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CANADA'S 500,000 LEAKY GAS WELLS THREATEN GROUNDWATER, HEALTH, CLIMATE

A new University of Waterloo report warns that natural gas seeping from 500,000 wellbores represent "a threat to environment and public safety" due to groundwater contamination, greenhouse gas emissions and explosion risks wherever methane collects in unvented buildings and spaces.

The 69-page report on wellbore leakage cowritten by three expert UofW professors outlines a longstanding and largely invisible engineering problem for Canada's oil and gas industry.

It also calls for dramatic reforms in monitoring and regulation including greater engineering oversight of the cementing of wellbores and "doing it right in the first place."

The scale of the problem? Ten per cent of all active and suspended gas wells in British Columbia now leak methane.

In addition, some hydraulically fractured shale gas wells in that



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province have become super methane emitters that spew as much as 2,000 kilograms of methane a year.

That amount of methane would make an audible hiss at the wellbore or form a big bubble in a swamp, says report lead author Maurice Dusseault, one of nation's top petroleum engineers.

An average wellbore may leak about 100 kilograms of methane a year, or the same as cow, but little data has been collected or accurately verified.

In Saskatchewan, about 20 per cent of all energy wells leak. In Alberta, regulators report chronic seepage from 27,000 wells.

Twenty years ago, the heavy oil fields of Lloydminster reported a leakage rate as high as 46 per cent. A 2010 industry study noted that the failure rate for steam injection wells for bitumen production approached 30 per cent. Leaks and climate change

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Methane leakage from wellbores, pipelines, pumps and urban gas distribution systems have become a hot button issue because they can undermine or reverse the greenhouse gas advantage that natural gas has over coal or oil.

A natural gas field that seeps three to four per cent of its product can be a more aggressive forcer of climate destabilization than coal and therefore dirtier, say a growing number of scientists.

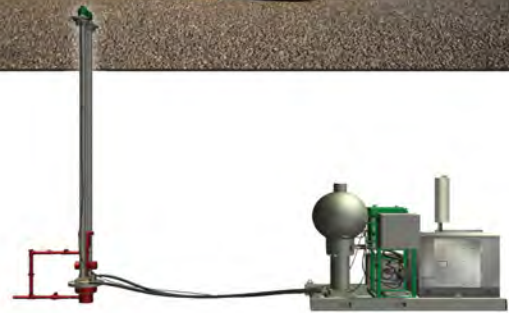
That's because methane is a much more powerful greenhouse

gas than carbon dioxide over a 20-year time frame.

Due to its potent climate effect, methane leakage from thousands of wellbores will ultimately become "a federal issue," warns Dusseault, who recently made presentations to the Alberta Energy Regulator on the scale of the problem.

"The Americans are going to get us moving on this issue," adds Dusseault, citing U.S. President Barack Obama's recent decision to reduce climate change emissions from power plants by 30 per cent.

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Ignoring the problem or shooting the messenger will just erode the industry's social license to operate, warns Dusseault. "I think the industry has to be more pro-active and should get in front of this issue."

Awareness 'exploded'

The problem has existed for decades, but industry and regulators have largely ignored the liability until climate science changed its profile along with an unconventional drilling boom that added tens of thousands of wells to the North American landscape.

Fourteen years ago, when Dusseault first wrote about the subject in a scientific paper titled "Why Oilwells Leak," he got no mail. "But now the public awareness has exploded."

Together with engineer Richard E. Jackson, a co-writer of the

recent report, Dusseault has been making non-stop presentations.

Each and every wellbore that punctures the earth potentially becomes a man-made superhighway for methane and other gases such as radon that would normally take millions of years to migrate to the surface.

If not cemented and sealed properly, stray gas will travel from deep or intermediate zones and migrate along the casing to the atmosphere, surface waters or into aquifers.

The shattering or hydraulic fracturing of rock formations, which often result in fractures jumping out of targeted oil and gas zones, can also provide additional pathways for methane seepage.

Across North America, leaking methane from wellbores has

killed vegetation, contaminated groundwater and infiltrated buildings resulting in dangerous and fatal explosions in both urban and rural environments.

Meandering methane The fact that gas may not be bubbling or hissing around a wellbore doesn't mean the wellbore is not leaking, say scientists.

Methane can wander kilometres away from the source (due to natural or manmade fractures in the earth) and later dissolve into aquifers that

provide drinking water. The methane can then exit rural kitchen taps in a milky, flammable and bubbling brew. Or it can collect in basements or water pump houses and explode.

Wellbore leakage into groundwater poses significant contamination risks, adds the Waterloo report.

Documented cases of groundwater contamination have occurred from wellbores in fractured coal seams of New Mexico and heavy oil fields of Lloydminster. But toxicologists have hardly studied the issue.

"We can expect that natural gas contamination of freshwater aquifers will result in the oxidized methane being replaced by H₂S and the net effect of the oxidation-reduction reactions will be a groundwater elevated in terms of Total Dissolved Solids, thus causing a pronounced deterioration in the quality of the groundwater," explains the report.

Many families in the well-fracked oil and gas fields of central Alberta have found high levels of methane and H₂S in their groundwater. But regulators routinely dismiss these cases.

Hazard poorly monitored John Cherry, a recognized University of Waterloo groundwater expert, says no oil and gas jurisdiction in North America has set up a proper groundwater-monitoring program to study the scale of the hazard.

Alberta, for example, has failed to collect baseline data on the state of its groundwater resources prior to and after intense oil and gas activity for decades despite repeated warnings by scientists to do so. In recent years the increasing use of hydraulic fracturing has had the effect



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of drawing a red circle around the hidden liability of wellbore leakage.

Fracking has not only added more wellbores (and methane pathways) to the landscape in the rush to develop difficult hydrocarbons trapped in shale rock and coal but added more pressure and stress to wellbores causing more leaks.

The Waterloo report, quietly released last month, notes that the fluid injection of steam, water, sand or chemicals to force out more hydrocarbons "elevates the mechanical and thermal loading on wellbores, and significantly increases the probability of leakage problem development during the operational lifetime of the wellbore, before final abandonment."

Cornell fracking expert Anthony Ingraffea has documented chronic leakage rates in newly fracked shale gas wells in Pennsylvania as high as seven per cent.

One Alberta study by Stefan Bachu and Theresa Watson found that more than 60 per cent of all deviated or horizontal wells in one test area leaked.

No one collecting key data So many leaks have been found in wellbores in the Montney and Horn River basin play in northeastern B.C., says the Waterloo report, that "more stringent standards" may have to be applied.

Fracking more shale formations could make the problem worse. Industry will have to puncture northeastern United States with another 500,000 wellbores in order

to drain the Marcellus formation. To fill proposed LNG plants BC would have to plant and frack another 50,000 wellbores over a landscape the size of Ireland by 2035. The Montney shale gas formation in B.C. is so thick that each well pad might eventually accommodate an underground forest of 50 wellbores.

To date, industry and regulators have done a poor job quantifying the scale and significance of methane leaks from wellbores, says Dusseault.

"The severity of the problem is not known because neither industry or oil and gas regulators are collecting the data," says the widely published engineer who advises both industry and government on topics as varied as hydraulic fracturing and cap rock integrity.

"We don't even know the total number of wells that are actually leaking. The numbers are not being collected and estimates range from a few percent to as high as 15 per cent."

The situation is even more complicated. About 151,000 abandoned wellbores in Alberta, 35 per cent of the well population, aren't being monitored for seepage: "there is no monitoring regulation in Canada that requires operators to test wellbores for leakage following final abandonment," says the report.

Yet, as Dusseault notes in a separate paper, "abandoned or active wells" that intersect wells being hydraulically fracked "constitute the seepage pathway of greatest risk for hydraulic fracturing fluids" to penetrate shallow aquifers.

Nor does government know what volume of methane is exactly leaking from wellbores or how it contributes to the overall burden of methane seepage from the natural gas industry.

"We don't know what percentage is going into the atmosphere or into the ground," says Dusseault. "There is no incentive to collect the numbers because industry views it as a bad news problem."

Expensive to fix Fixing leaking wellbores can be a financial nightmare for the industry. Plugging a faulty wellbore

can cost \$150,000, but in some problematic fields remediation costs can go as high as \$600,000. One remote well in northern British Columbia cost \$8 million to fix. And there is no guarantee of success.

The problem has become so extreme that report calls for better regulations, more accountable engineering and a national roadmap to "improve long-term wellbore integrity." (See sidebar.)

Oil and gas wells leak for a variety of reasons, but it's mostly a tale of about corrupted cement.

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Over time, a cement seal in a wellbore can shrink, crack, degrade or be dissolved by acids. In addition steel casing often corrode as they age. Additives added to the cement by drillers can weaken the seal. Plugs used to cap abandoned wells typically experience significant degradation. In some cases local geological conditions such as shallow gravel beds or swelling clays also make cement seals difficult.

Oil prices dramatically impact the quality of cement seals on wellbores, too. During periods of high oil prices companies try to drill as many wells as fast they can with the result that "wellbore construction practices were negatively impacted."

NORTHERN GATEWAY PIPELINE DEADLINE 10 DAYS AWAY

Some time in the next 10 days, the federal government is supposed to announce its final decision on the Northern Gateway pipeline – the multibillion-dollar political minefield dividing the West.

Even detractors expect the federal government to give the \$7-billion project the go-ahead.

But the nod from Ottawa would not be the crest of the mountain Northern Gateway must climb before the oil – and the money – begin to flow. The path to the British Columbia coast has many hurdles left for Calgary-based Enbridge (TSX:ENB) and its partners.

A joint review panel of the National Energy Board and the Canadian

Environmental Assessment Agency recommended approval of the project six months ago, subject to 209 conditions.

"The bottom line is there are 113 conditions that need to be met before construction can begin. That's going to take a lot of time," said company spokesman Ivan Giesbrecht.

If approved, that would be merely one more step in an ongoing process, Giesbrecht said.

"We have a lot of work to be done before we would be able to begin construction."

There are also the five applications before the Federal Court for judicial review of the federal panel recommendation, and further court challenges are likely.

he opposition of environmental groups was always a given. Expansion of Alberta's oil sands has become an international target for climate activists.

"Approval seems obvious. At the same time, opposition is so strong," said Nikki Skuce, a resident of Smithers, B.C., and a campaigner for the environmental group Forest Ethics Advocacy.

"It's going to be caught up in the courts for years and it's going to be ugly on the ground. People are willing to do what it takes."

That is no idle threat in a province that saw a decade-long War in the Woods over logging of old growth forests, which ended with new government regulations.

Protestors form a "women's circle"

to honour those leading the fight against the Enbridge Northern Gateway project in George Little Park, Terrace, B.C., June 16, 2013. About 300 people attended the rally the day before the final arguments begin for the Joint Review Panel on the controversial Northern Gateway pipeline.

And opposition is not limited to environmentalists and First Nations.

Another crippling blow to the project came from the residents of Kitimat – the B.C. city with the most to gain as the pipeline terminus

– when they voted to reject the project in a non-binding plebiscite.

Kitimat is no stranger to industry, born of an aluminum smelter in the 1950s, but for a majority of those who voted the risks outweigh the rewards.

Even the provincial government officially opposed the project at review hearings.

Victoria appears poised to reverse itself, deploying key ministers to a flurry of recent federal announcements on marine and pipeline safety. But the Liberal government may be waiting to

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"There's a question of whether going along with the approval of the Northern Gateway pipeline will make LNG development in B.C. more challenging by angering First Nations so adamantly opposed to the oil sands pipeline," said George Hoberg, a professor at the University of British Columbia's school of forestry and founder of UBCC350, a group pressing for action on greenhouse gas emissions.

There is deep resistance in B.C., he said.

"I think it's likely to be approved, but I would not be shocked if it was delayed or even denied," Hoberg said.

The product that the pipeline would carry is a hurdle.

The pipeline west would transport molasses-like diluted bitumen. Studies and previous spills have found that dilbit sinks in turbulent water conditions.

Opponents like Art Sterritt, director of Coastal First Nations, have said a tanker spill is possible - even likely - and cannot be cleaned up. His coalition of nine aboriginal communities remains vehemently opposed.

The greatest obstacle is the unflagging opposition of First Nations. Hamstrung by the federal government's failure to negotiate treaties in decades of talks, the company has been left in a legal limbo.

The company said the project has 26 aboriginal equity partners and consultations continue but

Clarence Innis, acting chief of the Gitxaala Nation on the North Coast, said they haven't heard from anyone and no talks are planned.

"We're going to do whatever we need to do to protect our territory," said Innis, whose community is located on an island at the mouth of the Douglas Channel.

The Gitxaala are already preparing a legal challenge.

"We played by the rules," Innis said.

"We've been ignored."

The fight is far from over on either side. There are hundreds of billions of dollars at stake, the company has said.

"It's in the national interest to be able to diversify the markets that we have for our most valuable natural resource," Giesbrecht said.

"We believe the project is the right thing for Canada, we've felt that way right from the very beginning and that's why we've pursued it.

ALBERTA ENERGY REGULATOR SUED AFTER FIRST NATIONS SHUT OUT OF HEARING

Two aboriginal bands are taking Alberta's energy regulator to court for being denied the right to speak at hearings into an oilsands development near their traditional lands.

The Beaver Lake Cree Nation and the Whitefish Lake First Nation were not allowed to address hearings into Canadian Natural Resources Ltd.'s

(TSX:CNO) Kirby expansion project.

The bands say the project is to be developed in the same area where they hunt and fish and will contribute to the demise of caribou in the region.

But the Alberta Energy Regulator ruled they wouldn't be directly affected by the development.

The regulator ultimately denied all applications to speak about the 85,000-barrel-a-day project and cancelled the hearings.

Observers have said the regulator's decision is part of a new pattern

to severely restrict who is eligible to address regulatory hearings.

CHRISTY CLARK RECUSES HERSELF FROM OIL REFINERY PROPOSAL OVER CONFLICT OF INTEREST

B.C. premier's former husband Mark Marissen has ties to a \$10-billion proposal in northern B.C.

Premier Christy Clark has recused herself from all involvement regarding an oil refinery proposal for northern B.C., due to a conflict

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of interest involving her ex-husband.

Clark's former husband, Mark Marissen, has ties to Pacific Future Energy which is pitching a \$10-billion dollar facility for the region.

"I certainly don't have any business ties or financial ties with my ex-husband, although we do have a child together and share that responsibility," Clark said at a press conference Tuesday.

"As premier of the province though, I have another responsibility, and that is to every single British Columbian."

The premier has expressed support in the past for a similar proposal being pitched by newspaper publisher, David Black, which also looks to refine oil in B.C., rather than ship raw Alberta bitumen to Asia.

B.C. Premier Christy Clark has recused herself from decisions regarding an oil refinery proposal for the province over a potential conflict of interest involving her ex-husband Mark Marissen. (CBC)

Clark said she sought out the opinion of the province's Conflict of Interest Commissioner in, what she called, "an abundance of caution".

"I sought the Conflict Commissioner's guidance and I will continue to seek his guidance," Clark said.

"It is my understanding that this proposal doesn't depend on, or is not linked to, any pipeline proposal. And I don't know if Mr. Black's [proposal] would have had the same distinction."

Clark said she will hand over any and all contacts and decisions on the Pacific Future Energy proposal as well as any other oil refinery proposal in B.C. to

Finance Minister, Mike de Jong.

BOOMING ALBERTA EXPECTED TO FUEL BULK OF CANADIAN JOB GAINS OVER THE NEXT TWO YEARS, RBC SAYS

The Royal Bank says most of Canada will experience stronger economic growth this year and next, but only Alberta will see the kind of gains that will make a real impact on job creation.

Like so many elements of the economy, we will benefit from the hiring gains made by our giant neighbour. Just not yet.

The latest quarterly report from Canada's largest bank predicts the overall economy will expand by 2.4% this year and 2.7% in 2015, moderately stronger growth rates than the Bank of Canada expects.

The RBC economists say they believe the U.S. economy is kicking into gear and that — combined with the lower value of the loonie — will result in more demand for Canadian exports.

Although most economists share the same view, the numbers so far have yet to show any real rebound in the hard-pressed export sector, particularly non-resource exports.

As has been the case in recent years, the RBC forecast sees a decidedly western tilt to economic activity and job growth this year and next.

Alberta will lead the pack with a 3.7% growth rate in 2014, slowing only moderately to 3.5% in 2015.

Employment in the province is expected to increase by 2.9% this

year, the same as in 2013, about three times the national average. That was underlined in last Friday's labour market report from Statistics Canada which showed that of 85,500 jobs created in Canada over the last 12 months, 71,200 were in Alberta.

The report does contain some good news for Ontario, which will see an export-led revival to 2.3% growth this year — the second-highest rate in the country — after advancing by a weak 1.3% the previous two years.

Still, new jobs will be scarce in Canada's most populous province, RBC says. Employment is expected to grow in line with the national average, or 0.9%.

The big surprise in the report is

that Saskatchewan's economy is projected to slow sharply to 1.4% growth after a 4.5% surge in 2013. The main reason is a reversal in the agriculture boom the province enjoyed last year, the bank said.

However, the slowdown won't last for long, with the bank predicting growth in Saskatchewan to rebound to about 3% in 2015.

Projected provincial growth rates in percentage terms for 2014 and 2015 were: Newfoundland (0.6, 1.4); Prince Edward Island (1.4, 1.2); Nova Scotia (2.2, 2.2); New Brunswick (1.0, 1.4); Quebec (1.9, 1.8); Ontario (2.3, 2.8); Manitoba (2.1, 2.8); Saskatchewan (1.4, 3.0); Alberta (3.7, 3.5); British Columbia (2.1, 2.8).

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