Troubling "Directive 83" Could Create Precedent for Drilling in Manitoba

An examination of Alberta's Hydraulic Shallow Fracturing Regulations

By Dennis LeNeveu

FRACKING, ALSO KNOWN AS the extraction of methane by fracturing of coal seams using compressed nitrogen, began in the Horseshoe Canyon Formation in Alberta in 2002. Initially, coal bed methane wells (CBM) completed in saline formations were subject to the regulations for conventional natural gas wells, which are exempt from environmental impact assessment. Alberta's Directive 27 issued in 2006 allowed shallow fracturing of non-saline formations below 200 metres from surface and above 200 m subject to impact assessment. Amendments to this directive and directives pertaining to baseline well water testing and well cementing procedures followed.

The recent Directive 83, issued in May 2013, permits CBM operations using compressed nitrogen up to 50 m from the top of the bedrock and horizontal fracturing up to 100 m from the bedrock top. An exclusion zone around water wells is specified. Provisions are made to protect offset energy wells and non-saline aquifers. A risk assessment, done by the licensee, must include estimations of the vertical length of induced fractures and the vertical distance to non-saline aquifers. Licensees must not use hydraulic fracturing fluids that may cause adverse effect on non-saline aquifers, and licensees are required to inform the regulator of non-compliance in accordance with the voluntary self-disclosure policy.

To date more than 166,000 CBM wells have been fractured in Alberta with well density varying between four to 12 per section. Over 7700 horizontal multistage wells have been fractured primarily into shale using large amounts of fresh water mixed with chemicals as fracturing fluids. Recently, a gelled propane mixture has been used as the fracturing fluid.

The coal seams fractured during CBM vary in thickness from 0.5 m to about 25 m and are typically encased by impermeable shale layers tens of meters thick. Coal seams are sometimes overlain directly by sandstone. The usable aquifers are usually sandstone but can be heavily fractured shale. Some of the sandstone is very impermeable and can contain oil and gas.

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However, there are many pathways for fugitive methane to escape into the formations during fracturing operations, including naturally occurring vertical connections and induced fractures. The fractures from CBM, typically less than 20 m in length, can penetrate through the protective shale layers into the aquifers. Induced fractures from horizontal wells can be over 100 m. The injection of fracturing fluids generates pressure waves that can open existing fractures in rock and damage well cement liners beyond the extent of the injected fluids. Horizontal drilling in shale fractures the layers that protect coal seams and the overlying sandstone that contains most of the aquifers.

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It is difficult to determine the exact extent and location of the aquifers that require protection and the length of induced fractures. Methane leaking into a small breach in a permeable aquifer can travel rapidly up the dripping plane, potentially causing extensive contamination. In the Retlaw-Mannville gas reservoir in southern Alberta, sour gas travelled over two kilometres from an injection well to a gas production well in less than nine months. Voids and cracks in well cement liners caused by fracturing and faulty cementing will accumulate gas that can directly enter permeable aquifers. The expansion of horizontal drilling in the shale and tight sand coexisting with CBM greatly magnifies the risk of methane contamination.

Despite the regulations in place there have been a growing number of complaints of methane contamination of well water over a wide area of Alberta. Beginning in 2006 baseline water testing was done on 4181 wells with 17 per cent found to have free gas as reported in the 2008 Science Review Panel Final Report. In 2013, free gas was found in 50 per cent of samples from over 200 groundwater observation wells in Alberta. High levels of nitrogen found with the methane are a signature for contamination from CBM. The fact that even more complaints have not been received is likely related to the non-disclosure agreements signed by many landowners in exchange for the use of their land for hydraulic fracturing.

In Manitoba, the Shallow Unconventional Shale Gas Project is assessing the exploitation of the Pierre shale. This thinly covered formation is over 400 m thick and extends over a large area of south western Manitoba. The Odanah shale aquifer is one of the upper members. The large shallow Oak Lake aquifer contains areas of highly fractured shale. Even if the shale aquifers are not directly fractured the risk of contamination from fracturing of the underlying deeper members of the Pierre shale is very high.

There is no indication that poisonous sour gas found in deeper formations such as the Bakken and Lodgepole occurs in the Pierre shales; however souring from bacteria that metabolize methane to produce hydrogen sulphide can develop during fracturing operations.

Shale gas wells decline in production rapidly over their lifetime requiring new wells to be constantly drilled to maintain profit margins and service debt. An economic collapse similar to the housing crisis in the U.S. could occur as new wells distributed over the continent inevitably diminish.

At present in Manitoba there are no regulations for hydraulic fracturing. The exploitation of shallow shale could begin tomorrow without assessment. This exploitation could cause extensive aquifer contamination and depletion of fresh water resources, exacerbate an economic collapse from unrecovered debt as continent wide shale resources decline and would add to the already excessive global burden of greenhouse gas.

Resources

http://www.aer.ca/documents/directives/Directive083.pdf

http://www.manitoba.ca/iem/mrd/geo/mgstracker/swmanitoba_shale_gas_project.html

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