FAQ Protecting Water Producing Gas

THE IMPACT OF NATURAL GAS & COALBED METHANE ON GROUNDWATER IN ALBERTA

Protecting Water, Producing Gas

Frequently asked questions on potential impacts of natural gas, including coalbed methane, production on groundwater in Alberta

Can seismic exploration damage a water well?

Sometimes landowners think that vibrations from seismic exploration (for oil or gas) have affected adjacent water wells. They also fear that poorly capped or filled shot holes may allow surface water to contaminate groundwater or allow cross-flows between shallow groundwater zones. Complaints about seismic operations are investigated by the geophysical inspector (Alberta Sustainable Resource Development, phone 780-427-3932). It is very difficult to prove the source of a problem, but the geophysical inspector estimates that up to ten per cent of complaints received are quite likely associated with geophysical activity. In such cases, landowners may be able to obtain assistance from the Water Well Restoration or Replacement Program administered by the Farmers`Advocate Office.

What is the value of baseline water well testing?

A baseline water well test is conducted before an adjacent gas or oil well is drilled. If there are later problems with the water well, the baseline test information should make it easier to identify any changes that have taken place in the water and to identify the source of the problem. Alberta Environment requires a company to offer baseline water well testing to all landowners with water wells within 600 metres of a CBM well to be drilled above the base of groundwater protection. If no water well is found within 600 metres, testing must be conducted at the closest water well within 600-800 metres.

Alberta Environment's standard for baseline testing, outlined on their website, includes testing for the presence of bacteria, certain minerals and free gas. A special protocol sets out how the gas sample is to be collected and analyzed.

Baseline water well testing can be so useful that some landowners negotiate to include a written clause in their surface lease agreement, requiring the company to test their water well before drilling a gas (or oil) well, in situations where testing is not required by Alberta Environment. Some landowners also negotiate that the company must provide a copy of the baseline testing results before the gas well is drilled.

Can drilling mud contaminate fresh water aquifers used for water wells?

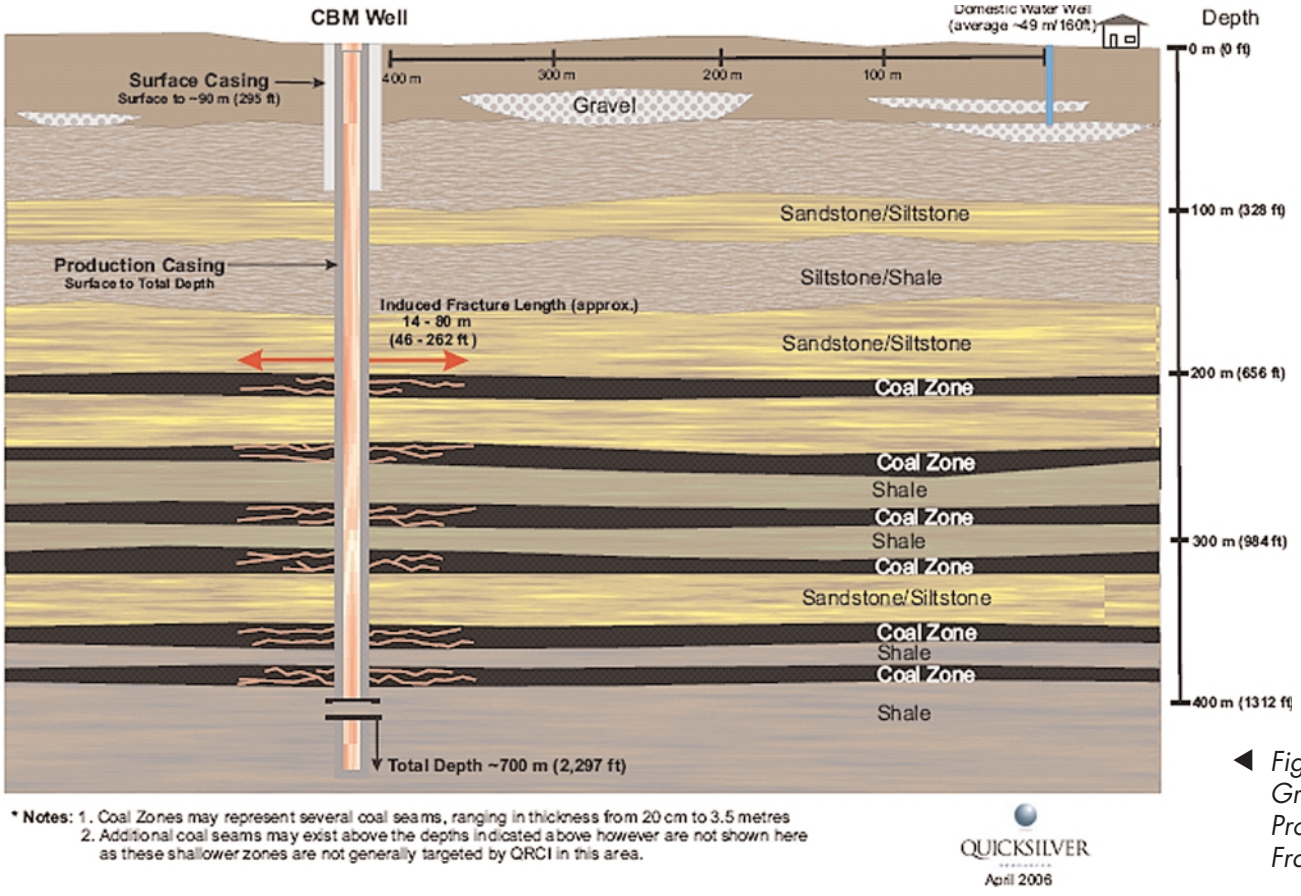
Drilling mud, which is used to lubricate the well bit and bring drill cuttings to the surface, is often mixed with surface water. Surface water, especially when taken from a dugout, may contain harmful bacteria such as *E. coli*. Drilling mud can flow into an aquifer if there is a loss of circulation during drilling. There is not a conclusive case of groundwater contamination from drilling mud in Alberta, but the Alberta Energy and Utilities Board (EUB) is planning an independent review of the subject. As a precaution, all surface water should be properly treated before use. Chlorination, which is a common practice, will kill some of the bacteria; those that survive are unlikely to travel far through sands and clays, which act as natural filters (though bacteria may travel further in limestone or through gravel).

What prevents gas from migrating from a gas-bearing zone into shallow groundwater?

When a gas well is drilled, it will usually have a surface casing to separate the well bore from shallow groundwater. If any gas gets into the well bore, it will flow to the surface via the surface casing vent (the gap between the surface casing and the production casing). Companies have to test the vent for gas within 90 days of completing a new well and take remedial action if they find any leaks to the surface.

Is there a risk that fracturing fluids could contaminate fresh groundwater?

Rocks are fractured by pumping a fluid or an inert gas (such as nitrogen) at high pressure to open up natural fractures and increase the flow of gas to the well bore. Fracturing is normally required to stimulate production of unconventional gas. Whether fluids (including water and hydrocarbons), foams, acids or gas are used depends on the rock formation. To protect fresh groundwater, the EUB does not allow the use of any toxic substances above the base of groundwater protection. They do not define what is toxic, as toxicity depends on the degree to which a product is diluted.



◀ *Figure 1: Groundwater Protection and Fracturing*

Can fracturing operations damage a water well?

Fracturing has typically been conducted in deeper formations, but with the development of CBM some shallow formations have been fractured.

In 2005, fracturing in shallow formations was shown to have damaged a few adjacent oil wells. The EUB issued Directive 27 to prevent fracturing within 200 metres horizontally and 25 metres vertically of an adjacent water well. Fracturing at less than 200 metres below the ground is only permitted if a company can show that there will be no harmful impacts. A technical review committee is examining shallow fracturing, to determine how far and in what direction fractures may extend (since fractures tend to extend horizontally in shallow formations, rather than vertically as in deeper formations). It will consider if the EUB limitations on fracturing should be amended.

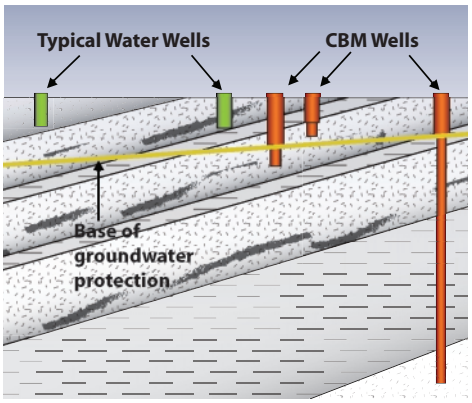
Why do some landowners have gas in their water well?

Alberta Environment's database shows that more than 900 water wells contain gas, which is assumed to be methane (the main gas in natural gas). There are three possible reasons for the presence of gas:

1) More than 26,000 water wells have been drilled through or completed in coal seams. As water is withdrawn, the pressure in the coal is reduced and gas flows into the water well.
2) Gas may have migrated from a gas-bearing formation (potentially related to oil or gas well activity), or from wetlands or a landfill.
3) Gas may be produced by bacteria or other microbes in an aquifer or water well.

When does gas in a water well become dangerous?

If any gas migrates from the formation into fresh groundwater, it can come to the surface in a water well and cause bubbling and frothing when a tap is turned on, as the gas is released into the air. Methane, which is the main constituent of natural gas, is odourless and non-toxic; low levels are not a concern, but attention should be paid if dissolved gas levels are between 10 and 28 mg/l, since the concentration of gas may be increasing to dangerous levels. If levels exceed approximately 28 mg/l, methane will be released to the air at surface pressure and temperature. If methane accumulates in a confined space it can cause asphyxiation. If the air contains 5-15 per cent methane, it can ignite and explode if there is a spark. All water wells should be well vented to the atmosphere to minimize the risk of a gas buildup in a confined space.



What can landowners do to minimize the risk of problems with a water well?

Gas in a water well or a change in flows might be due to activity taking place in the aquifer or in another zone. However, it may also be due to inadequate water well maintenance. To minimize the risk of gas making its way into water wells, landowners should take the following steps:

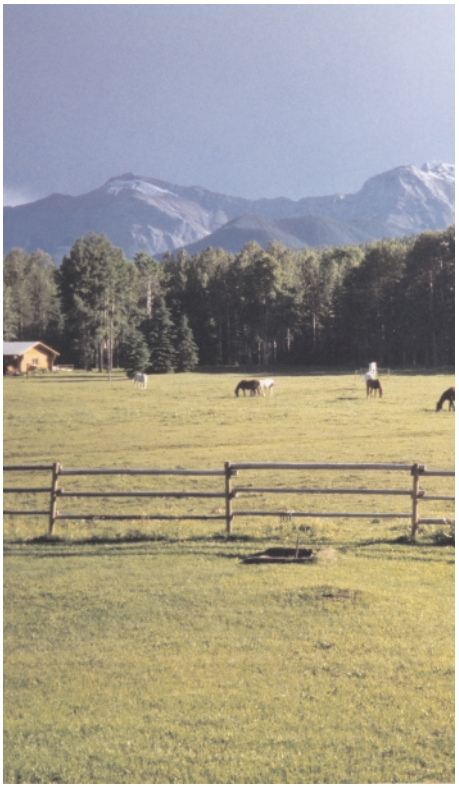
- Ensure that all water wells are vented to the outside, to avoid any gas build-up to explosive levels. Natural gas is sometimes found in very shallow formations.
- Regularly test the quality of well water.
- Learn about the gases (such as methane, carbon dioxide, nitrogen and hydrogen sulphide) that may be found in water wells.
- Read *Water Wells that Last for Generations* and learn about the importance of good water well maintenance to avoid the buildup of organic matter and bacteria (such as iron and sulphate-reducing bacteria). This report is available by contacting Alberta Agriculture and Food (1-800-292-5697) or visting their website.

How do investigators find the source of gas in a water well?

First a water and gas sample must be carefully taken from the water well (e.g., using the protocol that Alberta Environment sets out for baseline water well testing adjacent to CBM wells drilled above the base of groundwater protection). The volume of gas and its composition will be measured in a laboratory. If a baseline water well test has been conducted, the values will be compared to the baseline information. The relative proportion of methane, ethane and butane present in the water well gas may be compared with gas from various adjacent gas-producing formations. If the gas is almost pure methane (with perhaps a very small amount of ethane), it may have been produced by bacteria in the water. The isotopic fingerprint of the gas may also be analyzed and compared with gases in groundwater and in natural gas-bearing zones. If a gas comes from more than one source (that is, both from water and from a natural gas zone), it may be identified by a "mixed" isotopic fingerprint. Even with a lot of investigation, it is not always possible to find the exact source of the gas. This is explained in more detail in the Pembina Institute's full report, *Protecting Water, Producing Gas*, Appendix A.

Who should I contact about problems with my water well?

First call Alberta Environment's hotline at 1-800-222-6514 to report a problem water well. Next, if baseline water well testing was conducted, ask the company to retest your water well. Alberta Environment investigates complaints, with help from the EUB.



How can landowners ensure a company adopts best management practices?

Landowners can negotiate with a company for best management practices before they sign a permit to allow seismic exploration or a surface lease agreement that allows a company to put a well or pipeline on their land. Concerned citizens should encourage their neighbours to do the same.

- **Regional development.** Ask the company about its plans for the entire region and for a review of the environmental impacts of their entire project, if they have not already provided this information at public meetings.
- **Seismic exploration.** Keep seismic lines (both shot holes and heavy vibroseis equipment) away from low-lying areas, surface water and wetlands. Ensure shot-holes are properly plugged, preferably from bottom to top. Contact the government's geophysical inspector (see above) with any concerns. Remember, landowners do not have to allow seismic operations on their land.
- **Gas well setbacks.** Decide whether the 100-metre minimum EUB distance between a gas well and a water body is sufficient, or whether you wish to negotiate for a greater setback.
- **Baseline testing of water wells.** Negotiate to have baseline testing of water wells before a gas well is drilled, even if this is not required by Alberta Environment/EUB rules. Ask the company to use the basic government protocol, but consider asking for additional testing (e.g., for dissolved methane). Learn what the tests mean.
- **Drilling and fracturing a gas well.** Ask what measures are being taken to minimize the risk to fresh water aquifers (e.g., using treated water for drilling mud).
- **Water production.** Find out whether water will be produced with the gas, whether it will be salty, and how it will be handled. Will it be injected deep underground or will the company apply for permission to use the water? Will the water need treatment to ensure it does not harm the environment? Are pipelines carrying gas and produced water in the best location?
- **Written agreements.** Ensure that everything that has been agreed to with the company is put in writing (e.g., as an addendum to a surface lease agreement).

Want more information?

The Pembina Institute has written a detailed report, ***Protecting Water, Producing Gas: Minimizing the Impact of Coalbed Methane and Other Natural Gas Production on Alberta's Groundwater*** *(122 pages), which examines the many ways in which gas production may affect fresh water. It includes recommendations on how industry, government and landowners can help protect fresh water aquifers. The report, which includes references for all the information in this summary, can be found on the Pembina Institute web site.*

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For more information or to make a donation to the Pembina Institute please visit www.pembina.org.

See also the Alberta Environment website for information on CBM at www.waterforlife.gov.ab.ca/coal/index.html and the EUB website at www.eub.ca/portal/server.pt.

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