources and Energy in NSW Trade & Investment through an industry levee. These officers will provide an increased monitoring and compliance role as well as be available to answer questions in the areas where coal seam gas is extracted.

How are fracking chemicals or produced (waste) water from the fracking process prevented from seeping into other water systems?

The NSW Government places stringent conditions on petroleum exploration and production licences which require adherence to industry best practice. Codes of practice are in place which ensures protection of groundwater and surface water systems. These licences are monitored by the Division of Resources and Energy in NSW Trade and Investment.

Many physical safeguards are used in the construction and operation of CSG wells to ensure the protection of water sources from contamination or well leakage.

CSG wells are required to be constructed using several layers of steel casing which are pressure cemented into place for their entire length to ensure that the surrounding formations are completely sealed off from the well. The cement also protects the steel casing from corrosion by the groundwater which may be saline or otherwise corrosive. This prevents gas or fracking fluid being able to move into groundwater or surface water sources.

Under the NSW Code of Practice for Coal Seam Gas Fracture Stimulation, an approved Fracture Stimulation Management Plan must be in place before hydraulic fracturing can occur. If hydraulic fracturing is conducted, this must be carefully designed and monitored to ensure that the fractures do not extend beyond the target coal seam as drawing water from other formations makes the well less efficient.

Any chemicals to be injected as part of a hydraulic fracturing activity, along with the volumes and concentrations to be used must be identified in an approved Fracture Stimulation Management Plan. The use of BTEX chemicals in fracking fluids was banned by the NSW Government in 2011. The Australian Petroleum Production and Exploration Association (APPEA) has published a list of chemicals used in hydraulic fracturing in Australia.

Following hydraulic fracturing, the fracking fluids move back into the CSG well and are recovered at the surface. Production from the CSG well commences by pumping water from it, causing the groundwater in the coal seam to flow towards the well. This ensures that any remaining traces of fracking fluid move into the CSG well and can not move into surrounding formations.

When the productive life of a CSG well is over (this can be 15 to 30 years), the CSG well is backfilled to the surface with cement.

The NSW Aquifer Interference Policy sets out minimal impact considerations for assessing the impacts of aquifer interference activities on water resources.

Under the *Protection of the Environment Operations Act 1997*, any premises that have the capacity to produce more than five petajoules of gas per annum must hold an environment protection licence.

These licences are administered and enforced by the NSW Environment Protection Authority (EPA) and may include conditions relating to waste management and water quality. There are penalties for not holding a licence or for non-compliance with the conditions of a licence issued under the *Protection of the Environment Operations Act 1997*.

Coal seam gas mining reportedly extracts a lot of water – how much is extracted?

Groundwater associated with the coal seam is extracted as a by-product during the production of CSG. This water is commonly referred to by the CSG industry as produced water. In general, CSG production generates significant quantities of produced water, however the actual volume of water produced is highly variable depending on the permeability of the coal seam and surrounding geological formations, the depth of the coal seam and the stage of gas production.

As a general rule the targeted coal seams in NSW do not produce as much groundwater as those in Queensland. A *Waterlines* report, commissioned in 2011 by the National Water Commission, estimates potential water production by CSG operations over the next 25 years at 94 GL/yr from the Bowen Basin

(Queensland), 211.6 GL/yr from the Surat Basin (Queensland) and between 0.228 and 1.876 GL/yr in total from NSW.

Current projections (NWI 2010) indicate the Australian CSG industry could extract in the order of 7,500 GL of produced water from groundwater systems over the next 25 years, equivalent to ~300 GL/yr. In comparison, the current total extraction from the Great Artesian Basin (in Queensland) is approximately 540 GL/yr.

A licence is required under the *Water Management Act 2000* or the *Water Act 1912* for groundwater taken by the CSG extraction process.

Will the extraction of coal seam gas drain the Great Artesian Basin?

The formations targeted for CSG exploration and production in NSW are different to those in Queensland. In NSW the target CSG seams occur in older rocks below the Great Artesian Basin (GAB). There is generally a lower level of hydraulic connection between the GAB and the deeper target coal seams due to the thickness of the low permeability rock that exists between the GAB and the coal seam in NSW. The actual level of hydraulic connection between CSG seams and the overlying formations is not tested until depressurisation of the CSG well commences.

The NSW Aquifer Interference Policy sets out the licensing requirements and minimal impact considerations for aquifer interference activities, including coal seam gas exploration and production. A water licence is required for take of water from a water source.

In NSW, a limit is set on the amount of water available to be taken from each water source under a 10 year statutory water sharing plan. The limit for the water sources of the GAB has been reached, although water savings are being achieved through the Cap and Pipe the Bores program, and the water sharing plan ensures that only a maximum of 30% of the savings can be reallocated for industrial or agricultural production

The Aquifer Interference Policy also defines the process through which the NSW Office of Water will assess projects to determine any potential impacts on aquifers. This assessment will be based on 'minimal impact considerations' including the risk of groundwater movement between aquifers, impacts on the water table, water pressure levels and water quality changes in different types of groundwater systems. Advice on a proposal's ability to meet the minimal impact considerations will be provided to the appropriate consent authorities.

Information relating to baseline criteria, along with comprehensive modelling and monitoring of groundwater conditions and behaviour in CSG extraction areas, is required from the proponent and will inform understanding and on-going regulation of the coal seam gas industry. The NSW Office of Water is also installing groundwater monitoring bores in coal seam gas areas, which will enable independent monitoring to occur.

The produced water is said to be very salty. What will be done with that water? If the salt is removed from the water, what will be done with all the salt?

The quality of CSG produced water, like all groundwater, can be highly variable depending on the age and depth of the water and the geological nature of the host formations. In many instances the water is brackish (3000 to 7000 mg/L) and may contain traces of other naturally occurring substances associated with coal.

The reuse, recycling or disposal of CSG produced water is managed by an approval issued under the *Petroleum (Onshore) Act 1991* by the Division of Resources and Energy in NSW Trade and Investment. As part of this approval process, CSG activities are assessed under the *Environmental Planning and Assessment Act 1979*. CSG activities classed as State significant development also require approval under the *Environmental Planning and Assessment Act 1979*.

The use of evaporation basins for the disposal of CSG produced water has been prohibited by the NSW Government.

Any salt or salty water that is produced as a result of CSG activities will only be disposed of consistent with licence conditions. Approved methods for disposal of CSG produced water may include beneficial reuse (for example, for dust suppression at a coal mine), reinjection into an aquifer or treatment (for example by reverse osmosis) and reuse.

Coal seam gas drilling in the Condamine in Queensland has reportedly resulted in contamination of rivers. How will NSW prevent that happening with its river systems?

Gas seeps have been observed in Queensland rivers and are known to occur naturally, where coal seams are shallow, even in the absence of CSG activities. The creation or exacerbation of gas seeping into surface water bodies will be controlled by requiring adherence to strict codes of practice around well construction and operation, enforceable under petroleum licences by the Resources and Energy Division of NSW Trade & Investment. The codes of practice require wells to be designed to eliminate any gas leaking to the surface or into other formations including aquifers. Any proposed gas production must identify and manage any risks to surface and groundwater sources, and have a monitoring plan to allow for the prompt identification and mitigation of any health, safety or environmental risks.

A video on YouTube of a Queensland farmer in a coal seam gas mining area shows him being able to light his bore water. Is there any other explanation for this other than coal seam gas production is leaking methane into the water system?

Coal seams are targeted for gas exploration and production because they typically contain large amounts of gas which can be economically extracted and used as a community wide energy source. However much smaller amounts of methane gas can also exist naturally in other sedimentary formations such as sandstone, which are commonly used to supply groundwater. It is therefore possible for groundwater bores to yield traces of methane gas with a water supply under natural circumstances where no CSG activities are taking place.

What happens when there is a flood from a river into the area with a coal seam gas well and bubbles rise – could they be methane and therefore dangerous?

Under the Code of Practice for Well Integrity, CSG wells are required to be constructed so that the well is sealed along the length of the bore and at the surface, so that there can be no uncontrolled release of gas from the well or entry of water from rain or floods.

Additionally, as floodwaters encroach onto previously dry ground, the soil pore spaces are filled with water. This results in the release of bubbles into the water. These bubbles consist of air from the soil and are unrelated to CSG activities.

Is there anything about NSW's hydrogeology which means coal seam gas mining here will be safer in some locations than others?

Significant natural variation exists in the hydrogeological characteristics of coal seams and their overlying geological formations. In particular these characteristics relate to permeability, water quality, nature and extent of fracturing, and the degree of hydraulic connection between formations.

CSG wells are required to be designed, constructed, operated and decommissioned under strict standards that are aimed at protecting all of the formations through which they pass, regardless of their hydrogeological characteristics.

Are CSG wells anything like water bores?

There are some similarities and some differences between water bores and CSG wells. Both are constructed by drilling a hole and inserting a conduit (casing) which allows the water or gas to move from the targeted formation to the surface.

With water bores, the casing has holes or slots that allow the water to move into the bore from the targeted aquifer. Water normally has to be pumped out but sometimes underground pressure (artesian) allows it to flow freely to the surface. Water bores in loose materials are always cased using steel or plastic casing, whereas those in rock may or may not be cased for their entire depth. Water bores in the GAB are required to be pressure cemented between the steel casing and the geological formations, to avoid pressure loss and cross-contamination of aquifers. Saline or contaminated zones must be sealed off in all types of water supply and monitoring bores in all groundwater sources.

CSG wells are usually much deeper than water bores and are made of heavier duty steel to manage the higher pressures encountered. CSG wells have a minimum of two layers of steel casing and these are

pressure cemented into place to isolate the non targeted formations from the well. Only the part of the well against the coal seam has openings in it. The headworks of CSG wells are more sophisticated than those on water supply bores, having pressure blow out protectors and other equipment that regulates the flow and separation of gas and water.

What have farmers' water bores already done to aquifers?

The use of groundwater for watering of stock and the irrigation of crops is common across NSW and developed rapidly from the 1970s until the 2000s. During the past few decades, the growing use of groundwater has caused a decline in groundwater levels in some aquifers. This was compounded by the drought and reduced recharge. This decline was recognised and all groundwater sources are now being managed to sustainable levels set by water sharing plans under the *Water Management Act 2000*.

These water sharing plans set extraction limits for the total amount of water that may be extracted from each water source. The plans also establish priority of access and set rules as to when water can be extracted, used and traded. They include detailed rules to manage local groundwater extraction impacts on the aquifer, other users, connected water systems and dependent ecosystems.

More information

www.water.nsw.gov.au

www.resources.nsw.gov.au

www.environment.nsw.gov.au

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