GISERA
Gas Industry Social and Environmental Research Alliance

AUGUST 2018
FACTSHEET

Decommissioning coal seam gas wells

What does successful decommissioning of coal seam gas wells look like?

Current regulatory frameworks and industry practice in Queensland and NSW aim to prevent legacy issues arising from abandoned wells. But local stakeholders are less confident in the process than government and industry, and seek long term monitoring and oversight to demonstrate successful decommissioning.

This research combined geological, technical and social science expertise to consider effective and socially acceptable decommissioning processes for coal seam gas (CSG) wells in Queensland and New South Wales. The project involved:

1. reviewing regulatory frameworks
2. exploring the characteristics of successful decommissioning from different viewpoints
3. developing policy options for government, industry and local stakeholders.

KEY FINDINGS

This study identified the following policy options for government, industry and local stakeholders to address the concerns of all stakeholders and for efficient and effective well decommissioning:

- More accessible information from government and industry on the well abandonment process to improve broader public understanding
- A program of monitoring abandoned wells by government and industry, with publicly-available results
- Publication of factsheets by government, outlining the regulation processes, who is responsible, ownership questions and what would happen if there is a long term problem
- Improved mechanisms for government to deal with public enquiries, questions and complaints, and clear communication of these processes
- Improved government and industry processes to listen to the concerns of stakeholders through a consistent point of contact
- Industry to provide plain language summaries of well completion and decommissioning reports, with local stakeholders given details on when, how and where to access them.

Background

Australia has around 6000 productive CSG wells and a growing number of decommissioned wells. This study investigated perspectives on well decommissioning at different stages of the lifecycle, including sites where the industry is winding down around Camden NSW, continuing gas operations in central QLD, and proposed for future development around Narrabri, NSW, where it is not yet decided whether the industry will proceed.

Although the circumstances of these locations are very different, effective and trusted decommissioning of CSG wells at end-of-life was found to be crucial to avoid potential environmental legacy effects and to inform views about whether the gas industry is socially acceptable.

The ultimate authority to decide if decommissioning and rehabilitation has been properly completed lies with the State regulator. Both Queensland and NSW have similar policy frameworks for regulating the decommissioning of CSG wells, drawing on international experiences and lessons from past practice. Consultation with landholders is required in both jurisdictions. Landholders declare whether they are satisfied with rehabilitation works, and may also negotiate to retain some of the infrastructure if that suits their future objectives, such as fences and concrete slabs. Regulators in both states require companies to make a deposit that covers the full costs of rehabilitation as a way of protecting against companies defaulting on their obligations.

CSIRO | Australia Pacific LNG | QGC | origin | Santos | NSW Government | Australian Government Department of Industry, Innovation and Science | Supported by Government of South Australia | Queensland Government | Northern Territory Government

What's in a well?

The following terms are commonly used when talking about the well lifecycle.

Cement
Cement is placed in the wellbore, filling the space between the outside of the casing pipe and the surrounding rock, and is also used to 'hold' the casing in place. Cement is also used to plug the inside of the well when it is abandoned. The cement used in wells typically consists of Portland cement mixed with water and special additives to achieve desired performance. It is different to industrial concrete, which consists of Portland cement mixed with gravel, sand and water. The cement mix is designed to suit the local geology and well-specific engineering requirements. Laboratory testing checks the cement design and performance against well conditions.

Completion
After a well has been drilled for production purposes it is 'completed'. This involves installing a wellhead at the top of the well and completion hardware inside the well that allows the well to be operated as required. The completion will vary depending on the purpose of the well (production of gas, de-watering, monitoring).

Decommissioning and rehabilitation
Decommissioning involves rehabilitating the surface around the well pad and plugging and abandoning the well. Rehabilitation can begin as soon as drilling is completed and includes removing or burying rock cuttings, and disposing any fluids. A small area around the well head is retained for surface infrastructure.
Once a well is no longer required, the well will be plugged and abandoned. Abandonment aims to plug the well in perpetuity, preventing any movement of gas or water between rock layers in the subsurface or to the surface. Effective abandonment needs all potential fluid flow to be blocked, and relies on the integrity of the casing-cement-formation system as well as cement plugs placed inside the casing.

Delamination
Delamination is where pathways are created between the layers of cement, casings, or surrounding rock which could compromise the long term integrity of a well.

Drilling
Drilling a CSG well involves mobilising a drilling rig and associated equipment to the site, drilling the well, completion of the well and demobilisation of the drilling equipment. Drilling rigs used for CSG wells are typically smaller than those typically used for conventional petroleum wells as the target coal seams are at shallow depths compared to conventional petroleum resources. The rigs may be mounted on a single truck, with support vehicles, or be transported using several semi-trailers. The drilling stage occurs over several days to several weeks, depending on the depth and design of the well.

Drill cuttings
An 800-metre deep CSG well will produce around 50 cubic metres of drill cuttings, which are rocks removed from the hole. Drill cuttings have traditionally been captured in drilling sumps or pits. Drill cuttings are typically disposed of on site, through the mix-bury-cover method. However, pitless drilling techniques may be used to manage the drilling fluid and cuttings. Drill cuttings are typically disposed of on site, through the mix-bury-cover method.

A decommissioned coal seam gas well near Narrabri, NSW.

An example of casing and cement used in a decommissioned well.

Drilling fluids

Drilling fluids are typically made up of water and additives that reduce the friction between the drill rods and the wellbore walls, increase density and thickness of the fluid to help remove rock cuttings, and decrease the reactivity of the drilling fluid with the rock layers being drilled. The additives include:

- clays (primarily bentonite) to increase the thickness of the drilling fluid and to reduce loss of drilling fluid into the geological layers being drilled
- additives such as polymers to increase thickness and provide lubrication
- salts (typically potassium chloride or potassium sulphate) to limit damage to the geological layers being drilled and increase the density of the drilling fluid.

The amount of drilling fluid required for a well will be around 50,000 litres, although this will vary depending on the diameter and depth of the well and the characteristics of the formations the well intersects.

Plugging and abandoning

This typically involves:

- removing any production infrastructure
- testing the integrity of the casing and cement installed during drilling
- filling the well with cement to prevent gas or water from travelling up or down the middle of the well.

The wellhead and the top one to two metres of the casing below the ground surface will be removed, and a steel cap placed over the well. The remainder of the well pad is also rehabilitated.

Suspended well

A well that is not currently operating (not producing or being used for monitoring), but that has not been plugged and abandoned permanently.

Well/wellbore

Wells or wellbores are deep vertical holes drilled into the earth to extract oil and gas. They provide a pathway for the flow of gas and water to the surface. Once a well is drilled, steel casing, also known as a casing string, is run into the well hole and cemented into the ground.

Well casing

The well casing provides the structural integrity for the well and a channel for the flow of fluid. Casing is made up of a series of hollow steel pipes, known as strings, which are connected as they are lowered into the well. Engineers select the casing based on the characteristics of the local geology, the well design and any anticipated treatments, such as hydraulic fracturing. The casing is cemented into the well, sealing the gap between the casing and the rock formations the well is drilled through.

Well integrity

Well integrity prevents the unintended flow of gas or water into or out of a well. This includes at the surface or between rock layers in the subsurface, and is critical to maintain the safe operation of the well and to protect the environment. A loss of well integrity could impact the safety of people working on or near the well or the environment. Well integrity establishes barriers to control the flow of gas or water. Well integrity barrier elements include casing cemented into the well, a wellhead to control the flow of gas and water at the surface, and operational procedures to manage and maintain the well.

There are international standards covering well integrity to ensure the safe and effective management of wells throughout their life, including post abandonment.

Outcomes from stakeholder workshops

A series of workshops in Camden, NSW, Chinchilla, Qld, and Narrabri, NSW, were held for the study between June and September 2017. They brought together State agencies, industry representatives and residents. There was broad agreement that decommissioned wells should never leak, should not impinge future land uses, and should be barely noticeable.

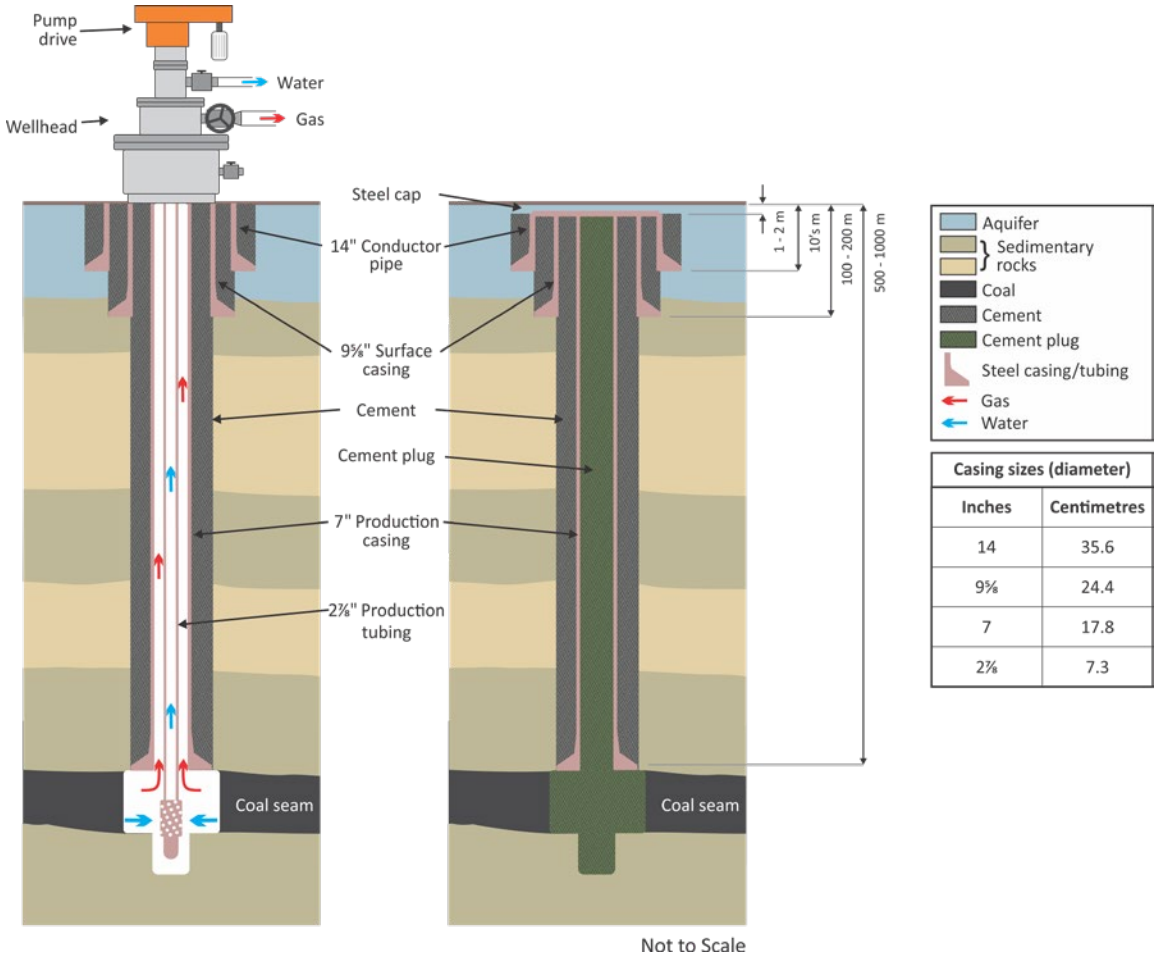
Across all workshops, government and industry representatives expressed strong confidence in the code of practice for each State and said, when implemented correctly, decommissioned wells would not result in legacy problems and would not require further action. In comparison, local stakeholders tended to lack confidence in the codes of practice and found that clear information about well decommissioning was difficult to access. The information they could access tended not to meet their needs, either in terms of delays in public release or in terms of incomprehensible technical language. This lack of transparent information detracted from residents' confidence in the decommissioning process.

Monitoring was another important issue raised. Because the government and industry's confidence in the codes of practice was so strong and informed by lessons from decades of practice overseas, monitoring was not seen to be required for decommissioned wells after all steps in the code of practice were completed. In contrast, residents reported reduced confidence in the codes of practice, which meant that ongoing monitoring of decommissioned wells was seen as crucial to detecting and responding to any potential future problems.

To find out more:

Read the full report *Decommissioning coal seam gas wells* at:

https://gisera.csiro.au/project/decommissioning-pathways-csg-projects/



Casing sizes (diameter)	
Inches	Centimetres
14	35.6
9⅝	24.4
7	17.8
2⅞	7.3

Typical completion of a vertical CSG well (not to scale).

Typical abandoned vertical CSG well.

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B&M | 18-00394