

Proposed amendments to Bill 6

1. Remove the words "high volume hydraulic fracturing" wherever it occurs and replace with the term "hydraulic fracturing." (defined below)
2. The definition of the term "hydraulic fracturing" should be included in the bill itself, not in regulations. A proposed definition is provided in point 3 below.
3. Amend Section 11A (1) to include a definition of hydraulic fracturing which incorporates the following specific criteria that characterize hydraulic fracturing for unconventional hydrocarbons and distinguish the type of hydraulic fracturing intended to be prohibited by this act from other types of hydraulic fracturing:
 - a) Involves the injection of fluids ("Fluid" means any material or substance which flows or moves whether in semi-solid, liquid, sludge, gas, or any other form or state.)¹
 - b) Pressure is "sufficient to create or enhance subsurface fractures", or "a force exceeding the parting pressure of the rock."
 - c) The result is to induce or enhance a network of fractures.
 - d) The purpose is to facilitate the release of any petroleum, natural gas or other hydrocarbons which will flow through these fractures.

Using these criteria, the section could be amended to read "In this Section 'hydraulic fracturing means "... the transmission of a carrier fluid to apply pressure and transport proppants to an underground geologic formation to create or enhance subsurface fractures and facilitate the release of any petroleum or natural gas, but does not include fracturing for the production of wells for potable water;"²

or

"Injecting fracturing fluids into the target formation at a force exceeding the parting pressure of the rock thus inducing a network of fractures through which oil or natural gas can flow to the wellbore."³

4. Section 11A (2) shall be amended by adding, after the words "unless exempted by the regulations for the purpose of testing or research" the following sentence: "Such exemption will only be permitted if the data and research results sought are not available, or cannot reasonably be obtained, from research and testing conducted in other jurisdictions."

¹ From Vermont Statute 152 prohibiting hydraulic fracturing

² Nova Scotia Importation of Hydraulic Fracturing Wastewater Prohibition Act

³ *Environmental Impacts of Shale Gas Extraction in Canada*, Council of Canadian Academies. Expert Panel on Harnessing Science and Technology to Understand the Environmental Impacts of Shale Gas Extraction, 2014, p 224

5. Section 11B (2) should be amended by inserting an additional clause after “(d) environmental issues” which will read “climate impacts.”
6. Section 11B (2) should be amended by inserting additional clauses after “(f) regulatory effectiveness and efficiency” which will read:
 - Primary deference to the precautionary principle
 - Existence of adequate peer reviewed independent studies of the short, intermediate and long term impacts of hydraulic fracturing
 - Limitations in our knowledge of how to close down hydraulic fracturing sites and laterals in a manner that will preclude migration of contaminants, and the long-term implications
 - Readily available, adequate and affordable in the Province: facilities, equipment, techniques, experts and funding for baseline environmental and assessments, and baseline and on-going long term monitoring of all potential environmental and health impacts, that take into account all cumulative effects
 - Readily available, adequate and affordable in the Province: facilities, equipment, techniques, experts and personnel, that may be required to ensure the prompt removal of all pollutants that may be released into the environment, and otherwise restore adversely affected life and property.
 - Existence of adequate and readily accessible methodology for projecting the ultimate costs of: (i) investigating releases of contaminants, (ii) determining the extent of contamination, (iii) remediating contamination, (iv) monitoring contamination and remediation, and (v) paying for the replacement water sources, cancers, birth defects, loss of property values, loss of income and other consequences of contamination.
 - Legislative enactment of speedy, cost effective, affordable remedy for citizens, municipalities and the Province when damage or injury occurs or is likely to occur, that places the burden of proof and financial onus on polluters and those that engage them -- not citizens, imposes strict liability without fault for polluters and those that engage the polluters as contractors or otherwise, eliminates judicial barriers to class actions by Nova Scotians, and gives Nova Scotians the ability to assert claims that are based on violations of any law or regulation intended to be for the protection of the environment or health
 - Existence of whistle blowing legislation that protects whistleblowers and requires polluters and those that engage them, to provide compensation for those in the industry to report violations of applicable law, regulation and any release or discharge of any contaminant that is not expressly authorized by law or regulation
 - Requiring industry to provide secure liquid financial resources that will remain available to pay all reasonably foreseeable costs and losses

citizens, municipalities and the Province may incur including investigation, litigation, remediation, restoration, repair and replacement costs – despite bankruptcy, disposition of assets or adverse changes in financial condition of industry, surety companies, insurance companies and individual polluters and those that engage them

- Adoption of readily available sanctions with significant deterrent effect, that the Province, municipalities and members of the public may obtain if contamination occurs, from the polluters and those who engage the polluters
 - An effective means of ensuring that any community that might be affected by hydraulic fracturing, including First Nations have consented to the proposed hydraulic fracturing after being presented with all materials facts in the form of health and environmental assessments that are prepared with extensive public input, for each well and well pad but consider all cumulative impacts.
7. Section 11B should be amended by inserting, after Section 11B (2), a new clause 11B (3) which will read, “If the Minister reviews the prohibition, such review shall include a transparent process involving sufficient opportunity for broad public consultation and input from independent experts.”
 8. Amend Section 11 to acknowledge the need for acquiring community consent before hydraulic fracturing for unconventional hydrocarbons may occur by adding Section 11 C, which will read:
 - (a) “Municipalities have the right to ban or restrict hydraulic fracturing for unconventional gas, oil or other hydrocarbons.
 - (b) If a future legislature lifts the prohibition on hydraulic fracturing contained in this bill, before hydraulic fracturing is permitted proceed within any municipality, a local municipal referendum authorizing it would be required, after community members have been presented with all materials facts in the form of health and environmental assessments that are prepared with extensive public input, for each well and well pad but considering all cumulative impacts.
 9. Amend Section 11A (2) by replacing the words “in shale formations” with the words “in tight, non-porous rock formations including shales, tight sands and coal.” Amend the explanatory note so that the wording is consistent.

Defining hydraulic fracturing within Bill 6 and extension of the prohibition to HF for unconventional hydrocarbons

1. Remove the words "high volume hydraulic fracturing" wherever it occurs and replace with the term "hydraulic fracturing." (defined below)
2. The definition of the term "hydraulic fracturing" should be included in the bill itself, not in regulations. A proposed definition is provided in point 3 below.
3. Amend Section 11A (1) to include a definition of hydraulic fracturing which incorporates the following specific criteria that characterize hydraulic fracturing for unconventional hydrocarbons and distinguish the type of hydraulic fracturing intended to be prohibited by this act from other types of hydraulic fracturing:
 - a) Involves the injection of fluids ("Fluid" means any material or substance which flows or moves whether in semi-solid, liquid, sludge, gas, or any other form or state.)¹
 - b) Pressure is "sufficient to create or enhance subsurface fractures", or "a force exceeding the parting pressure of the rock."
 - c) The result is to induce or enhance a network of fractures.
 - d) The purpose is to facilitate the release of any petroleum, natural gas or other hydrocarbons which will flow through these fractures.

Using these criteria, the section could be amended to read:

"In this Section 'hydraulic fracturing means "... the transmission of a carrier fluid to apply pressure and transport proppants to an underground geologic formation to create or enhance subsurface fractures and facilitate the release of any petroleum or natural gas, but does not include fracturing for the production of wells for potable water;"²
or

"Injecting fracturing fluids into the target formation at a force exceeding the parting pressure of the rock thus inducing a network of fractures through which oil or natural gas can flow to the wellbore."³

Rationale: The definition of hydraulic fracturing should be included in the body of the act, not in regulations. The four major criteria suggested are sufficient to define the type of hydraulic fracturing necessary to define hydraulic fracturing for unconventional hydrocarbons.

It is unclear why the Minister feels it is necessary to specify "high volume hydraulic fracturing" or to include "a highly technical definition." Legislation in other jurisdictions with similar intent to this Bill contain definitions such as those suggested above. This government's own bill prohibiting importation of wastewater from hydraulic fracturing contains such a definition.

A highly technical definition would be much more difficult to monitor and enforce. It could also provide potential for unintended loopholes or manipulation of regulations. Any fracturing of shale for extraction of hydrocarbons, whether gas, oil or other, will have very similar risks and potential impacts, both below and above ground. Both the Wheeler Review, and the Council of Canadian Academies 2014 review of shale gas extraction refer to hydraulic fracturing, and define

¹ From Vermont Statute 152 prohibiting hydraulic fracturing

² Nova Scotia Importation of Hydraulic Fracturing Wastewater Prohibition Act

³ *Environmental Impacts of Shale Gas Extraction in Canada*, Council of Canadian Academies. Expert Panel on Harnessing Science and Technology to Understand the Environmental Impacts of Shale Gas Extraction, 2014, p 224

it as having certain general characteristics. The major distinction drawn is between conventional hydrocarbons, in porous formations, and unconventional hydrocarbons, in tight, non-porous formations. Industry draws the same distinction. (See handout from Shell Oil.)

The Wheeler Review adopted this definition: "In this report, we define "the process of hydraulic fracturing" (from our mandate) as: "the process of hydraulic fracturing and its directly associated activities and technologies for the purpose of unconventional gas and oil development." Directly associated activities and technologies would include the drilling and finishing of exploration and development wells, but exclude detailed consideration of the construction and management of pipelines and distribution networks.

The government has recognized, by the range of issues which were included in the Wheeler Review, and which are specified in this Bill as issues that the Minister is to review if this prohibition is to be reconsidered, that the technical process of hydraulic fracturing cannot be isolated from its "directly associated activities and technologies" in assessing the potential risks and impacts.

Throughout the document we use the term "unconventional gas and oil development," and by this we infer "by hydraulic fracturing." Also, except when specified, we also use the term "hydraulic fracturing" to infer "and its directly associated activities and technologies." In particular cases, we use the term "hydraulic fracturing" to mean the specific technical activity."

(Wheeler Report)

Adopting a definition of hydraulic fracturing which is both specific enough and general enough to capture the key elements that distinguish this technology from other potential uses is the challenge facing the government in this bill. I believe the wording proposed above addresses this challenge. If Section 11A (1) is amended as proposed, then amendment to "defining high-volume hydraulic fracturing" should be omitted, and the explanatory note should read, "This Bill (a) prohibits hydraulic fracturing in shale unless exempted by regulation for the purpose of testing or research."

Adopting a more inclusive definition of what is to be prohibited

The Liberal Party's commitment on the issue of hydraulic fracturing has never been restricted to "high volume hydraulic fracturing" or to fracturing shale alone. This is detailed in a submission you will have received from Mark Tipperman.

In a communication with NOFRAC, the party stated: "The Nova Scotia Liberal Party believes a moratorium should continue to be imposed on **the practice of hydraulic fracturing to access hydrocarbons**, until such a time as the practice is properly investigated and a complete and independent scientific review is completed."

And, in a letter to a private citizen clarifying the Liberal election position, Premier McNeil stated, "The Liberal Caucus introduced a bill which would have put a complete moratorium on fracking until and unless an independent study and review showed the process could be safe in the Nova Scotia geological context."

Those were good commitments. To make this bill consistent with the election commitment, and consistent with the work of the Wheeler Commission, the bill should be amended in two ways. First, to include the definition of hydraulic fracturing as outlined above in the Bill, and second, to extend the bill to cover hydraulic fracturing for all unconventional hydrocarbons in tight, non-porous formations, whether that be shale, tight sandstone, siltstone or coal.

Finally, I would like to flag for your attention a point, which is explained in detail in a submission you will have received from Mark Tipperman, which provides additional reasons to adopt the two amendments I have proposed.

The Wheeler Review notes that hydraulic fracturing is high risk in many areas. What legal remedies and protections would citizens have if (when) damages did occur? Nova Scotians generally believe we have the same protections as we hear about south of the border. But as Mr. Tipperman clarifies, we do not. On page 5 of his submission, he outlines a number of points of Nova Scotia law including:

--- Polluters are effectively freed from liability to the public for contamination if the general nature of their activity (for example, manufacturing, refining or oil and gas extraction) is permitted by law, and the polluter is not negligent and does not create a nuisance

--- Under Canadian law, there is no *res ipsa loquitur* doctrine available, i.e. no doctrine that the thing (contamination) speaks for itself and its mere presence establishes negligence. If the polluters' business operations are authorized by law, the polluters are not responsible even if the injured person can prove the polluter caused the contamination of water and air, loss of property values, cancer, birth defects or other physical suffering.

--- Each injured person or immediate family has to file their own suit, hire their own lawyers, expert witnesses and pay all of the associated costs Even though many residents of an area may be injured in the same general way, ...

This lack of accessible legal remedy for damages to ordinary citizens in Nova Scotia law should be seriously considered in the drafting of this bill. I believe it provides additional argument that the bill should include a general and inclusive definition of hydraulic fracturing, and should address hydraulic fracturing for all unconventional hydrocarbons. If it does not, individual citizens will be left without legal remedy facing an industrial operation that has documented high risks.

Further, the government itself will be hampered in any instances of proving damage by these and other legal standards in NS law, as outlined by Mr. Tipperman. As well, we need to be aware that, unlike in the US, there is no federal structure comparable to the Environmental Protection Agency, which could finance and carry out the lengthy and extremely costly investigations that would be required to prove cause of damages.

This brings us once again, for the protection our common environment, and individual citizens, to the need to amend Bill 6

- to include a definition of hydraulic fracturing in the Bill itself, as set out in the proposed amendments
- to extend the prohibition to HF for all forms of unconventional hydrocarbons.

Submitted to Law Amendments Committee
October 22, 2014
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Definitions of Hydraulic Fracturing

1. U.S. Geological Survey

<http://energy.usgs.gov/OilGas/UnconventionalOilGas/HydraulicFracturing.aspx>

Hydraulic fracturing, informally referred to as "fracking," is an oil and gas well development process that typically involves injecting water, sand, and chemicals under high pressure into a bedrock formation via the well. This process is intended to create new fractures in the rock as well as increase the size, extent, and connectivity of existing fractures. Hydraulic fracturing is a well-stimulation technique used commonly in low-permeability rocks like tight sandstone, shale, and some coal beds to increase oil and/or gas flow to a well from petroleum-bearing rock formations.

2. Vermont: Act No. 152:

(29) "Fluid" means any material or substance which flows or moves whether in semi-solid, liquid, sludge, gas, or any other form or state.

(30) "Hydraulic fracturing" means the process of pumping a fluid into or under the surface of the ground in order to create fractures in rock for the purpose of the production or recovery of oil or gas. (Added 1981, No. 240 (Adj. Sess.), § 2, eff. April 28, 1982; amended 2011, No. 152 (Adj. Sess.), § 2, eff. May 16, 2012.)

The prohibitions are:

Sub-Chapter 8: Hydraulic Fracturing For Oil Or Gas Recovery

§ 571. Hydraulic fracturing; prohibition

(a) No person may engage in hydraulic fracturing in the State.

(b) No person within the State may collect, store, or treat wastewater from hydraulic fracturing. (Added 2011, No. 152 (Adj. Sess.), § 3, eff. May 16, 2012.)

3. NS Importation of Hydraulic Fracturing Wastewater Prohibition Act, Section 2(a) defines hydraulic fracturing as follows:

"... the transmission of a carrier fluid to apply pressure and transport proppants to an underground geologic formation to create or enhance subsurface fractures and facilitate the release of any petroleum or natural gas, but does not include fracturing for the production of wells for potable water;"

4. Council of Canadian Academies. Expert Panel on Harnessing Science and Technology to Understand the Environmental Impacts of Shale Gas Extraction, Environmental Impacts of Shale Gas Extraction in Canada, 2014 defines hydraulic fracturing as:

"Injecting fracturing fluids into the target formation at a force exceeding the parting pressure of the rock thus inducing a network of fractures through which oil or natural gas can flow to the wellbore." P. 224

The glossary of the CCA report provides these definitions:

Horizontal Drilling: A drilling procedure in which the wellbore is drilled vertically to a kickoff depth above the target formation and then angled through a wide 90 degree arc such that the producing portion of the well extends horizontally through the target formation.

Hydraulic Fracturing: Injecting fracturing fluids into the target formation at a force exceeding the parting pressure of the rock thus inducing a network of fractures through which oil or natural gas can flow to the wellbore.

5. **Report of the Nova Scotia Independent Panel on Hydraulic Fracturing, David Wheeler Chair, 2014:**

In this report, we define "the process of hydraulic fracturing" (from our mandate) as: "the process of hydraulic fracturing and its directly associated activities and technologies for the purpose of unconventional gas and oil development." Directly associated activities and technologies would include the drilling and finishing of exploration and development wells, but exclude detailed consideration of the construction and management of pipelines and distribution networks. Throughout the document we use the term "unconventional gas and oil development," and by this we infer "by hydraulic fracturing." Also, except when specified, we also use the term "hydraulic fracturing" to infer "and its directly associated activities and technologies." In particular cases, we use the term "hydraulic fracturing" to mean the specific technical activity. See Chapter 1 for more details and definitions. These various uses should be self-evident in the text.

Activities and technologies associated with exploration and development of conventional oil and gas resources, which may include some of the same technologies used in exploration for unconventional resources e.g. the acquisition of seismic data and the drilling vertical wells, are not addressed in this report. These activities were outside the scope of our review.

From the glossary in the Report:

Horizontal Drilling: A procedure which first requires drilling vertically to a depth above the target formation and then angling to 90 degrees so that the well extends horizontally through the target formation at the producing end.

Hydraulic Fracturing: Well stimulation from injecting fracturing fluids into a formation at a force to induce a network of fractures through which oil or natural gas can flow to the wellbore.

Note: The only mention in the NS Panel's report of "high volume" appears to be in a footnote: 13. Municipality of the County of Inverness, By-Law #45, Being a by-law to prohibit the use of chemical (slickwater) hydraulic fracturing, otherwise known as high volume hydraulic fracturing (HVHF) or fracking, to extract methane gas or petroleum. (May 6, 2013).

6. ***Support to the identification of potential risks for the environment and human health arising from hydrocarbons operations involving hydraulic fracturing in Europe, Report for European Commission DG Environment, AEA 2012***

1.3.3 Definition of high volume hydraulic fracturing

From a technical viewpoint, hydraulic fracturing is the process by which a liquid under pressure causes a geological formation to crack open. The main use of interest for the purpose of this project is the use of hydraulic fracturing for extraction of hydrocarbons (natural gas or oil). The process is also known as "HF", "fracking," "fracing" or "fracing," but is referred

to as “hydraulic fracturing” or “fracturing” in this report.

Within the scope of this study, hydraulic fracturing is to be understood as the cycle of operations from the upstream acquisition of water, to chemical mixing of the fracturing fluid, injection of the fluid into the formation, the production and management of flowback and produced water, and the ultimate treatment and disposal of hydraulic fracturing wastewater.

7. **Fracking: Current Knowledge and Potential Environmental Impacts, Hydraulic Fracturing or ‘Fracking’: A Short Summary of Current Knowledge and Potential Environmental Impacts: A Small Scale Study for the Environmental Protection Agency (Ireland), Healy 2012:**

Hydraulic fracturing, or ‘fracking’, is a method used by drilling engineers to stimulate or improve fluid flow from rocks in the subsurface. In brief, the technique involves pumping a water-rich fluid into a borehole until the fluid pressure at depth causes the rock to fracture. The pumped fluid contains small particles known as proppant (often quartz-rich sand) which serve to prop open the fractures. After the fracking job, the pressure in the well is dropped and the water containing released natural gas flows back to the well head at the surface. The boreholes themselves are often deviated away from the vertical, into subhorizontal orientations; to ensure better and more efficient coverage of the targeted shale gas reservoir.

8. Bulgaria

“It is prohibited to use the technology of hydraulic rupture (fracturing) or any other technology, which represents the injection of a mixture of liquids (gels or liquid gas), chemical additives, and/or fluids, mechanical and/or organic fillers in the wells, resulting in formation of new and/or expansion of existing natural fractures or fracture systems in any sedimentary formations, including coal layers, for the purposes of exploration and production of oil and natural gas.”

Adopted by the 41th National Assembly on June 14, 2012

Defining the prohibition as applying to “High volume hydraulic fracturing”

There are also jurisdictions which use a more specific definition of high volume hydraulic fracturing which specifies amounts of water at each stage and cumulatively.

We believe that given the understanding that the risks and potential impacts of hydraulic fracturing are based on “the process of hydraulic fracturing and its directly associated activities and technologies for the purpose of unconventional gas and oil development” (Wheeler Report), that it is preferable to use the more general definition of hydraulic fracturing with the characteristics defined above.

Neither the Wheeler Review nor the Council of Canadian Academies Shale gas report rely on a definition of high volume hydraulic fracturing, or refer to this term in their reports.

Establishing a prohibition based on a particular volume of water used, or a specific amount of pressure, leaves the door open to the possibility that new, unstudied, types of hydraulic fracturing for unconventional gas could fall outside the prohibition. This would go counter to the government’s stated commitment not to allow hydraulic fracturing “until we can definitively determine that fracking will not harm our resources, our environment or the general public in any way.”

Submitted to Law Amendments Committee on Bill 6

October 22, 2014

Barb Harris, River John, Nova Scotia

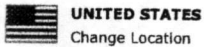
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Why Natural Gas?

Understanding Tight and Shale Gas

How We Operate

Where We Operate

Understanding Tight and Shale Gas

Natural gas is the cleanest-burning hydrocarbon fuel and can meet many of today's energy needs. The technology advances that have made it possible to unlock new sources of natural gas are an important step forward in developing a cleaner energy future.

Understanding Natural Gas

Natural gas is fossil fuel in its purest form. It contains just two elements – carbon and hydrogen, and is a gas in its raw state. This means it requires minimal processing and creates fewer emissions in its production and use than other fossil fuels. That makes natural gas an important fuel for reducing carbon dioxide and other atmospheric emissions.

Like all fossil fuels, natural gas was created over millions of years from the breakdown of organic materials below the earth's surface. Conventional natural gas fields consist of large free-flowing pockets of trapped gas that can be tapped from a single well.

In tight gas and shale fields, the gas accumulation occurs within smaller and tighter pore spaces in the rock.

What is shale gas?

Shale gas is a description for a field in which natural gas accumulation is locked in tiny bubble-like pockets within layered sedimentary rock such as shale. Think of it as similar to the way tiny air pockets are trapped in a loaf of bread as it bakes.

On the North American continent, traditional vertical oil and gas drilling methods were able to access only a small fraction of the gas within these formations. But recently, operational efficiencies and proven technology have come together to make shale gas both accessible and economically competitive.

To extract the gas from shale formations, Shell uses thoroughly tested technology in a responsible way.

What is tight gas?

While shale gas is trapped in rock, tight gas describes natural gas that is dispersed within low-porosity silt or sand areas that create a tight-fitting environment for the gas. How tight? Tight gas is defined (in the U.S.) as having less than 10 percent porosity and less than 0.1 millidarcy permeability.

- Porosity is the proportion of void space to the total volume of rock. For example, fresh beach sand has around 50 percent porosity. Tight gas is held in pores up to 20,000 times narrower than a human hair.
- Permeability is the ability of fluid to move through the pores. A person can blow air through a rock sample having about 1000 millidarcies permeability.

In general, the same drilling and completion technology that is effective with shale gas can also be used to access and extract tight gas. Shell uses proven technology in responsible ways to access this needed resource.

What is sour gas?

In some areas, including portions of the Rocky Mountain range, natural gas occurs mixed with higher levels of sulfur, creating hydrogen sulfide (H₂S), a corrosive gas. This "sour gas" requires

Accessing shale gas and tight gas

Hydraulic fracturing Q&A



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