Methane in water bores

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There is concern that the extraction of coal seam gas (CSG) has the potential to increase the amount of methane gas found in water supplies used by local communities.

What is methane?

Methane is the main component of CSG – a form of natural gas that is extracted from underground coal seams. Methane is a naturally occurring gas that is colourless, odourless and is lighter than air. Methane is non-toxic, but there are risks associated with ignition and suffocation, especially in closed spaces.

Does methane occur naturally in water bores?

Yes, since the 1900s methane gas has been found in water bores in the Surat and Bowen basins.

Reports of 'natural gas in water bores causing explosions and catching fire' have been documented in Roma since the early 1900s.

Methane in water bores may be present as "free gas" and or "dissolved gas" and can accumulate undetected in bores and bore enclosures that are not properly vented because it is odourless.

The bubbling of gas in the bore can affect pumps by hindering water flow, commonly known as 'gas lock'. Gas bubbles can also affect water quality by increasing turbidity and dissolving more sulphur substances that cause bad odour.

The presence of gas in water bores is particularly common for bores sunk near or into the Walloon Coal Measures. Water extraction from these water bores can depressurise the coal measures allowing dissolved methane gas to become a free gas, mimicking the CSG production process.

Roma gas works (ca. 1906) – plant for separating natural gas from artesian water (Source: State Library of Queensland)

Stories from the vault

"The Water Supply Department intended to take measures to separate the gas from the water, and convert the flow from the two bores into one flow, which will be available for the use of the townspeople. If the efforts to be made to secure the gas be successful, it will be possible, it is hoped, to use it for illuminating purposes, which will be incalculable advantage to Roma." (The Brisbane Courier (Brisbane), Saturday 8 December 1900, page 11)

"...He noticed that the water had become less in volume and was impregnated with air or gas...when suddenly the beam bearing the weight shot up, and an immense volume of gas rushed from the mouth of the casing with a terrific roar... Perhaps for a quarter of an hour it continued thus, when suddenly, with an explosion similar to the discharge of a cannon, the gas was converted to flames..." Western Star and Roma Advertiser (Toowoomba), Wednesday 28 October 1908, page 2).

Is the amount of methane gas in water bores increasing?

Depressurisation of groundwater has occurred for more than 100 years as a result of drilling for water, gas and oil. This depressurisation and pathways to the surface created by the drilling has increased methane gas in water bores.

Other factors such as the advent of the CSG industry, decomposition of organic matter in landfills and poor maintenance of bores can also lead to increased methane in water bores.

To understand whether methane in water bores is a concern already or whether it is getting worse requires understanding of sources of methane gas in the subsurface and use of state-of-the-art methods for measuring gas in water bores.

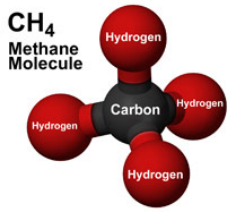
To distinguish whether any increases are due to CSG or any other processes, methane identification methods are needed to separate the impacts of CSG developments from other processes such as existing water extraction. This will help distinguish where methane is coming from and whether it is being mixed, diluted or transformed along the way.

Where does methane come from?

Methane in water bores can come from natural and human-made sources. In some cases, it has formed over millions of years from decomposing organic matter held under high temperatures and pressures (thermogenic methane).

In other cases, it has formed from microbial decomposition of organic matter in both natural (e.g. wetlands) and human-made (e.g. landfills) environments and is known as biogenic methane.

However, the development of water and gas and exploration for oil has led to depressurisation of aquifers, which mobilises the gas and through the drilling of bores have created pathways for gas to move to the land surface.



Methane molecule (Source: https://www.seagas.com.au/the-natural-gas-story/)

How can biogenic or thermogenic methane gas be identified?

A common method used to identify whether a methane source is biogenic or thermogenic is the use of the carbon and hydrogen isotopes of methane and other hydrocarbons.

Isotopes are different forms of an element. For example, carbon-13 (^{13}C) and carbon-14 (^{14}C) are both isotopes of carbon (C) and hydrogen-2 (^{2}H or deuterium (D)) and hydrogen-3 (^{3}H or tritium (T)) are isotopes of hydrogen (H).

Another method is to determine what other type of gases are also mixed with methane. Naturally occurring methane gas typically contains small amounts of ethane and other hydrocarbons. The proportion of methane to ethane in a gas can help determine its origin.

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