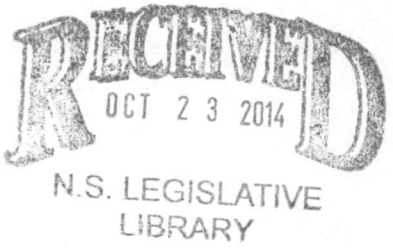
LAW AMENDMENTS COMMITTEE

Red Room, Province House

Tuesday, October 21, 2014



Bill #6 - Petroleum Resources Act (amended)

4:00 p.m.	1.	Barbara Pike, Chief Executive Officer *Maritime Energy Association*
	2.	Catherine Abreu *Ecology Action Centre*
	3.	Angela Giles
	4.	Katelyn Perfitt
5:00 p.m.	5.	Rachael Greenland-Smith
	~~6.~~	~~Robin Tress~~
	7.	Evelien Vanderkloet
	8.	Ken Summers

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October 3, 2014

RE: An Act to Amend Chapter 342 of the Revised Statutes, 1989, the Petroleum Resources Act

Ecology Action Centre Submission to the Law Amendments Committee

The Ecology Action Centre (EAC) acknowledges that the proposed amendment is welcome recognition of significant community concern over hydraulic fracturing.

Ecology Action Centre (EAC) highlights two aspects of the legislation as being keys to its positive potential:

1) The legislation establishes the notion that any move to overturn the prohibition on high-volume hydraulic fracturing must be made with careful consideration;

2) The legislation suggests parameters to be used within the context of such consideration.

Having acknowledged the strengths of Bill No. 6, EAC submits that certain amendments to the Act are required to safeguard the principle tenants of the proposed legislation and respect the concerns of Nova Scotians.

Testing and Research

Bill No. 6 states:

> 11A(2) No person shall engage in high-volume hydraulic fracturing in shale formations unless exempted by the regulations for the purpose of testing or research.

A mechanism must be established for determining whether a person may be allowed to engage in high-volume hydraulic fracturing for the purpose of testing or research and under what circumstances such testing and research would be deemed appropriate.

The EAC recommends the following clauses be added to the Act:

> **11A(2)(a) The Minister may exempt a person wishing to engage in high-volume hydraulic fracturing for the purposes of testing and research.**
>
> **11A(2)(b) Where the Minister considers exemption from the prohibition, the Minister shall engage in prior, informed and meaningful consultation with the community where testing and research is to take place to ensure community consent to the process.**

These additional clauses respect the findings of the Hydraulic Fracturing Review which establishes community consent as key to any future consideration of hydraulic fracturing.

The regulations must not include a general exemption from the legislated prohibition for testing and research purposes. To include such an exemption would fundamentally undermine the purpose of Bill No. 6.

Reviewing the Prohibition

Bill No. 6 rests the authority to review the prohibition of high-volume hydraulic fracturing solely with the Minister:

> 11B(1) The Minister may review the prohibition under Section 11A.

Given the presumed intention of Bill No. 6 to enshrine the caution against high-volume hydraulic fracturing as urged by Nova Scotians throughout the Hydraulic Fracturing Review, any potential to overturn the prohibition must be a matter for consideration by the full legislative assembly. Only the consideration of the Nova Scotia Legislature would adequately respect the deep concern expressed by Nova Scotians.

The EAC asks clause 11B(1) be amended to read:

> **11B(1) A review of the prohibition under Section 11A may be undertaken by the legislative assembly subject to a majority vote in the legislative assembly to undertake such a review.**

Section 11(B) of Bill No. 6 outlines a helpful series of parameters that may be used to review the prohibition. EAC believes the 'net benefit' test as outlined must be required, rather than suggested, in order to safeguard the agency of Nova Scotian communities.

The EAC asks clause 11B(2) be amended to read:

> **11B(2) Where the Legisture reviews the prohibition, the Legislature must determine whether the net benefit to Nova Scotians, taking into account**
>
> **(a) whether community consent is present;**
>
> **(b) social issues;**
>
> **(c) economic issues;**
>
> **(d) health issues;**
>
> **(e) environmental issues;**
>
> **(f) scientific and technical issues;**
>
> **(g) regulatory effectiveness and efficiency; and**
>
> **(h) any other matter or thing that the Legislature considers necessary or advisable.**

Definition of High-Volume Hydraulic Fracturing

Bill No. 6 tasks the regulations with establishing a definition of high-volume hydraulic fracturing. It is extremely unusual for such a definition to be left out of legislation and left up to regulations. EAC recommends that stakeholder input be considered in the development of a definition of high-volume hydraulic fracturing for the purposes of legislation in order to ensure the community concerns this legislation is responding to are appropriately reflected by the definition.

The following definitions have been recommended by other stakeholders and are supported by the EAC:

"... 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;" (from NS Importation of Hydraulic Fracturing Wastewater Prohibition Act, Section 2(a))

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." (from Council of Canadian Academies, 2014 report on shale gas, p. 224)

Hydraulic Fracturing and Other Geological Formations

Bill No. 6 limits the prohibition of high-volume hydraulic fracturing to shale formations. EAC asks that all unconventional oil and gas development requiring high-volume hydraulic fracturing be included in this legislation. This would mirror the approach used by the provincial review of hydraulic fracturing.

Sincerely,

Catherine Abreu

Energy Coordinator
Ecology Action Centre

from
Rachael
Greenland - Smith

Presentation to Law Amendments Committee on Bill 6, Amending Petroleum Resources Act 21 October 2014

Ken Summers Minasville, Hants County

Leaving the definition of hydraulic fracturing to the regulatory process turns the ban ultimately into a matter of Ministerial or Cabinet discretion. This fundamentally contradicts the government's intention to put any possible future decision to end the ban, to debate and a vote in the Legislative Assembly. [See 22 October Law Amendments presentation by Barbara Harris.]

The fundamental weakening of Bill 6 is rendered more problematic due to the history in Nova Scotia of highly contingent oil and gas industry regulatory enforcement.

The intent of Bill 6 is to build public confidence through transparency and public accountability. Government discretion in whether regulations are actually enforced in a timely fashion further removes decisions about hydraulic fracturing from spheres of transparency and public accountability.

The Petroleum Directorate of the Department of Energy is deeply committed to promoting the development of an onshore oil and gas industry in Nova Scotia. This commitment includes civil servants who are active advocates for companies, working closely with colleagues charged with regulating those companies.

This has led to a historical practice in Nova Scotia where the actual enforcement of regulations on companies seeking to develop onshore oil and gas resources is known to be a matter of negotiation.

There are many documented instances of these phenomena in the exploration for shale gas by Triangle Petroleum that began with drilling in 2007. Ministers of the previous NDP government often attributed these enforcement "gaps" to the unfamiliarity of government, at that early time, with development that relies on hydraulic fracturing as the main means of extraction. Those Ministers also showed an awareness of the difference made by the public attention to hydraulic fracturing that only became visible in 2011.

But we have right now a continuing lack of willingness by the Depart of Energy or Minister Younger to compel Triangle Petroleum to meet its clear outstanding obligations.

- Triangle Petroleum has responsibility for the clean-up and site reclamation of a 2002 oil well in Cogmagun, Hants County. Residents who have questioned about the site since May have repeatedly been given the excuse that the Department of Energy cannot find the landowners to get permission to inspect the site. There has been no answer to questions of whether or when Triangle will be compelled to reclaim the site.

- Triangle has publicly said that it will reclaim the Cogmagun site after it has drained the two fracking waste ponds in Kennetcook, but there is no technical or business case connection to reclamation at the Cogmagun site. There has been no answer to questions whether the Minister finds it acceptable that Triangle Petroleum is allowed to wait in definitely on rectifying a now 12 year old failure to reclaim the site.

- There are the two Triangle Kennetcook well sites that cannot be reclaimed until the fracking waste ponds have been drained. But the company has 3 more abandoned well sites from the 2008-2009 exploration program that do not have waste ponds, and which Triangle has said publicly it will not use again, even if the company returns to active drilling and development on the Windsor Block lease.

- Again, there is no technical or business case reason that these 3 well sites should not be reclaimed now. But the company also puts off that reclamation until after the draining of the two Kennetcook waste ponds, which has no timeline.

- Minister Younger has also not answered residents' questions of whether he finds it acceptable that Triangle is not compelled to reclaim these 3 well sites in a timely fashion.

Ken Summers

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From: Mark Ashworth <ashworths.england@hotmail.com>
Sent: Friday, October 03, 2014 4:25 PM
To: Office
Subject: Comments on Bill No. 6

Good afternoon,

I am writing to express my extreme disappointment (and annoyance) at the proposed legislation to ban high volume hydraulic fracturing of onshore wells. I have been following the impressive work carried out by Dr Wheeler and the panel, and I very much welcomed the balanced approach and content of their report. In making this decision, it appears that the goverment has chosen to ignore the work done by the panel and instead has responded with a 'knee-jerk' reaction to the 'no frack' lobby groups content to adopt a 'NIMBY' approach to Nova Scotia industrial and energy development.

I love living and working in this province, but I am worried that unless the government allows industry and individuals to prosper by seeking to develop our energy industry, the province will continue to move ever closer to being nothing more than a provincial retirement home funded only by federal handouts, 50 mile yard sales, farm markets, government paving projects and an unpredictable tourism industry. The people of Nova Scotia (and in particular, the young people of Nova Scotia) deserve better than this !

My 18 year old son is just about to begin a 3 year degree course studying Petroleum Engineering at the Cape Breton University. He is full of enthusiasm and keen to learn all about exploration and production techniques. He was asking me why Nova Scotia hasn't looked to develop its resources and is now banning a technique used all over the world that may bring wealth and opportunity to the people of Nova Scotia. I couldn't really answer his question, except to say that it is policy / politics directed by fear and conjecture as opposed to technical knowledge and good judgement.

As a result of this unfortunate decision, I suspect that my son will be yet another young person forced to leave Nova Scotia in order to make a decent living and pursue his ambitions. I feel that this is very unfair and fundamentally wrong that laws are being put in place that make it more difficult for young people and talented individuals to prosper in this province. It is a message to Nova Scotians, other Canadians and the people around the world that we are content to be a "have-not" province and happy to allow our young talent to leave the province.

I recognise that many people in the province have concerns about the dangers of fracturing wells (and development of Nova Scotia's resources in general), but to close the door entirely is not the answer. Education and further research is the key so that we can develop our resources to allow the people of this province to prosper.

In passing this legislation, it will be a sad day for Nova Scotia and in particular for the young talent that would love to live and work in this province.

Mark Ashworth

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BY EMAIL & FAX

October 20, 2014

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Re: Bill 6 – Hydraulic Fracturing Amendments of the Petroleum Resources Act

Dear Members of the Legislative Assembly:

I write to you as a concerned Nova Scotian, a member of Steering Committee of Nova Scotia Fracking Resources & Action Coalition ("NOFRAC") and as a lawyer with 40 years of experience. I write to address two areas of concern. First, the limited scope of the Bill. Second, the limited scope of the factors the Minister is required to consider if the Minister wants to review the ban imposed by the Bill in the future.

Scope of the Bill

The scope of the Bill is at odds with the precautionary principle as reflected in the Environment Act, the platform of the Liberal Party in the last provincial election, the scope of work that the current government contracted for with Cape Breton University ("Wheeler Contract"), and the final report of the panel assembled by Dr. Wheeler pursuant to the Wheeler Contract, entitled Report of the Nova Scotia Independent Review Panel on Hydraulic Fracturing ("Report").

The Bill would merely prohibit "high volume" hydraulic fracturing in "shale", leaving significant parts of the Province in harms way of hydraulic fracturing in other geological formations and in any hydraulic fracturing that was not "high volume" as defined in regulations. A definition for which the Bill provides only the most general guideposts, leaving the then current Minister with too much discretion when the regulations are adopted or modified.

By limiting the Bill's ban to "high volume" "shale" hydraulic fracturing, the Bill is a significant departure from prior statements made by the Liberal Party, the scope of the practice to be examined under Wheeler Contract and the Report the Government sought and accepted.

In Premier McNeil's September 10, 2013 email to Yuill Herbert, then opposition leader 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.

Similarly, in the Liberal Party's formal description of its election platform on hydraulic fracturing, the Liberal Party responded to NOFRAC as follows:

> 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. It was only recently that the NDP government committed to an independent review, after Liberals have been calling for this for years and introduced legislation on this matter. ***
>
> Until we can definitively determine that fracking will not harm our resources, our environment, or the general public in any way, the extraction procedure should be prohibited.

The contract signed by Minister Younger with Cape Breton University dated August 28, 2013 described the scope of the Wheeler Panel's work in Schedule "A", Section 1.1 as:

> The Contractor will work as a consensus builder, engaging the public and technical experts as part of an external review process on hydraulic fracturing in Nova Scotia. The scope of the \independent, external review will include examining the environmental, health and socio-economic impacts of hydraulic fracturing.
>
> The external review is expanding upon work initiated by the Province through its internal review of hydraulic fracturing activity. The Contractor will include in their scope of work the areas covered as part of the internal review, these include:
>
> - ***
> - Use of and effects on surface water; examining surface water acquisition for hydraulic fracturing operations, including the quantity of water required and potential sources.
> - Impacts on land (e.g. potential soil contamination) which may result from hydraulic fracturing.
> - Management of additives in hydraulic fracturing fluids, including disclosure, examination of the additives used in hydraulic fracturing and their impacts.
> - Waste management, including surface ponds of produced waters; assessing the current and available waste management technologies for treating and disposing of water used

> in hydraulic fracturing, including recycling and reinjection of hydraulic fracturing fluids***

Minister Younger's November 21, 2013 announcement regarding the Wheeler Panel included the following statements (http://www.blog.andrewyounger.ca):

> The review is being led by David Wheeler, president of Cape Breton University. After he has chosen an expert panel, including experts in the areas of science, health and aboriginal knowledge, Mr. Wheeler will conduct public consultations on the environmental, socio-economic and health impacts of hydraulic fracturing in Nova Scotia.

In the Report's Executive Summary at Page 2:

> We summarize current energy policy in Nova Scotia, and we describe the current state of the art on environmental, health, and social risks of unconventional gas and oil development using hydraulic fracturing and associated techniques, drawing on the Council of Canadian Academies (2014) report: *Environmental Impacts of Shale Gas Extraction in Canada.*

In the Report's Executive Summary at Page 4:

> Consequently, we advocate a precautionary approach and make the following top level recommendations:
>
> • Based on the analysis described in this report a significant period of learning and dialogue is now required at both provincial and community levels, and thus hydraulic fracturing for the purpose of unconventional gas and oil development should not proceed at the present time in Nova Scotia.
> ***

The Bill should be amended to provide the ban the Government promised to enact and that carries out the conclusion of the Wheeler Panel in the Report, namely a legislative ban of all hydraulic fracturing for hydrocarbons, sometimes referred to as unconventional oil and gas development.

If there is one thing that Wheeler has announced in public, that he and the public agree upon, it is that there is not enough evidence for anyone to conclude that hydraulic fracturing can safely proceed in Nova Scotia at this time or in the near term.

It has been evident for quite some time that only a small percentage of the public favors hydraulic fracturing and that percentage is declining as the evidence of its toxic consequences and costs passed onto the public become better understood. It's time for Provincial government to adhere to the precautionary principle and follow through on its platform, the forbearance recommended by the Wheeler Panel in the Report, and adopt a legislated ban of all hydraulic fracturing, not merely "high volume" hydraulic fracturing in "shale" as the Minister or cabinet that happens to be in office at that particular time thinks the practice should be defined.

Factors the Minister is to Consider if the Minister Decides to Review the Ban

My experience includes 6-1/2 years as a lawyer in the New York State Attorney General's office, in administrative, civil and criminal enforcement, followed by a stint of administrative enforcement with the New York Stock Exchange, Inc. With enforcement budgets, staffing, and expertise far exceeding anything that most other State and Provincial enforcement agencies in North America might be able to raise, we could still do little more than selectively enforce the law, using prosecutorial discretion to identify the cases and actors that warranted the use of the limited budgets, staff and expertise of our enforcement agencies and the trial courts and other forums that determined the ultimate outcomes of contested litigation and administrative proceedings. In my subsequent years of practice, as a lawyer, property owner and as a volunteer, I've encountered an altogether too common inability and often unwillingness on the part of various levels of government to enforce the law, and when enforcement is pursued the results are too often nothing more than a slap on the wrist and an incidental cost of doing business.

There are inherent limits on the effectiveness of regulations, including without limitation intended, the inability of regulatory bodies to ensure full or even substantial compliance with any regulatory program, including by way of example only, regulatory bodies inability to monitor, investigate and enforce regulations, for a variety of reasons including by way of example only: (i) staff not adequately trained; (ii) administrators without adequate background; (iii) political and industry influences in regulations and regulatory decision making; (iv) inadequate funding; (v) the sheer numbers of personnel and incidents that need to be scrutinized and investigated contrasted with relatively scant investigation and enforcement staff; (vi) judicial attitudes towards enforcement of non-violent civil and criminal offenses; and(vii) the inadequacy of available judicial and administrative remedies. Even the best regulatory enforcement agencies, do little more than enforce regulations against a select few for the purposes of trying to address the worst situations presented, the most persistent violators or to establish important precedents; and enter into consensual agreements or orders for remedial action that involves significant compromises to achieve settlements without the investment of staff and other resources required for enforcement actions in court or even before an administrative tribunal.

As a commercial real estate lawyer, over the last few decades, I have come across many sites with contamination in excess of legal limits. More often than not, the contamination was caused by elements of the oil and gas industry. In almost all instances, the only physical means of reducing the levels of contaminants was aeration or vaporization and naturally occurring breakdown. Levels of ground water contamination in excess of legally permissible limits continued for years in most instances. Underground plumes of contaminants frequently migrated considerable distances. Almost all of the contamination was ignored, until buyers and lenders of the contaminated property obtained environmental site assessments of the contaminated sites that were performed by qualified environmental consultants.

Under Canadian bankruptcy law, polluters can be relieved of financial responsibility for the contamination they cause and be given a "fresh start," that may leave the public at large, the affected municipalities and the Province with the resulting expenses. This altogether too likely

scenario could lead the Province, municipalities and all taxpayers with significant future financial liabilities.

In Canada (Attorney General) v. MacQueen, 2013 NSCA 143 (CanLII), <http://canlii.ca/t/g246b>_the affected individuals owned land or lived near a steel works and claimed that the steel works contaminated their properties and created risks to their health from the contaminants generated by the steel works, that included lead and arsenic. Under the precedent and reasoning expressed by the Nova Scotia Court of Appeals in the Sydney Steel case:

- 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 (To prove negligence, a person filing suit must prove that the polluter knew or should have know that their conduct was reasonably likely to cause pollution, that the pollution caused was the kind of harm that should have been foreseen, that the polluter actually caused the contamination, and the contamination caused a loss to the person filing the suit and the cost of remedying the loss, with the person injured by the contamination required to take at their expense reasonable measures to lessen the extent of the loss from the date the contamination was discovered until the date the lawsuit is finally decided.) 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. To prove a nuisance, a person must establish that the polluter significantly and unreasonably and interfered with the use of the injured person's real property.

- 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, the Sydney Steel decision demonstrates the Court of Appeals will narrowly interpret the statutory rights of residents to join together in a class section lawsuit. Class actions are the only feasible way for almost any private citizen to seek redress in the courts in most contamination suits, as the costs of hiring lawyers and expert witnesses can be spread amongst a larger number of injured persons. The litigation often drags on for years as it did in the Sydney Steel case. Pursuing contamination claims on an individual basis is generally prohibitively expensive under a negligence or nuisance standard.

It is extremely difficult to prove the actual source of pollutants that cause contamination, There is no practical or practicable way for members of the public, municipalities or the Province to pay for or perform the extraordinary baseline and ongoing testing of their water and air, and the wholesale engagement of experts that would be required to determine if the water and air is "safe" or for the courts to establish claims against polluters for liability under a negligence standard, nuisance or even a strictly liability without fault standard.

And even when it is possible to prove the source of contamination, contamination by itself does not in Nova Scotia establishes legal liability for the resulting consequences.

There are other significant barriers for those hurt by pollution. For example:

- Suits must be filed within a limited time period or be forever barred even though the extent of the resulting injury and loss is not known until much later.

- Polluters can be very litigious running up very large legal fees for injured persons.

- Polluters are often successful in sealing the court files and settlement agreements that disclose the evidence and extent of the polluters' responsibility.

- The actors that actually make the mistakes that do constitute negligence, are often subsidiaries and independent contractors with very limited assets and net income. One of the many defenses the permit and lease holders employ to escape liability is that the negligence was that of a subsidiary or an independent contractor for which they have no legal responsibility.

- If an injured person is ultimately successful in court proceedings, the actual recovery of any award made by the Court is dependent upon the availability of assets that can be seized or sold with proceeds of sale sufficient to pay the award.

- Awards of all or substantially all of a prevailing party's attorneys fees are generally not available in Nova Scotia; and these are probably not the kinds of cases that most lawyers would be willing to take on, let alone on a "contingency fee" basis, i.e. no fee unless they win.

- When there are proceeds to pay the award, the fees of the lawyers and expert witnesses are paid from the proceeds collected, to the extent not awarded by the court and otherwise paid by the polluter.

Citizens in Nova Scotia do not have any right to seek any redress against polluters under the Environment Act. There is no standing for citizens under the Environment Act to bring claims for damages or injunctions against polluters, and there is no prospect of being able to compel the Province to enforce the Environment Act as the Act gives the Minister considerable discretion how to apply and enforce the Act. See: Environment Act Section 142.

Innocent victims of pollution in Nova Scotia deserve much better. Polluters and those that engage their services, should be liable to those injured even if the polluters were not at fault. Polluters should bear the burden of proving they did not cause contamination when contamination is identified. Those who wish to engage in the extraction of fossil fuels through a process that uses or releases hazardous substances should bear the entire risk that their activities injure the innocent.

And when the innocent are injured, the financial resources required to address their physical and financial injuries need to be readily available.

Bonds are most often cited as the appropriate financial asset to ensure that there will be at least some funds available if contamination occurs. There are some very serious problems inherent in bonds, which compromise getting appropriate security to cover potential harm. They include:

- Bonds are issued by surety companies. Surety companies limit their liability under the bonds to a maximum dollar figure or a specific action, such as completion of a building. There is no possible means of estimating the total cost, let alone in future dollars of trying to remediate contamination that occurs in the future, treat cancers and birth defects that arise in the future, provide alternative water sources they are required in the future, provide testing and monitoring required in the future, make repairs to well casings or pipes in the future, compensate for lost property values, and recover the costs and expenses of experts, laboratories and lawyers that are needed to pursue pollution claims to be paid by bond proceeds.

- The time line for discovery of the consequences of hydraulic fracturing may be 100 years or more. Bonds are written for limited periods of time. If the bonds are not called during their limited lifespans, they expire.

- Bonds are not cash. Sureties do fail financially and have the right to contest liability under bonds. Bonds are not cash or even letters of credit payable on demand. Bonds are issued to a named beneficiary. Ordinary citizens will likely have no recourse on the bonds. If the government calls a bond and the surety pays, will proceeds be available to compensate the public and reimburse government and if the answer is yes, will they be sufficient to cover all of this liability. If not, how will proceeds be divided amongst the competing Provincial and public claimants.

If the Province does go down the road of authorizing hydraulic fracturing, cash security needs to be deposited with the Province with the amount of the security determined on a well pad by well pad basis, taking into account a myriad of factors including hydrogeology, toxins introduced and released and extent and proximity of potential victims and the extent of their potential losses.

Many of these concerns and suggestions that are offered by the writer below were included in the Report issued by the Wheeler Panel.

In the Report at Pages 269-270:

> The panel notes that emerging best practices appear to be a requirement for an environmental assessment for each proposed well, as well as considering the well in terms of cumulative impact.

Cumulative impacts analyses should include not only the extent of other wells that have been, are and may in the future exist, but also exposures to contaminants over a lifetime, and the collective effect of all potential contaminants.

In the Report at Page 271:

> There have been a number of audits of regulatory enforcement agencies in recent years, which appear to document a general trend of some agencies not acting in response to identified and potential environmental violations.
> ***
> Enforcement requires an adequate budget. The experience in some U.S. states has been that already overburdened agencies are unable to effectively monitor with their existing staff and funding (Gerkin, 2013; Wiseman, 2012).
> ***
> Enforcement also requires expertise. This issue was raised by members of the public who questioned how Nova Scotia could secure the services of a sufficient number of independent topic experts to perform the required monitoring activities. Others pointed to the expertise that is required if sites become contaminated, or are contaminated and abandoned, and noted that, unlike the United States, we do not have an entity such as the U.S. Environmental Protection Agency that is resourced and charged with matters such as expertly addressing uncontrolled hazardous waste sites. 23 Effectiveness is also a matter of identifying appropriate sanctions for violations.

In the Report at Page 272:

> If a company is legislatively responsible for the costs of all negative impacts, they will be more diligent about compliance. Such an outcome is more likely to occur where companies are required to post bonds, which must be framed to provide security that costs will be addressed even if a company goes bankrupt. ***While bonds act both as an incentive and reduce the likelihood of the public bearing financial burdens, the public also raised concerns about the efficacy of bonding. They pointed to three major deficiencies. First, that bonds are only valid for a certain period of time and harm may materialize long after a bond has expired. Second, that only government, and not citizens, are usually able to recover against a bond. Third, that bonds provide specific coverage, and costs are difficult to predict given knowledge gaps about long-term consequences and uncertainty about remediation costs.

In the Report at 274:

> …the social license to operate is thus a precondition and a continuing condition for hydraulic fracturing to occur in any given community. It is also how we interpret the proper application of a "precautionary approach," which implies (in this case) that the most important level at which risks and benefits must be adequately modelled and decisions understood is at the community/ecosystem level. We have styled this as the need for a "community permission to proceed."

Bill 6 should be amended to require that if the Minister wishes to review the ban on hydraulic fracturing, that the factors the Minister must take into account, include:

- 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 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.

Respectfully submitted,

Mark Tipperman

cc: By email: Hons. Stephen McNeil, Andrew Younger, Randy Delorey, Keith Irving

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October 21, 2014

To the Law Amendments Committee of the Nova Scotia Legislature,

In the current wording of Bill 6, section 11A – exemptions are stated for formations other than shale, and for purposes of testing and research:

> *"11A (1) In this Section and in clause 27(1)(ta), "high-volume hydraulic fracturing" means high-volume hydraulic fracturing as defined by the regulations.*
>
> *(2) No person shall engage in high-volume hydraulic fracturing* ***in shale formations*** *unless exempted by the regulations for the purpose of testing or research."* (emphasis added)

I wish to bring to the attention of the committee an opportunity to clarify and strengthen the wording of this section.

As written, the bill would affect a type of rock that is interbedded with many other rocks. *Interbedded* is defined as beds (layers) of rock lying between or alternating with (in a sequence of) beds of a different kind of rock. Exploration companies compile information about the rocks from surface to the target formation during exploratory drilling, and report to funders and government agents. The following excerpts are from "Elmworth Energy Corporation (Triangle Petroleum Corporation) NSDE Development Plan Application, Oil and Natural Gas Development Project, Windsor Block, dated June 2008" and show how common these alternating rock types are in the Kennetcook area:

> *"The unconventional gas reservoirs within the Horton Bluff Formation are composed of* ***interbedded*** *mudstone, siltstone, and sandstones."*
>
> *"Shale gas reservoirs are unconventional* ***sequences*** *that can best be described as low porosity low permeability, organic rich rock that relies on fracture stimulation to produce."*
>
> *"At least four different* ***shale units*** *have been identified in the Kennetcook wells that have potential as unconventional gas reservoirs."*
>
> *"Thickness of prospective* ***shale package*** *can exceed 200 metres"*
>
> *"It is possible that Elmworth may encounter traditional oil or natural gas reservoirs in the uphole Horton or Windsor groups, while drilling for gas in the Horton Bluff Formation."* (emphasis added)

According to the Atlantic Geoscience Society[1] (emphasis added), "The Horton Bluff Formation is characterized by **interbedded shales, sandstones, and impure dolomitic carbonates** that probably represent paleosols. ...dominated by successive shallowing-upward **cycles** representing the filling of the lake following each subsidence episode. Although relatively undeformed (at least compared with later stops) the **succession** contains a number of soft-sediment features. Most notably, synsedimentary dykes are common, and frequently feed upward into conspicuously thickened, lenticular **units of overlying sandstone**."

These quotes describe a local geology in the Kennetcook area that is comprised of complex repeating layers of shale, sandstone, and other rocks reflecting natural changing environments over geologic time. This pattern is common in geologic formation across Nova Scotia during the Carboniferous period, when many organic sediments were deposited and are now being explored for economic petroleum potential. Other examples include the Pictou Group ("sandstone, siltstone, shale, coal and conglomerate"[2]) and Windsor Group ("limestone, siltstone, gypsum, anhydrite, salt, sandstone"). In most cases, it would be impossible and economically infeasible to technically allow fracture stimulation of one bed and not another based on rock type.

I strongly recommend that Section 11A (2) be amended by replacing the words "in shale formations" with the words "in tight, non--- porous rock formations including shales, tight sands and coal."

Respectfully,

Jennifer West

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[1] http://www.ualberta.ca/~jwaldron/nsfieldtrip/HortonCheverie.htm

[2] Geology Map of Nova Scotia, 1994.

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."

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[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."

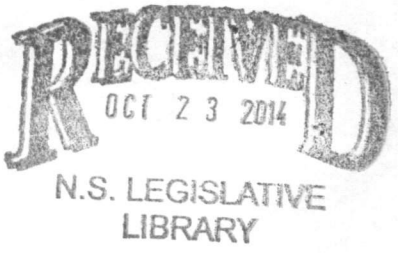
8. Amend Section 11 to acknowledge the need for acquiring community consent before hydraulic fracturing for unconventional hydrocarbons may occur by adding Section 11 C, which will read:
   (a)"Municipalities have the right to ban or restrict hydraulic fracturing for unconventional gas, oil or other 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.

LAW AMENDMENTS COMMITTEE

Red Room, Province House

Wednesday, October 22, 2014



Bill #6 - Petroleum Resources Act (amended)

4:30 p.m.	1.	Lorna Wood Houck
	2.	Barb Harris
	3.	Barbara Gallagher
	4.	Dawn Allen
5:30 p.m.	5.	Alison Petten
	6.	Irvine Carvery
	7.	Jocelyn Burr
	8.	Ross Haynes, Q.C.
	9.	Jane MacKay
	10.	Rylie Arnell
	11.	Simon Greenland-Smith

Barb Harris

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."

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[2] Nova Scotia Importation of Hydraulic Fracturing Wastewater Prohibition Act
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   - 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.

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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:
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(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.

Barb Harris

Defining hydraulic fracturing within Bill 6 and extention 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

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[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 ta "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 committments. 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 costtly 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
Barb Harris, River John, NS
bharris@ns.sympatico.ca

Barb Harris

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," "fraccing" 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

<u>Defining the prohibition as applying to "High volume hydraulic fracturing"</u>
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, <u>unstudied,</u> 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
bharris@ns.sympatico.ca

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 **Accessing shale gas and tight gas** **Hydraulic fracturing Q&A**

Natural gas is fossil fuel in 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.

[redacted]

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 (H_2S), a corrosive gas. This "sour gas" requires

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Energy for Today: Tight Gas and Shale Gas

Advances in proven technology are making it possible to unlock new sources of natural gas.

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PAGE TOOLS

To: Members of the Law Amendments Committee,

From: Barbara Gallagher, Co-Chair
Citizen Action to Protect the Environment (CAPE)

Bill # 6 Re Ban on Hydraulic Fracturing

I am writing on behalf of Citizen Action to Protect the Environment (CAPE), a Hants County-based registered community group. We understand that Minister Younger aims to incorporate in legislation the main recommendations from the Wheeler report on hydraulic fracturing. I want to address two main concerns: community consent and other factors that need to be considered if/when the Minister reviews the ban.

We applaud the banning of fracking but are concerned about the omission of the need for community consent prior to the use of fracking for development of unconventional gas if/when there is consideration of lifting the ban. It is noted throughout the final Wheeler report that a precautionary approach must underpin provincial policy on hydraulic fracturing for the purpose of the development of unconventional gas and oil resources. On page 324 the authors state that they believe that the only level at which the precautionary principle becomes truly meaningful is at the community level where the costs and benefits can be weighed in a local context.

A Top Level Recommendation from the report was that NS should design and recognize the test of "a *community permission to proceed"* before exploration occurs for the purpose of using hydraulic fracturing in the development of these resources.

The first Contingent General Recommendation states that if new knowledge persuades communities to want to examine the costs and benefits of these resources, "then seismic testing for the purpose of pursuing hydraulic fracturing would proceed only when full, prior and informed community consent was established …" (p.326).

Community members will incur the consequences of risks taken and will need to be fully informed and satisfied that the practice will not be harmful to their environment, health, or resources. One of the panellists, Ian Mauro, stated that when comparing the letters to research on fracking that he "found the risks and benefits perceived by regular people were generally well-founded" (Chronicle Herald Sept 13/14). Citizens had several months to become educated on the technical details and nuances of the material on fracking that was distributed by the panel and obtained from other sources.

With no mention of community consent in the legislation, we have to question whether adequate attention has been given to the requirement of the precautionary principle. We realize that it will take time to develop a process for determining community permission, but we believe a 30-day public comment period does not even allow for full and prior information, and certainly not informed consent.

Our members reside in the Windsor-Kennetcook Block where fracking occurred without them being fully informed or supportive. We are looking for legislation that includes a clause that affirms that full, prior and informed community consent is required before seismic testing and fracking occur. Our suggestion is:

11A(3) (a) High-volume hydraulic fracturing will only occur with full and prior consultation with area residents and their informed consent.

(b) Municipalities have the right to ban or restrict hydraulic fracturing in their municipalities.

In addition to full, prior and informed community consent, we recommend that other conditions also be added to those considered by the Minister when reviewing the ban. The review should include a transparent process for public consultation with the opportunity for input from independent experts. Even with the Wheeler review, we noticed that the material presented in drafts for public review tended to be biased in favour of industry, and some note-worthy reports omitted (Health Canada 2012 report on fracking). Information requested in responses to these drafts was often ignored. Examples include:

-Information on TENORMS and procedures and safety precautions when removing them
-Details re treatment option for wastewater in Kennetcook; osmosis process- general info on the cost and who would pay; disposal and tracking of radioactive carbon filters

Community members are generally open to industry, but not when the environment, and then their health have to be sacrificed. As noted by the Wheeler panel, it is the community that should determine whether the level of risk is acceptable. Regulations are only as good the monitoring capabilities and the assurance of compliance.

We would recommend that the Ministerial review include a process to protect individuals and taxpayers from both short and longterm costs for water, resource, and health problems, as well as environmental remediation when damages occur from fracking. We are aware of the multi-year struggle by Jessica Ernst, from Rosebud Alberta and the Parr family in Texas to obtain compensation for their losses. We would recommend a condition of adequate liquid financial resources from companies to be held to cover potential financial losses to citizens and the province, with the cost of burden of proof on polluters. Timely compliance, such as problems with disposing of fracking wastewater, seems to be a common issue with environmental regulations, and we suggest that these liquid financial resources could influence actions.

Thank you for considering our proposed changes. We are hopeful this legislation will reflect the wisdom inherent in the quote from Cicero at the beginning of the final Wheeler report, " **The health of the people is the highest law**."

Respectfully submitted,
Barbara Gallagher
Co-Chair, CAPE

From: dawn allen <dawn.allen@hotmail.ca>
Sent: Thursday, October 23, 2014 10:39 AM
To: Office
Cc: Premier; Minister, Energy; min_env@gov.ns.ca; chuck@chuckporter.ca; margaretmillermla@bellaliant.net; rallen@westhants.ca; spineo@westhants.ca; rmatheson@westhants.ca; admin@westhants.ca; tbrown@westhants.ca; cochrane@westhants.ca; jdaniels@westhants.ca; mcampbell@westhants.ca; vswinamer@westhants.ca
Subject: Law Amendments committee submission
Attachments: Law Amendments_testing and research_D Allen Oct 2014.pdf

Thanks for the opportunity to present to the Committee.

As you can see I have cc'd my concerns to a few others.

This issue is important to me and all Nova Scotians.

Dawn Allen
Centre Burlington,
HWY 215
Hants County, NS

Law Amendments Committee submission

Dawn Allen,
Centre Burlington
Hants County

Oct 22, 2014

Regarding the province's position on fracking in our province - I was initially pleased to see the word 'ban' being used, but with further examination it appears there is much that needs to be strengthened in the wording of the proposed amendment to Chapter 342 of the Revised Statutes, 1989, the Petroleum Resources Act.

Although I have the same concerns as many on the lack of definition of 'high volume' and on the specifics of the means that will be used to attain 'community consent' I am very much concerned by what could be meant by *'exempted for the purposes of testing and research'*.

Seismic testing

I do know now that the Hants County area that I live in (Centre Burlington and Cogmagun) has already had some seismic testing done along property baselines and along some resource roads. I know it involved blasting at an unknown depth. I also know of 4 properties in the nearby areas where drilled wells are said to have collapsed, turned bad or have stopped producing water. We deserve the right to know both when and where testing is going to occur, what damages may occur due to seismic testing and who will pay for the damages. We also should have some sort of water testing on both surface

and drilled water wells within a specified distance of any test and research fracking activities.

Will seismic mean using explosive charges at depth or are there other forms of seismic work that will be employed using other types of heavy equipment that will cause road damage, dust, noise and fumes? Nova Scotians must have prior and complete information about the methods and procedures that will be used in seismic testing.

Test drilling and blasting of fluids into the ground

Hydraulic fracking (the fracturing of rock formations by pumping large quantities of fluids down a well at high pressure) regardless of it being done on a small scale vertically or horizontally will create the potential for faulty well casings, and the potential leakage of both methane and any fluids used during the fracking process into aquifers. That is to say, any of the concerns that are associated with commercial fracking will be there for any test fracking that is being proposed. And we need to know what chemicals are being used in the test fracking so that we know what to monitor for. The Kennetcook area drill logs mention the possibility of expecting coal seams, gypsum layers and of drill hole deviations.

Flowback from the test fracking activities

We need to be informed of the treatment of, and the disposal location of the flowback waters and the drilling muds that will be produced from test fracking. Monitoring needs to take place not just by government and industry reps but by a committee of local people. I have seen first hand, from the evidence left at a well site near my home, that a drainage ditch had been

trenched to direct flowback waters from the wellhead towards a naturally low lying area. Any test and research activities need to be closely monitored at all times.

Will chemical potential damage be reversible? An analysis of the chemicals used in the frack fluids used in the Kennetcook area drill well logs included: alcomer, alkapam, bentonite, chembreak eca, drispac, dyna det, envirofloc, humalite, kelzan, sulphamic acid, XL-defoamer to name but a few. The public should know if industry has developed successful methods of extracting these chemicals from our soil and water.

Around my area, the No Fracking signs are consistently put up by those who have moved here from Alberta or who have worked there or who currently work there. A young couple – she works in local real estate, he works Out West – put their house up for sale almost as soon as the talk of fracking began. Yet we hear about the thousands of wells that have been drilled safely in other provinces. What is the proximity of those wells to habitation. And how much is New Brunswick truly making off of its resource? And on this question, try to find out the truth and not get the information from industry sources. Where fracking is taking place in those western provinces are there the same settlement patterns and the same geology? The answer is no. I think we currently have all the geologic research that we need to preclude testing for the viability of fracking.

it is the people whose husbands work out west in the oil and gas industry

Unless more information is given in the proposed amendments to the Petroleum Resources Act there is much for Nova Scotians to be distrustful about.

This Bill, as it now stands, explicitly excludes *testing and research* related to fracking, but it fails to include a definition of —testing and research. Nova Scotia needs a strong definition written in the Act, not the regulations.

Thanks for the opportunity to speak before the Law Amendments Committee.

Dawn Allen
Centre Burlington
Hants County, NS

Alison Patten

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."

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[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.

Alison Petten

Review

Environmental Public Health Dimensions of Shale and Tight Gas Development

Seth B.C. Shonkoff,[1,2] Jake Hays,[3,4] and Madelon L. Finkel[4]

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Background: The United States has experienced a boom in natural gas production due to recent technological innovations that have enabled this resource to be produced from shale formations.

Objectives: We reviewed the body of evidence related to exposure pathways in order to evaluate the potential environmental public health impacts of shale gas development. We highlight what is currently known and identify data gaps and research limitations by addressing matters of toxicity, exposure pathways, air quality, and water quality.

Discussion: There is evidence of potential environmental public health risks associated with shale gas development. Several studies suggest that shale gas development contributes to ambient air concentrations of pollutants known to be associated with increased risk of morbidity and mortality. Similarly, an increasing body of studies suggest that water contamination risks exist through a variety of environmental pathways, most notably during wastewater transport and disposal, and via poor zonal isolation of gases and fluids due to structural integrity impairment of cement in gas wells.

Conclusion: Despite a growing body of evidence, data gaps persist. Most important, there is a need for more epidemiological studies to assess associations between risk factors, such as air and water pollution, and health outcomes among populations living in close proximity to shale gas operations.

Citation: Shonkoff SB, Hays J, Finkel ML. 2014. Environmental public health dimensions of shale and tight gas development. Environ Health Perspect 122:787–795; http://dx.doi.org/10.1289/ehp.1307866

Introduction

Technological innovations in drilling and well-stimulation techniques have led to the production of natural gas from previously inaccessible geological formations, such as shale. Proponents of modern gas development argue that it has created a unique economic and political opportunity. Some in the public health community, however, have concerns about the potential for the extraction process to negatively impact the environment and human health (Finkel et al. 2013; Goldstein et al. 2012; Saberi 2013; Witter et al. 2013).

Producing natural gas from shale and tight gas formations in an economically feasible manner frequently requires a new constellation of existing technologies: high-volume, slickwater, hydraulic fracturing from clustered, multiwell pads using long directionally drilled laterals. This method can involve drilling a well vertically thousands of feet below the surface and then directionally (horizontally) for up to 2 miles. An average of 2–5 million gallons of fluid consisting of water, proppant (often crystalline silica), and chemicals (some of which are known carcinogens or otherwise toxic) are injected into the well at a pressure high enough to fracture the shale rock [U.S. Environmental Protection Agency (EPA) 2010a]. Chemicals often referred to as slickwater are added to the fracturing fluid to decrease its friction. The fracturing fluid creates and expands cracks in the shale. When the pressure is released, the cracks are held open by the sand, allowing the tightly held gases to flow into the cracks and up the production casing. The gas is then collected, processed, and sent through transmission pipelines to market. In 2012, shale gas constituted nearly 40% of U.S. gas production, up from 2% in 2000 (Hughes 2013).

Natural gas has a variety of attractive attributes. In the current market, it is a relatively inexpensive and abundant fuel. When combusted for electricity generation, it emits fewer health-damaging contaminants and approximately 50% less carbon dioxide emissions compared with burning coal (U.S. Energy Information Administration 2013). Yet, emerging scientific evidence suggests that there may be health risks associated with the development of shale gas.

In this review we discuss the body of scientific literature relevant to the environmental public health impacts of shale gas production. We highlight what is currently known and identify data gaps and research limitations.

Methods

Scope of review. For this review, we focused primarily on literature directly pertinent to the human health dimensions of shale and tight gas development. "Tight gas" refers to natural gas produced from reservoir rocks of low permeability, such as shale or sandstone. Shale gas and other forms of tight gas are referred to as "unconventional" because of their atypical reservoirs, which require new production techniques. However, we cite some studies that did not directly evaluate unconventional natural gas operations, but that are nonetheless relevant to various aspects of the overall process [e.g., particulate matter (PM) pollution, ozone]. In the case of ozone, for instance, we analyzed top-down studies that measured tropospheric concentrations rather than studies that supplied bottom-up measurements (e.g., leakage rates). Publications included in our review are predominantly sourced from the peer-reviewed scientific literature but include, where appropriate, government reports and other gray literature. Although the production chain of gas development is far reaching, we focused on the processes that begin with trucking the water, sand, chemicals, and other materials to the well pad, and end with the disposal of wastewater. Evidence suggests that these processes present the greatest risks to environmental public health and therefore have received the most attention in the scientific literature (Korfmacher et al. 2013; McKenzie et al. 2012; Rozell and Reaven 2012; Witter et al. 2013).

Terminology. Terminology is important when discussing modern forms of natural gas development. In part because of a lack of well-defined, uniform terminology, there has been confusion regarding which processes constitute this type of development. The terms, "hydraulic fracturing" or "fracking" are regularly used in the popular media as umbrella terms to describe the entire process of obtaining shale gas, as well as other forms of unconventional natural gas development, from land clearing and well spudding to transmission of natural gas to market. However, taken literally, "hydraulic fracturing" refers only to well-stimulation processes and excludes other potentially more health and environmentally

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We are grateful for comments and suggestions provided by A. Law (Weill Cornell Medical College) and R. Morello-Frosch (University of California, Berkeley).

S.B.C.S. and J.H. are employees of Physicians Scientists and Engineers for Healthy Energy (PSE), a nonprofit organization funded by private donations whose mission is to bring scientific transparency to discussions on energy sources and energy production. PSE received no funding for the preparation of this manuscript. M.L.F. declares she has no actual or potential competing financial interests.

Received: 9 November 2013; Accepted: 2 April 2014; Advance Publication: 16 April 2014; Final Publication: 1 August 2014.

impactful processes, including but not limited to well drilling, fracturing-fluid production, wastewater disposal, transportation of materials, and the processing, compression, and transmission of gas and liquids.

Many of the studies we cite in this review may also apply to other forms of oil and gas development that use well-stimulation techniques, including matrix acid stimulation, acid fracturing, and steam injection. However, these other techniques are beyond the focus of this review. The term "unconventional oil and gas development" can also refer to bitumen/tar sands extraction and processing, and other types of fossil fuel development that employ novel engineering and production techniques to obtain fuels from unconventional resources (e.g., coalbed methane) that are beyond the scope of our review. Because most of the environmental public health–relevant scientific literature on modern oil and gas production has focused on the development of natural gas from shale formations, we use the term "shale gas development." However, here we discuss, where appropriate, scientific literature on other forms of unconventional or tight gas development that include the most prominent and relevant features of shale gas development, such as high-volume, horizontal hydraulic fracturing.

Identification of relevant studies. The literature directly relevant to the environmental public health dimensions of shale gas development is still limited. For this reason, we adopted a broad search strategy comprising the following:

- Systematic searches in three peer-reviewed science databases across multiple disciplines: PubMed (http://www.ncbi.nlm.nih.gov/pubmed/), Web of Science (http://www.webofknowledge.com), and ScienceDirect (http://www.sciencedirect.com)
- Searches in existing collections of scientific literature on this subject, such as the Marcellus Shale Initiative Publications Database at Bucknell University (http://www.bucknell.edu/script/environmentalcenter/marcellus), complemented by Google (http://www.google.com) and Google Scholar (http://scholar.google.com)
- Manual searches (hand-searches) of references included in all peer-reviewed studies that pertained directly to shale gas development.

For bibliographic databases, we used a combination of Medical Subject Headings (MeSH)-based and keyword strategies, which included the following terms, as well as relevant combinations:

shale gas, shale, hydraulic fracturing, fracking, drilling, natural gas production, Marcellus, Barnett, Denver-Julesberg Basin, air pollution, methane, water pollution, public health, water contamination, fugitive emissions, air quality, epidemiology, unconventional gas development, and environmental pathways.

This search identified a total of 211 peer-reviewed publications that pertain directly to shale gas development. [This database, the PSE STUDY CITATION DATABASE on Shale Gas & Tight Oil Development, is available online (http://psehealthyenergy.org/site/view/1180), and we will continue to update it with relevant literature.] Of these 211 publications, only 33 presented original data that met our inclusion criteria and that we considered relevant as primary literature.

Inclusion/exclusion criteria. From the studies identified through 1 February 2014, we excluded nonrelevant technical papers and studies related to economics, climate change, sociology, regulation, seismicity, water usage, social stress, and quality of life considerations. Although we excluded commentaries from the results of our review, a few are cited in order to provide documentation of particular considerations among the public health community. We included studies with direct pertinence to the environmental public health and environmental exposure pathways (i.e., air and water) associated with shale and tight gas development. In this regard, we supplemented the shale gas literature with studies that evaluated particular environmental pathways and health outcomes. For instance, we included studies directly related to the health impacts of tropospheric ozone, fine particulate air pollution, and endocrine-disrupting chemicals (EDCs). We excluded the vast majority of non–peer-reviewed scientific literature, but environmental impact statements and other government reports are cited where appropriate.

Results

The environmental public health framework and possible exposure pathways. The environmental exposure pathway framework is often used to describe associations between pollutant sources and health effects via emissions, environmental concentrations of pollutants, pollutant exposure pathways (e.g., mouth, nose, ears, eyes, skin), and dose (i.e., micrograms of pollutant ingested per day) (Figure 1) (Agency for Toxic Substances and Disease Registry 2005).

Potential sources of health-relevant environmental pollution are present throughout many phases of shale gas development. These sources include shale gas production and processing activities (i.e., drilling, hydraulic fracturing, hydrocarbon processing and production, and wastewater disposal); the transmission and distribution of the gas to market (i.e., transmission lines and distribution pipes); and the transportation of water, sand, chemicals, and wastewater before, during, and after hydraulic fracturing.

Hydraulic Fracturing Fluids: Chemical Toxicology and Exposure Pathways

Shale gas development uses fracturing fluids that contain organic and inorganic chemicals known to be health damaging (Aminto and Olson 2012; U.S. House of Representatives, Committee on Energy and Commerce 2011). Fracturing fluids can move through the environment and come into contact with humans in a number of ways, including surface leaks, spills, releases from holding tanks, poor well construction, leaks and accidents during transportation of fluids, flowback and produced water to and from the well pad, and run-off during blowouts, storms, and flooding events (Rozell and Reaven 2012). Further, the mixing of these compounds under conditions of high pressure—and often high heat—may synergistically create additional potentially toxic compounds (Kortenkamp et al. 2007; Teuschler and Hertzberg 1995; Wilkinson et al. 2000). Compounds found in these mixtures may pose risks to the environment and to public health through numerous environmental pathways, including water, air, and soil (Leenheer et al. 1982).

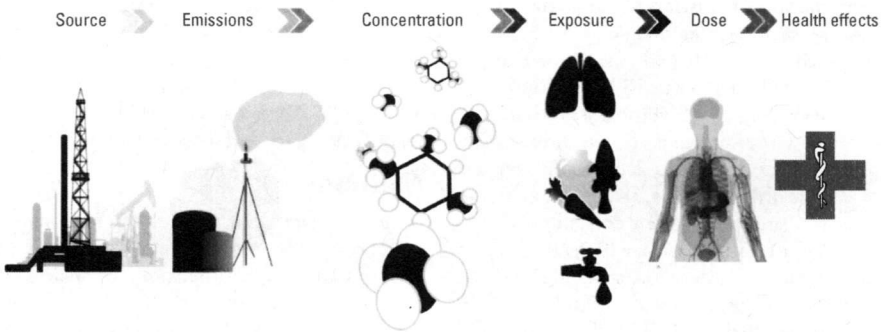

Figure 1. The environmental exposure pathway provides an analytical framework to describe, in broad terms, the connections between pollutant sources and human health outcomes. This framework begins with the emission source, in this case a well pad and associated infrastructure, which emit a variety of contaminants into the air, water, and soil. The concentrations of pollutants in the air, water, and soil that result from these emissions influence the magnitude of human exposures through organs such as the nose, mouth, and skin. Once the level of exposure is identified, it is then possible to estimate the dose, or how much of the pollutant is ingested in a given period of time. The dose, in turn, determines the health outcome.

Chemicals are used in drilling and fracturing processes as corrosion inhibitors, biocides, surfactants, friction reducers, gels, and scale inhibitors, among others (Aminto and Olson 2012; New York State Department of Environmental Conservation 2011; Southwest Energy 2012). These chemicals include methanol, ethylene glycol, naphthalene, xylene, toluene, ethylbenzene, formaldehyde, and sulfuric acid, some of which are known to be toxic, carcinogenic, or associated with reproductive harm (Colborn et al. 2011; New York State Department of Environmental Conservation 2011). Many of these compounds are considered hazardous water pollutants and are regulated in other industries (Clean Water Act of 1972; Safe Drinking Water Act of 1974; U.S. House of Representatives 2011).

Many of the chemical compounds used in the fracturing process lack scientifically based maximum contaminant levels, making it more difficult to quantify their public health risks (Colborn et al. 2011). Moreover, uncertainty about the chemical makeup of fracturing fluids persists because of the limitations on required chemical disclosure, driven by the Energy Policy Act of 2005. For instance, in many states, companies are not mandated to disclose information about the quantities, concentrations, or identities of chemicals used in the process on the principle that trade secrets might be revealed (Centner 2013; Centner and O'Connell 2014; Maule et al. 2013).

Some companies make efforts to be more transparent in the disclosure of chemicals used in the process. FracFocus (http://www.fracfocus.org) was developed as an online, voluntary chemical disclosure registry, and some agencies (e.g., Bureau of Land Management) have suggested that it be used as a regulatory compliance tool (Konschnik et al. 2013). However, the registry has been criticized because of uncertainty surrounding the timing, substance, and omissions of the disclosed data on the website (Konschnik et al. 2013).

Because of the limited information that is available, researchers have sought to acquire more information on the chemical makeup of fracturing fluids through other means. For example, using material safety data sheets, Colborn et al. (2011) identified 353 of 632 chemicals contained in 944 products used for natural gas operations in Colorado, and they examined available information on each product. Their study represents one of the first attempts to conduct a chemical hazard assessment by identifying some of the compounds in fracturing fluids.

It should be noted that the scope of the study by Colborn et al. (2011) is limited in that they did not measure exposure, dose, or health outcomes across populations. The researchers identified Chemical Abstract Service (CAS) numbers for the chemicals and used these in systematic searches of databases such as TOXNET (http://toxnet.nlm.nih.gov). On the basis of search results, the researchers classified the compounds into 12 health-effects categories. At certain concentrations or doses, > 75% of the chemicals they identified are known to negatively impact the skin, eyes, and other sensory organs; the respiratory system; the gastrointestinal system; and the liver. Fifty-two percent of the chemicals have the potential to negatively affect the nervous system, and 37% are candidate EDCs (Colborn et al. 2011).

EDCs present unique hazards, particularly during fetal and early childhood growth and development (Diamanti-Kandarakis et al. 2009). They can affect the reproductive system and epigenetic mechanisms that may lead to pathology decades after exposure (Zoeller et al. 2012). EDCs have challenged traditional concepts in toxicology because effects at higher doses do not always predict effects at low doses (Vandenberg et al. 2012). In other words, the dose does not always make the poison.

Kassotis et al. (2014) measured estrogen and androgen receptor activity in surface and groundwater samples in Colorado using reporter gene assays in human cell lines. Water samples collected from the more intensive areas of natural gas development exhibited statistically significantly more estrogenic, antiestrogenic, or antiandrogenic activity than references sites with either no operations or fewer operations (Kassotis et al. 2014). The concentrations of chemicals detected were in high enough concentrations to interfere with the response of human cells to male sex hormones and estrogen. This study by Kassotis et al. (2014) indicated that EDCs are a potential health concern in natural gas operations, and suggested that chemicals used in the process should be screened for EDC activity.

Air Quality

Air pollutant emission sources from shale gas development can be grouped into two main categories: *a*) emissions from drilling, processing, well completions, servicing, and other gas production activities; and *b*) emissions from transportation of water, sand, chemicals, and equipment to and from the well pad.

Air pollution: drilling, well stimulation, gas production, processing, and servicing. The literature suggests that shale gas development processes emit hazardous air pollutants including—but not limited to—BTEX compounds (benzene, toluene, ethylbenzene, and xylene), formaldehyde, hydrogen sulfide, acrylonitrile, methylene chloride, sulfuric oxide, nitrogen oxides (NO_x), volatile organic compounds (VOCs), trimethylbenzenes, aliphatic hydrocarbons, diesel PM, and radon gas (McKenzie et al. 2012; Pétron et al. 2012; Roy et al. 2013). These emissions can result in elevated air pollution concentrations that exceed U.S. EPA guidelines for both carcinogenic and noncarcinogenic health risks (McKenzie et al. 2012; Meteorological Solutions Inc. 2011).

McKenzie et al. (2012) used U.S. EPA guidance to estimate chronic and subchronic non-cancer hazard indices (HIs) and cancer risks from exposure to hydrocarbons for residents living > 0.5 mile and ≤ 0.5 mile from wells in Colorado. The authors found that residents living ≤ 0.5 mile from wells were at a greater risk for health effects from exposure to natural gas development than those living > 0.5 mile from wells. Notably, they found a subchronic non-cancer HI of 5 for those living ≤ 0.5 mile compared with an HI of 0.2 for those living > 0.5 mile from wells, which was driven primarily from exposure to trimethylbenzenes, xylenes, and aliphatic hydrocarbons (McKenzie et al. 2012). Unfortunately, baseline air quality data prior to the study were not available. However, the statistically significant spatial associations between air quality and shale gas development indicate that air quality may be negatively impacted and health risks may increase during various stages of shale gas development.

Bunch et al. (2013), however, found that shale gas production activities did not result in community-wide exposures to concentrations of VOCs at levels that would pose a health concern. They compared VOC concentration data from seven air monitors at six locations in the Barnett Shale region in Texas with federal and state health-based air comparison values (HBACVs) in order to determine possible acute and chronic health effects; none of the concentrations exceeded acute HBACVs (Bunch et al. 2013). Air quality data included in their study were generated from monitors focused on regional atmospheric concentrations of pollutants (Bunch et al. 2013). Conversely, McKenzie et al. (2012) included samples at the community level in close proximity to gas development. Finer geographically scaled samples often capture local atmospheric concentrations that are more relevant to human exposure. This may be a primary reason why health hazard estimates differed between the two studies.

Roy et al. (2013) estimated emissions of NO_x, VOCs, and PM for an air emissions inventory for the development of natural gas in the Marcellus Shale region for 2009 and 2020. They predicted that, in 2020, shale gas development activities would contribute 6–20% (mean, 12%) of the NO_x emissions and 6–31% (mean, 12%) of anthropgenic VOC emissions in Pennsylvania. However, these estimates were based on assumptions of improvements in gas production, completion,

and processing infrastructure. If source-level emissions remain the same as in 2009, Marcellus VOC emissions were predicted to constitute approximately 34% (19–62%) of the regional anthropogenic VOC emissions in 2020 (Roy et al. 2013). Increases in emissions of VOCs and NOx, which are precursors of tropospheric ozone formation, could complicate ozone management in the region and potetentially offset ozone precursor emission reductions in other sectors at a time when several regions in Pennsylvania struggle to be within ozone attainment (Roy et al. 2013).

In another study focused on hydrocarbon emissions, Colborn et al. (2014) assessed air quality in western Colorado using weekly air samples collected before, during, and after drilling and hydraulic fracturing on a new natural gas well pad. They found numerous chemicals in the air samples that are associated with natural gas development operations, most notably methane, ethane, propane, and other alkanes. Many non-methane hydrocarbons (NMHCs), which were observed during the initial drilling phase, are associated with multiple health effects. Notably, 30 of the NMHCs they observed in the field were EDCs. In addition to the direct air pollution associated with natural gas drilling and processing (e.g., NMHCs, VOCs) outlined above, there are also indirect pollution concerns, such as the secondary atmospheric formation of tropospheric (ground-level) ozone (Colborn et al. 2014).

Studies have indicated that shale gas development is associated with the production of secondary pollutants such as tropospheric (ground-level) ozone, which is formed through the interaction of methane, VOCs, and NO_x in the presence of sunlight (Jerrett et al. 2009; U.S. EPA 2013). Tropospheric ozone is a strong respiratory irritant associated with increased respiratory and cardiovascular morbidity and mortality (Jerrett et al. 2009; United Nations Environment Programme 2011). Although toxicological data suggest that pure methane is not by itself health damaging (excluding its role as an asphyxiant and an explosive), it is a precursor to global tropospheric ozone (Smith et al. 2009).

Pétron et al. (2012) analyzed data collected at the National Oceanic and Atmospheric Administration (NOAA) Boulder Atmospheric Observatory (http://www.esrl.noaa.gov/psd/technology/bao) and filtered by wind sector, which indicated a high alkane and benzene signature from the direction of the Denver-Julesburg Basin, an area of considerable oil and gas development. The researchers found that an estimated 4% (range, 2.3–7.7%) of all natural gas (composed mostly of methane) produced was being accidentally leaked or purposefully vented to the atmosphere (Pétron et al. 2012). Karion et al. (2013) observed significant methane leaks in the Uintah Basin shale gas field, with an estimated 6.2–11.7% of total gas production leaking into the atmosphere.

In a national methane emissions study that combined ground and aerial sampling of methane with computer modeling, Miller et al. (2013) found that atmospheric levels of methane due to oil and gas extraction could be 4.9 ± 2.6 times greater than current estimates from the Emissions Database for Global Atmospheric Research (EDGAR) (http://edgar.jrc.ec.europa.eu/index.php) and the U.S. EPA. Although it is difficult to distinguish the sources of methane between oil and gas production and gas production, transmission, and storage, Peischl et al. (2013) estimated that 17% of gross methane production from oil and gas activities in the Los Angeles Basin are leaked or vented to the atmosphere.

Some studies have modeled ozone impacts associated with shale gas operations. Kemball-Cook et al. (2010) modeled ozone precursor emissions (VOCs and NO_x) in the Haynesville Shale play that lies beneath the northeast Texas/northwest Louisiana border. Photochemical modeling for 2012 showed increases in 8-hr ozone design values of up to 5 ppb, which, along with the amount of projected emissions, give cause for concern about future atmospheric concentrations of ozone in Texas and Louisiana (Kemball-Cook et al. 2010). Olaguer (2012) used the Houston Advanced Research Center (HARC) neighborhood air quality model to simulate ozone formation near a hypothetical natural gas–processing facility, using estimates based on both regular and nonroutine (e.g. flaring) emissions. This model predicted that under average conditions, using regular emissions associated with compressor engines may significantly increase ambient ozone in the Barnett Shale formation (> 3ppb at 2 km downwind from the facility) (Olaguer 2012).

Substantial air quality impacts from oil and natural gas operations in Wyoming, Colorado, Utah, and Texas have also been directly measured (Carter and Seinfeld 2012; Edwards et al. 2013; U.S. Department of Energy 2011). Schnell et al. (2009) studied air quality in the rural Upper Green River Basin (UGRB) of Wyoming near the Jonah-Pinedale Anticline natural gas field in February 2008. They observed high photochemical ozone concentrations in the UGRB in the winter, reporting readings of up to 140 ppb, just less than double the U.S. EPA ozone concentration limit of 75 ppb (U.S. EPA 2012a). Before 2005, typical wintertime ozone concentrations in this area were 30–40 ppb (Pinto 2009). This increase in ozone concentration during this time period could be associated with the increase in NO_x and VOC emissions from oil and gas development activities in the area (Schnell et al. 2009). In a study conducted for the Wyoming Department of Environmental Quality, Meteorological Solutions Inc. (2011) found that the 8-hr ozone concentrations in the UGRB in 2011 exceeded the U.S. EPA ozone 8-hr standard for 13 days (Meteorological Solutions Inc. 2011) and exceeded the U.S. EPA scientists-recommended limit of 65 ppb for 25 days (Weinhold 2008).

In Utah there were 68 days in the winter of 2010 when ozone levels exceeded the U.S. EPA ozone standard of 75 ppb, and in 2011 there were readings more than double the U.S. EPA standard (Utah Department of Environmental Quality 2013). Results of experiments conducted by the U.S. EPA and NOAA indicated that ozone precursor emissions (VOCs and NO_x, primarily) from oil and gas development in the Uintah Basin in Utah were a primary factor in the increased ozone level (Utah Department of Environmental Quality 2013).

Crystalline silica sand, used as a proppant (to "prop" open cracks in the target formation to allow gas to flow up the well), is delivered by trucks to the drilling site. Transporting this sand in trucks and trains and mixing it into fracturing fluids with sand movers, conveyer belts, and blender hoppers at the well site release silica dust into the air, where well-pad workers can be exposed (Esswein et al. 2013). Workers experience the most direct exposure; however, silica dust may also be an air contaminant of concern to nearby residents. The etiological association between respiratory exposure to silica dust and the development of silicosis is well known [Centers for Disease Control and Prevention (CDC) 1992, 2002]. Silicosis is a progressive lung disease in which tissue in the lungs reacts to silica particles, and can result in inflammation and scarring, which decreases the ability of the lungs to take in oxygen (CDC 1992, 2002). Respiratory exposure to silica is also associated with other diseases such as chronic obstructive pulmonary disease, tuberculosis, kidney disease, autoimmune conditions, and lung cancer (CDC 2002).

In cooperation with industry partners, Esswein et al. (2013) collected full-shift air samples at 11 sites in five states to determine levels of worker exposure. Of 111 air samples, 51.4% showed silica exposures greater than the calculated Occupational Safety and Health Administration permissible exposure level and 68.5% showed exposures greater than the National Institute for Occupational Safety and Health recommended exposure limit of 0.05 mg/m^3 (Esswein et al. 2013). Further, these researchers noted that the type of respirators worn by workers were not sufficiently protective in some cases, given the

magnitude of silica concentrations (Esswein et al. 2013).

Air pollution: transportation. Each well requires on average between 2 and 5 million gallons of water per hydraulic fracturing event (U.S. EPA 2010a). Water is generally not pumped directly to wells but is instead transported by diesel trucks, each of which has an approximate capacity of 3,000 gallons (U.S. EPA 2011b). It has been estimated that approximately 2,300 trips by heavy-duty trucks are required for each horizontal well during early stages of shale gas development (New York State Department of Environmental Conservation 2011). With thousands of such wells concentrated in high-development regions, levels of truck traffic and diesel-associated air pollution will increase in these areas.

The pollutant of primary health concern emitted from the transportation component of shale gas development is fine diesel PM. Diesel PM is a well-understood health-damaging pollutant that contributes to cardiovascular illnesses, respiratory diseases (e.g., lung cancer) (Garshick et al. 2008), atherosclerosis, and premature death (Pope 2002; Pope et al. 2004). For example, a study from the California Air Resources Board (Tran et al. 2008) indicated that there is an expected 10% (uncertainty interval: 3%, 20%) increase in the number of premature deaths per 10-$\mu g/m^3$ increase in $PM_{2.5}$ (PM ≤ 2.5 μm in aerodynamic diameter) exposure. Particulates can also contain concentrated associated products of incomplete combustion, and when particle diameter is < 2.5 μm, they can act as a delivery system to the alveoli of the human lung (Smith et al. 2009). In addition to diesel PM, as previously mentioned, NO_x and VOCs—other pollutants prevalent in diesel emissions—react in the presence of sunlight and high temperatures to produce tropospheric (ground-level) ozone.

Water Quality

Rozell and Reaven (2012) conducted a risk assessment that identified five main pathways of water contamination in the shale gas production process: *a*) transportation spills of fracturing fluid or produced water; *b*) well casing leaks; *c*) leaks through fractured rock; *d*) drilling site discharge; and *e*) wastewater disposal. They found that wastewater disposal carries a potential risk of water contamination several orders of magnitude larger than that of the other pathways (Rozell and Reaven 2012).

Other studies have suggested that structural impairment of cement used to prevent transzonal gas migration in the wellbore is the most common mechanism through which groundwater can become contaminated (Vidic et al. 2013). Indeed, state environmental regulators at the Pennsylvania Department of Environmental Protection found that oil and gas development was responsible for polluting water supplies for at least 161 residences in Pennsylvania between 2008 and 2012, primarily due to cement structural integrity in wells and wellbores (Legere 2013). For the purpose of this review, we focused primarily on well casing leaks, drilling site discharge, and wastewater disposal because these are generally regarded as the most viable means of water contamination (Rozell and Reaven 2012; Vidic et al. 2013).

Flowback and produced water. Estimates of the proportion of fracturing fluid that returns to the surface as flowback and produced waters range from 9% to 80%, with most estimates around 35% (Horn 2009; New York State Department of Environmental Conservation 2011; U.S. EPA 2010a). These wastewaters contain the chemicals used in the fracturing fluid as well as compounds found deep in geological strata, such as salts, chlorides, heavy metals (e.g., cadmium, lead, arsenic), organic chemicals (e.g., BTEX compounds), bromide, and—depending on the geology—naturally occurring radioactive materials (e.g., radium-226). Many of these naturally occurring compounds are associated with human health effects when exposure is sufficiently elevated (Balaba and Smart 2012; Colborn et al. 2011; Haluszczak et al. 2013). A proportion of flowback and produced waters are treated and released as effluent or for other beneficial uses, such as irrigation for agriculture. However, many of the chemicals persist in high quantities because treatment facilities are unable to screen for and eliminate the complex array of compounds and products of synergistic interactions among them (Ferrar et al. 2013; Hladik et al. 2014; Lutz et al. 2013).

Flowback and produced water are sometimes treated at facilities and then discharged into surface waters (Ferrar et al. 2013). Warner et al. (2013a) examined water quality and isotopic compositions of discharged effluents, surface waters, and stream sediments associated with a Marcellus wastewater treatment facility site. Their findings suggest that insufficiently treated flowback and produced water that contained elevated concentrations of contaminants associated with shale gas development entered local water supplies, even after treatment. They also found elevated levels of chloride and bromide downstream, along with radium-226 levels in stream sediments at the point of discharge, that were approximately 200 times greater than upstream and background sediments and well above regulatory standards (Warner et al. 2013a). These types of water emissions may increase the health risks of residents who rely on these surface and hydrologically contiguous groundwater sources for drinking water (Wilson and VanBriesen 2012) and sources of food (i.e., fish protein) (Papoulias and Velasco 2013).

In a meta-analysis of chemical and physical characterizations of produced waters from shale gas, Alley et al. (2011) found that most of the produced waters generated by shale gas development were classified as saline (> 30,000 mg/L) or hypersaline (> 40,000 mg/L). These authors pointed out that treatment of this produced water for beneficial use often involves reverse osmosis, a practice that may generate a waste stream too large to justify the activity. Alley et al. (2011) also found that prior to treatment, produced waters can exceed toxicity thresholds of contaminants of concern, including—but not limited to—phosphates, cadmium, aluminum, barium, chloride, strontium, radium-226, bromine, lithium, and magnesium. Toxicity thresholds used in their meta-analysis were LC_{50} values (concentration lethal to 50%) for *Ceriodaphnia dubia* Richard, *Daphnia magna* Straus, and *Pimephales promelas* Rafinesque, and water-use criteria from the Food and Agricultural Organization of the United Nations guidelines for agricultural uses and the U.S. EPA Water Quality Criteria for surface discharge (Alley et al. 2011).

The results of Alley et al. (2011) agree with other reports that samples of fracturing fluids, drilling muds, and flowback and produced waters in wastewater–surface containment ponds contain chemicals that, at elevated doses or certain concentrations, have been associated with health effects ranging from skin and eye irritation to neurological and nervous system damage, cancer, and endocrine disruption (Colborn et al. 2011). Moreover, between July 2009 and June 2010, 192.5 million gallons of produced water was reported in Pennsylvania alone, with no certainty as to the location and type of disposal to be employed (Pennsylvania Department of Environmental Protection 2010).

The handling and disposal of flowback and produced water also hold implications for air quality because of volatile compounds, such as BTEX compounds, that are often mixed with the fluids. This may be particularly relevant when wastewater is stored in surface containment ponds and misted into the air to promote evaporation (Colborn et al. 2011).

Gas and fluid migration. Subsurface gas and fluid migration is most commonly associated with impaired structural integrity of well cement and, to a lesser extent, well casings. Failures in well barriers may allow intrusion of gases and fluids from producing formations below the casing shoe or from shallower gas- and fluid-bearing formations intersected by the wellbore to lower-pressure annuli. This may result in annular gas flow or sustained

casing pressure and thus become a pathway for gas migration to the surface, a known mechanism of emissions of gases to the air and migration of gases and fluids to groundwater (Brufatto et al. 2003; Watson and Bachu 2009). Methane and other hydrocarbons can also migrate along improperly plugged wells, through an inadequately sealed annulus, or between geological zones as a result of cement failures in the wellbore (Vidic et al. 2013).

Leaking oil and gas wells have been recognized as a potential mechanism of subsurface migration of methane and heavier *n*-alkanes and other non-methane VOCs into groundwater and the atmosphere, contributing risks to drinking water and air quality (Bourgoyne et al. 2000; Brufatto et al. 2003; Chilingar and Endres 2005; Watson and Bachu 2009). Cement failures in onshore and offshore wells, reported to occur in 2–50% of all wells, provide pathways for gas migration to occur in the wellbore (Bourgoyne et al. 2000; Brufatto et al. 2003; Watson and Bachu 2009).

Because methane has a low solubility (26 mg/L at 1 atm, 20°C) (Vidic et al. 2013) and is relatively unreactive compared with longer-chain and unsaturated hydrocarbons (Jackson et al. 2011), it is typically regarded as nontoxic and is not regulated in the United States as a solute in water wells. However, there are no peer-reviewed studies on the health effects of chronic exposure to lower concentrations of methane in drinking water or indoor or outdoor air (Jackson et al. 2011). Further, if there is a pathway for methane migration, there could be a pathway for associated health-damaging gases coproduced with methane.

Some attention has been paid to the flammability of methane, the risk of explosions, and the risk of asphyxiation (primarily in high indoor concentrations). For example, in 2007 in Geauga County near Cleveland, Ohio, methane contaminated a water well and a home exploded; the Ohio Department of Natural Resources blamed a faulty concrete casing in a nearby gas well (Ohio Department of Natural Resources 2008). Similarly, in Pavillion, Wyoming, high concentrations of methane found in drinking water wells were attributed to gas production activities (DiGiulio et al. 2011). In addition, the U.S. EPA concluded that methane from geological layers not targeted for gas production migrated up the wellbore to an aquifer as a result of well cement failures in Parker County, Texas (U.S. EPA 2010b).

In certain regions, methane can naturally occur in aquifers, and there are conflicting scientific opinions about whether its presence is caused or exacerbated by shale gas development (Davies 2011; Saba and Orzechowski 2011; Schon 2011). However, there are convincing findings that shed light on the likelihood that shale gas development is associated with high methane levels in drinking water wells. Osborn et al. (2011) found that communities in Pennsylvania that had active shale gas development (one or more gas wells within 1 km) had statistically significantly higher concentrations of methane in their water wells compared with nonextraction sites (no shale gas wells within 1 km). The chemical signature of the methane found in drinking water wells in the active area indicated that the methane came from a high-pressure, deep-earth source (thermogenic methane). Alternatively, the methane from nonactive sites had signatures of shallow earth origins (biogenic methane). This suggests that shale gas production processes were the source of the methane contamination (Osborn et al. 2011).

Building on previous work by Osborn et al. (2011), Jackson et al. (2013) analyzed 141 drinking water wells across northeastern Pennsylvania. The researchers found methane in 82% of the samples (115 of 141 wells), with average concentrations six times higher for homes that were < 1 km from natural gas wells (59 of 141). These data, based on isotopic signatures and gas ratios, suggest that a subset of homeowners living < 1 km from shale gas wells had drinking water that was contaminated with stray gases associated with gas development activities (Jackson et al. 2013).

There is evidence that, in some locations, pathways exist between deep underlying formations and shallow drinking water aquifers (Vengosh et al. 2013). A modeling study by Myers (2012) suggested that pathways would allow for the transport of contaminants from the fractured shale to aquifers. Warner et al. (2012) found evidence of possible migration of Marcellus brine through naturally occurring pathways, based on strong geochemical fingerprints in salinized groundwater samples.

Both of these studies (Myers 2012; Warner et al. 2012) suggest that migration through fractured rock can serve as a subsurface contamination pathway to underground sources of drinking water. They also highlight the significance of the specific geographic configuration because some shallow drinking water resources are at more risk for contamination than others. In a study of the Fayetteville Shale in Arkansas, Warner et al. (2013b) suggested that methane contamination of shallow groundwater may not be a problem in certain shale formations. This difference may be attributed to geological variations across geographic space, including the presence of intermediate gas-bearing formations that are found overlying parts of some shale plays (e.g., Marcellus) but not others (e.g., Fayetteville).

In addition, Fontenot et al. (2013) evaluated water quality in private drinking water wells near natural gas operations in the Barnett Shale formation in Texas and found higher levels of arsenic, selenium, strontium, and total dissolved solids in wells located within 3 km of active gas wells. The authors used historical data from the region as a baseline to determine the contamination rates before the expansion of natural gas operations. Although heavy metals were present at low levels in aquifers in the region, concentrations were significantly higher in areas of active development (Fontenot et al. 2013). The authors were able to link contamination to natural gas activities; however, the specific factor responsible for contamination (e.g., well casing failures, mobilization of natural constituents, hydrogeochemical changes from lowering the water table) was not determined (Fontenot et al. 2013).

Researchers have been challenged in their ability to link associations between water contamination and unconventional natural gas development to any particular part of the process. After complaints about the taste and odor of well water from residents of Pavillion, Wyoming, the U.S. EPA initiated a groundwater investigation (DiGiulio et al. 2011). The observed water wells were located in an area known as the Pavillion gas field, which contained 169 gas production wells and 33 containment ponds used for storage/disposal of drilling wastes and produced and flowback waters from unconventional natural gas development of a sandstone formation.

From 2009 to 2011 the U.S. EPA conducted four sampling events meant to determine the presence (not extent) of groundwater contamination in the formation. In that study, DiGiulio et al. (2011) detected elevated concentrations of benzene, toluene, ethylbenzene, and xylenes (BTEX) in sampling wells at concentrations of 246, 617, 67, and 750 µg/L, respectively. Trimethylbenzenes and diesel range organics were detected at concentrations up to 105 and 4,050 µg/L, respectively, and total purgeable hydrocarbons were detected in the groundwater samples near the containment ponds (DiGiulio et al. 2011). Although these initial data indicated groundwater impacts that seem likely to be associated with unconventional gas production practices (U.S. EPA 2011a), the results of the study by DiGiulio et al. (2011) have been contested, and it is still unclear which part of the gas development process (if any) is responsible for the contamination. Further, there are geological differences between sandstone and shale, and fracturing is often conducted closer to the surface in sandstone formations. However, the findings suggest an association between water contamination and production activities that have also been identified in shale gas development (DiGiulio et al. 2011).

Site discharge and improper waste disposal. Fracturing fluids and produced waters can also contaminate underground sources of drinking

water during waste management and disposal. Flowback and produced waters are often contained in evaporation ponds, pits, and tanks, in some cases in very close proximity to residences (Bamberger and Oswald 2012; Rozell and Reaven 2012). These containment ponds are often, but not always, lined to protect against leakage; however, case studies have documented reported ruptures to these liners that may have led to water and soil contamination and contributed to fish and livestock deaths (Bamberger and Oswald 2012). An analysis of waste obtained from reserve pits indicated the potential for exposure to technologically enhanced naturally occurring radioactive material and potential health effects from individual radionuclides (Rich and Crosby 2013).

Groundwater contamination can also result from surface spills at active well sites. Gross et al. (2013) analyzed data from the Colorado Oil and Gas Conservation Commission (http://cogcc.state.co.us) and noted 77 reported surface spills (associated with < 0.5% of active wells) impacting groundwater in Weld County, Colorado. The groundwater samples were analyzed for BTEX components. Most notably, benzene measurements exceeded the U.S. EPA National Drinking Water maximum contaminant level of 5 ppb in 90% of the samples (Gross et al. 2013). Because baseline-sampling measurements were not available, the background BTEX concentrations remain unclear. However, natural groundwater concentrations are typically low near deposits of crude oil, coal, and natural gas (Gross et al. 2013).

Discussion

Future research needs. There is a growing body of scientific literature on the environmental public health dimensions of shale gas development; however, a number of important data gaps persist. Measurements of emissions and atmospheric concentrations should be conducted among diverse geographies, both indoors and outdoors, to help to estimate the types and magnitude of population exposures to pollutants associated with shale gas development. In addition, studies that take into account personal exposures and time–activity patterns of individuals would be helpful in assessing epidemiologically meaningful exposures. These studies could include the use of personal monitors and sampling of household drinking water in conjunction with health records to look at disease outcomes.

Perhaps the most important information gap is the lack of epidemiological studies. There is a need to assess the strength of the association between risk factors, such as air pollution and water contamination, and health outcomes among populations living in close proximity to shale gas develoment activities compared with those populations living in areas without these activities. Although lacking in definitive proof of cause and effect, self-reporting health surveys and environmental testing have suggested possible adverse health outcomes from shale gas development in Pennsylvania (Steinzor et al. 2013). Of particular interest are the epidemiological studies on vulnerable populations, including pregnant women, young children, the elderly, and those with compromised immune systems, who live, work, and play in close proximity to shale gas development. Because workers are likely to be the first and the most exposed demographic from shale gas development, further occupational health studies are also needed.

There have been some efforts in epidemiology and risk assessment, including a recent retrospective cohort study by that examined associations between maternal residential proximity to natural gas development and a number of birth outcomes. The authors found no positive association between density and proximity of wells within a 10-mile radius of maternal residence and prevalence of oral clefts, preterm birth, or term low birth weight. However, the researchers did observe a positive association between density and proximity of pregnant mothers to shale gas development and the prevalence of congenital heart defects and possibly neural tube defects in their newborns (McKenzie et al. 2014).

There have been some other epidemiological efforts as well, including a study funded by America's Natural Gas Alliance that evaluated associations between childhood cancer incidence in Pennsylvania and hydraulic fracturing sites (Fryzek et al. 2013). The authors included 29,000 hydraulically fractured wells drilled between 1990 and 2009 in their analysis and obtained data on childhood cancers from the Pennsylvania cancer registry for this time period. However, shale gas development did not begin in Pennsylvania until 2006, when four wells of this type were drilled. In fact, only 726, or 2.5% of the 29,000 wells in their database, were relevant to directionally drilled shale gas wells. Unfortunately, this exposure misclassification and the disregard for the extended latency periods of many childhood cancers render this study inconclusive as to the effect of shale gas development on childhood cancer rates. The study by Fryzek et al. (2013) demonstrates the need for more epidemiological assessments that pay attention to the latency periods of environmentally mediated diseases.

Epidemiological investigations are challenged by the difficult task of identifying specific risk factors and the uncertainty in exposure classification because compounds used in shale gas development are often not disclosed. In these cases of uncertainty, a comprehensive water monitoring and—under certain circumstances, a biomonitoring program—that uses both targeted and nontargeted strategies would be useful. Useful data could be generated by targeted testing for specific compounds known to be associated with shale gas development in drinking water supplies and in the blood and urine of a representative sample of individuals living in close proximity to shale gas development. Nontargeted techniques, including time-of-flight mass spectrophotometers (TOF-MS), may also be helpful. Rather than monitoring for individual chemicals, TOF-MS has been important for the progress of biomonitoring in recent years by allowing researchers to monitor for tens of thousands of organic compounds at a time. This enables researchers to circumvent policy issues that do not require companies to disclose the compounds they employ in their activities, such as is the case in many regions throughout the United States.

Even with full disclosure of the chemicals added to fracturing fluid, the ability to link chemicals to specific health outcomes remains difficult. Fracturing fluids and flowback and produced wastewaters are complex mixtures of chemicals with individual and possibly cumulative and synergistic properties. Many health outcomes are not specific to chemicals associated with shale gas development (e.g., headaches can be caused by a number of factors, rashes can be nonspecific, and asthma can be induced through a number of pathways), complicating the task of assessing associations between exposures and health outcomes. In turn, more exposure assessments and water and air monitoring should be undertaken to investigate the full suite of compounds emitted to the environment from these activities.

The chemicals contained in fracturing fluids are often not publicly disclosed because of trade secret laws and exemptions under the Energy Policy Act of 2005 that further confound environmental public health research. Moreover, the U.S. EPA is precluded from regulating hydraulic fracturing under the Safe Drinking Water Act (1974), and Congress expressly exempted hydraulic fracturing from the Underground Injection Control program (U.S. EPA 2012b). The nondisclosure of these chemicals creates research barriers because it is difficult to monitor for unknown compounds.

Limitations. In this review, we focused on the peer-reviewed scientific literature on the environmental public health dimensions of shale gas development. Although we used a broad search strategy, some publications and other relevant data could have been missed in our literature searches. However, we consider this to be a substantive summary of the currently available literature. Results of future studies will clarify the scientific understanding of the environmental public health concerns of shale gas development.

Conclusion

We reviewed the body of evidence of potential environmental public health dimensions of shale gas development. Scientific modeling and field investigations have helped to illuminate the emerging environmental issues with which shale gas production may be associated. Several studies have suggested that shale gas development contributes to pollutants in ambient air at concentrations known to be associated with increased risk of morbidity and mortality (Colborn et al. 2014; Kemball-Cook et al. 2010; McKenzie et al. 2012, 2014). Similarly, some evidence supports theories of water contamination risks through a variety of pathways, most notably during wastewater transport and disposal and through failed cement in wells with poor structural integrity (Vengosh et al. 2013; Vidic et al. 2013; Warner et al. 2013a). The existing peer-reviewed scientific data suggest that there are potential risks that could possibly influence public health. More research is needed to clarify the magnitude of these concerns. Because shale gas development activities have accelerated dramatically over the past decade, the need for well-designed empirical studies becomes increasingly apparent.

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Jocelyn Burr

Preferred changes to Amendments to Chapter 342 of Revised Statutes of Petroleum Resources Act

The purpose of my submission is not to advise this Committee of the risks or externalities associated with Hydraulic fracturing, yet given that a government decision to draft preventative legislation is the entire reason we are here I'm assuming you will acknowledge there to be some. I want to rather take this time explain four changes with I would like to see made to the Amendments in question which will create an appropriate legislative tool.

1. I would like to suggest that the definition for hydraulic fracturing be included in the amendments as follows: "Injecting fluids into or releasing formations fluids from a geological formation at a force exceeding the parting pressure of the rock inducing a network of fractures through which natural gas can flow to the wellbore " (adapted from Council of Canadian Academies, 2014)

With a definition of hydraulic fracturing included in the text of the amendments, and therefore the act, both MLAs and the people could see what is being prohibited and what is being allowed. Without defining the activities that are prohibited in the Act there is no legislated ban. The lack of a legislated ban is the lack of a contract between the government of Nova Scotia and its people. Without that definition there is going to be a lack of trust between the government and its people, no matter the ultimate text included in the regulations.

2. I would like you to remove the current sentence providing an exemption clause for research and testing.

"Research" and "testing"are not defined in the Act or in regulations. There are no regulatory bodies currently able to handle the oversight needed for research and testing in this area. There is not physical infrastructure to deal with the material production from research and testing operations. The lack of royalty structure means there is no compensation for the risks associated with research and testing, and with active leases " polluter pays" legislation is not able to be enforced.

3. Remove the wording of " shale formations" and replace with "formations which contain naturally occurring hydrocarbons". \

Coal bed methane uses similar technology to hydraulic fracturing and has similar consequences. Moreover coal bed methane is again only economical when done with a large number of wells in a concentrated area. It still produces formation water with NORMS< heavy metals and drilling chemicals.

4. Strike the wording which authorizes the Minister responsible for the Petroleum Resources Act to conduct a review of high-volume hydraulic fracturing and rewrite explicitly stating the public forum and community-based decision making process which is required for any change in legislation to these amendments.

The minister is not a community. During extensive work by the Wheeler Review panel the common recommendation was for the ultimate decisions to be community based. Moreover on Sept. 3, 2014 Min. Andrew Younger promised a) The people of Nova Scotia own the resources of the province and have the right to decide what is done with them. b) Create energy options supported by the Assembly of Nova Scotia Mi'kmaq chiefs. The wording of this acts reflects non of this .

Good afternoon.

My name is Jane MacKay --- citizen, educator, business owner.

In the course of our business we have designed and developed educational and resource material for entrepreneurial start-ups and provided coaching and counselling and assistance in business plan writing to approximately 1,000 businesses.

There is not enough time here to go into the number of stories we have heard about bureaucratic and attitudinal barriers to starting businesses in this Province.

Let me say that the image one builds with business owners or customers is cumulative. And I have heard enough to believe that the tipping point is coming here; that the not open for business sign is on the door.

If anyone here heard Ken Rowe's remarks yesterday morning you know that I am not alone in thinking this.

In my work and community activities here are some examples of what I see and hear:

- the College of Registered Nurses of Nova Scotia has the longest application process for out of Province, already licensed and currently working RN's, of any in the country. I know of one nurse, for example, who was working in another province and four months after moving to NS still had not managed to become licensed here.

-Dental hygienists moving here from out of province face the same challenges.

- A TSE listed, perhaps the largest, heavy metal exploration company spends a million dollars annually in Eastern Canada on summer prospecting activities. They do not come to Nova Scotia. They are quoted to me as saying New Brunswick and Newfoundland say what can we do to help and Nova Scotia says here is what we are going to do to you.

- Our son is a 30 something pursuing a successful career in Seattle WA. He and his friends, who are also working elsewhere and some of whom have returned here think Nova Scotia is the most difficult place in the country to try to get anything done for a start up business.

- The Federal Government currently has a moratorium on the issuing of oyster growing leases in Nova Scotia. Nova Scotia oyster farmers, unlike lobster fishers, can sell everything they can grow. Oysters, unlike salmon, clean the marine environment. I am not aware that the Provincial Government is doing anything to correct this

economically damaging policy. Some applicants for oyster leases have, I am told, been in the process for as long as seven years.

- If I register a business in BC, Alberta or Saskatchewan it is automatically registered in the other two provinces. I recently spoke with a manager of a NB registered business who is trying to do business throughout Atlantic Canada. He says the cost of operating and managing red tape in the four Atlantic Provinces is financially and mentally draining.

The point is there is not much doubt we have a reputation of being a very difficult place to do business or get qualifications recognised and my experience is it is deserved. It is interesting to note that Seattle, WA, where I mentioned my son lives, has no state income tax and the sales tax is a little under 10%.

It is the home of Amazon, Google, Microsoft, Starbucks, Celestial Seasonings Tea.....

We cannot in my or your lifetimes aspire to zero provincial income tax. However we can adopt policies which let aspiring start-ups and established businesses know we are interested in helping them get established here.

We can hang out a BIG open for business sign.

Lest anyone thinks I am unconcerned about potential hazards of resource extraction I would like to quote from Dean Jobb's book about the disaster that was Westray. (Page 169)

The Nova Scotia Government's website states:

> Most issues attributed to hydraulic fracturing have been traced back to poor drilling practices rather than the fracture operation itself.
>
> Nova Scotia has rules and regulations designed to protect against poor drilling practices.
>
> Since the commercial application of hydraulic fracturing in the late 1940s, more than a million wellbores have been drilled and stimulated using hydraulic fracturing.

The ban on fracturing proposed by the government in this bill suggests to the world (a lot of Pictonians already believe it) that we are incapable of developing safe, enforceable regulations for resource industries. Or if we are it will take years to do so. In this world to be successful is to be nimble.

Ray Ivany's report speaks to changing attitudes in Nova Scotia as a key ingredient to changing our economic fortunes.

As we speak the opening ceremony for the International Slow Food Annual Conference in Turin Italy is probably concluding. There are at least five delegates from Nova Scotia there. I am willing to bet none of them are free range chicken growers or small turkey processors.

We need the government to be leaders in this change of attitude not the last person turning out the lights. Please consider the message being sent to the rest of the country with Bill 6 - Petroleum Resources Act (amended) An Act to Amend Chapter 342 of the Revised Statutes, 1989, the Petroleum Resources Act

In closing I would like to add my voice to those Nova Scotians who believe it is hypocritical to take the gas generated by fracturing in other Provinces and ban it here.

Jane MacKay
Dartmouth, NS
902 469-2022

October 22, 2014

Good afternoon.

My name is Jane MacKay --- citizen, educator, business owner.

In the course of our business we have designed and developed educational and resource material for entrepreneurial start-ups and provided coaching and counselling and assistance in business plan writing to approximately 1,000 businesses.

There is not enough time here to go into the number of stories we have heard about bureaucratic and attitudinal barriers to starting businesses in this Province.

Let me say that the image one builds with business owners or customers is cumulative. And I have heard enough to believe that the tipping point is coming here; that the not open for business sign is on the door.

If anyone here heard Ken Rowe's remarks yesterday morning you know that I am not alone in thinking this.

In my work and community activities here are some examples of what I see and hear:

- the College of Registered Nurses of Nova Scotia has the longest application process for out of Province, already licensed and currently working RN's, of any in the country. I know of one nurse, for example, who was working in another province and four months after moving to NS still had not managed to become licensed here.

-Dental hygienists moving here from out of province face the same challenges.

- A TSE listed, perhaps the largest, heavy metal exploration company spends a million dollars annually in Eastern Canada on summer prospecting activities. They do not come to Nova Scotia. They are quoted to me as saying New Brunswick and Newfoundland say what can we do to help and Nova Scotia says here is what we are going to do to you.

- Our son is a 30 something pursuing a successful career in Seattle WA. He and his friends, who are also working elsewhere and some of whom have returned here think Nova Scotia is the most difficult place in the country to try to get anything done for a start up business.

- The Federal Government currently has a moratorium on the issuing of oyster growing leases in Nova Scotia. Nova Scotia oyster farmers, unlike lobster fishers, can sell everything they can grow. Oysters, unlike salmon, clean the marine environment. I am not aware that the Provincial Government is doing anything to correct this

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Jane MacKay
Dartmouth, NS
902 469-2022

October 22, 2014

From: Rupert Jannasch <rupertjannasch@hotmail.com>
Sent: Wednesday, October 22, 2014 8:23 AM
To: Office
Subject: Fracking legislation

From: Rupert Jannasch, President, Hants County Federation of Agriculture

By far the greatest concern the farming community has with fracking is the potential damage to water quality. Farmers rely on clean water to meet stringent food safety guidelines, as well as to provide for their families. Much of the debate over fracking could be avoided if industry would disclose which chemicals were used in the fracking process. In order for a true, science-based approach to be taken to regulate the industry, there must be monitoring of all the chemicals used, before, during and after fracking. Otherwise, any claims about the safety of the process will be groundless. The Hants County Federation of Agriculture therefore urges the Government of Nova Scotia to include disclosure of chemicals used during fracking, both for research and commercial purposes, in the legislation designed to govern this technology. There can be no effective regulation without disclosure.

Thank You.

Rupert Jannasch

From: Joanne MacPherson <joannemacpherson@northnovacable.ca>
Sent: Wednesday, October 22, 2014 6:57 AM
To: Office
Subject: Law Amendments hearing on Fracking Moratorium

I am writing to encourage Energy Minister Andrew Younger and the honourable members of the Nova Scotia Legislative Assembly to put in place a solid moratorium law on Fracking so that our drinking water and home are protected from unconventional shale gas fracking.

We had opportunity to hear Economist Dr. Michael Bradfield give a talk in Pugwash recently about why his submission to the Wheeler Report was not included. It is very troubling to know that information on the potential income value of Fracking was not included. Dr. Bradfield was very articulate and convincing, showing us the lose/lose scenario for Nova Scotians if inland fracking were to go on here. These oil companies do not pay royalties in the first two years. There is a loop hole that permits them to get around paying royalties by applying for new leases. The total projected revenues from these royalties are a small fraction of what we bring in already through HST payments.

Nova Scotia needs a steady and reliable source of income. Boom-type projects that lead to bust and leave behind expensive damages and setbacks are not wanted here.

Surveys consistently show that more Nova Scotians value their drinking water over potential profits. Packed rooms across this province during the Wheeler Commission tour demonstrated this. People are holding meetings across the province now to talk about a Greener Economy where good jobs are being created in other countries focused on renewable energy.

Please hold firm on the Fracking moratorium and keep out speculative shale gas explorations and development.

Thanks

Joanne MacPherson
Wallace Bay

From: Terry Lay <gftlay@gmail.com>
Sent: Tuesday, October 21, 2014 3:43 PM
To: Office
Subject: NS Liberals fracking ban

I wish to state that I do not agree with the proposed Liberal Bill to ban fracking as it stands.

Respectively,

Terry Lay

From: Lewis MacKay <lewis@weareapt.com>
Sent: Wednesday, October 22, 2014 10:16 AM
To: Office
Subject: Law Amendments Committee Bill 6

Dear Mr. Hebb:

It is my understanding that the committee is today discussing the merits of bill 6 regarding fracking in Nova Scotia. I believe that this bill is moving our province in a wrong direction and will further erode the economic potential of our province. As a province we have placed too many restrictions on potential business and economic possibilities that now we find ourselves in the position whereby many of our young people have to move away to find gainful employment. Many of them are finding work in jurisdictions who allow fracking, with the proper controls, with the result that their economies are growing while ours is shrinking.

Recently we had the benefit of the Ivany report on our current state and what needed to happen to pull us out of the rut created by past inaction and over regulations. It seems that our politicians have not heard the message and instead have decided to bury their heads in the sand and pretend that all is well. Rather then looking for ways to maintain the status quo, our legislators need to step outside the box and look for ways to tap the potential that lies within our province. Saying no to any and all innovations is not the way to build a stronger and more vibrant economy.

Also there is a moral dilemma here - Our current government is saying no the fracking regardless of the science involved and yet is more than willing to allow Nova Scotians to access the resources from other jurisdictions that are made available through the results of fracking. It is time for our politicians and in fact all Nova Scotians to emerge from our shells and become part of the real world. Saying no to fracking on an emotional basis while ignoring the science is not the way to go.
Sincerely
Lewis MacKay
44 Forest Rd.,
Dartmouth
902-469-2022

From: Lewis MacKay <lewis@weareapt.com>
Sent: Wednesday, October 22, 2014 10:16 AM
To: Office
Subject: Law Amendments Committee Bill 6

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Sincerely
Lewis MacKay
44 Forest Rd.,
Dartmouth
902-469-2022

From:	Matthews, Jennifer <jennifer.matthews@capp.ca>
Sent:	Wednesday, October 22, 2014 10:39 AM
To:	Office
Cc:	Barnes, Paul
Subject:	CAPP submission to the Law Amendments Committee in regards to Amendments to Bill No. 6 – Petroleum Resources Act
Attachments:	CAPP_submission_to_NS_Law_Amendments_Committee_re_changes_to_the_Petroleum_Resources_Act_high_water_fracking_ban.pdf; CAPP_Appendix_A_for_submission_to_Law_Amendments_Committee_re_HF.pdf

Dear Mr. Hebb:

On behalf of Paul Barnes, Manager Atlantic Canada and Artic with the Canadian Association of Petroleum Producers (CAPP), I am writing to provide a written submission to the Law Amendments Committee in response to amendments to Bill No. 6 – Petroleum Resources Act prohibiting high volume hydraulic fracturing.

Unfortunately, Mr. Barnes cannot present to the Law Amendments Committee in person and should committee members have questions following the review of this submission, please do not hesitate to contact Mr. Barnes at 709-724-4200 or via email.

Kind regards,

Jennifer Matthews for Paul Barnes

Jennifer Matthews | HSE Policy Analyst

CAPP CANADIAN ASSOCIATION OF PETROLEUM PRODUCERS

Canada's Oil and Natural Gas Producers

D: 902.420.9084 | C: 902.240.7946 | Email: jennifer.matthews@capp.ca | Website: www.capp.ca

CAPP
CANADIAN ASSOCIATION
OF PETROLEUM PRODUCERS
Canada's Oil and Natural Gas Producers

October 22, 2014

Mr. Gordon Hebb
Chief Legislative Counsel
Office of the Legislative Counsel
CIBC Building, Suite 802
1809 Barrington Street
P.O. Box 1116
Halifax NS B3J 2X1

Dear Mr. Hebb:

Re: Amendments to Bill No. 6 – *Petroleum Resources Act*

The Canadian Association of Petroleum Producers (CAPP) represents companies, large and small, that explore for, develop and produce natural gas and crude oil throughout Canada. CAPP's member companies produce approximately 90 per cent of Canada's natural gas and crude oil and provide a wide range of services that support the upstream crude oil and natural gas industry.

Together CAPP's members and associate members are an important part of a national industry with revenues of about $110 billion a year. CAPP's mission, on behalf of the Canadian upstream oil and gas industry, is to advocate for and enable economic competitiveness and safe, environmentally and socially responsible performance.

Unfortunately, I am unable to present to the Law Amendments Committee in person and I am writing to express our opposition to legislation prohibiting hydraulic fracturing activity, specifically, high volume hydraulic fracturing.

Our members support lifting the two-year ban on Hydraulic Fracturing and proceeding in a staged and measured way to permit the development of Nova Scotia's onshore natural gas resource and the existing legislation does not need to be amended to do that.

CAPP continues to support dialogue between all interested parties that builds further understanding of the technology, practices and processes that our members use to safely explore for and develop onshore hydrocarbons. This same dialogue helps CAPP and its members to continually improve its practices and management systems. It also helps us understand what Nova Scotians want to know and what issues need to be addressed.

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CAPP have been responsive to Expert Panel process on Hydraulic Fracturing and provided input on all 10 Discussion Papers and understand the need for an open, respectful, and transparent process. Unfortunately, however, recent public sessions have not been conducive to supporting a respectful, balanced discussion regarding the work of the Expert Panel and deprived those who came to learn more about hydraulic fracturing.

CAPP is working actively to engage in dialogue with governments, industry and the general public to enhance awareness of the safe, environmentally responsible and economic opportunities of the natural gas industry to promote a business and regulatory framework that acts in the public interest. The advancement of a well-informed, balanced approach that serves Nova Scotia's needs is at a critical juncture. The proposed amendments to the existing legislation prohibiting hydraulic fracturing activity, specifically, high volume hydraulic fracturing sends the wrong message to industry that the Province is indeed closed for business when it comes to developing its onshore resources and that the technologies and regulations in place in other Canadian jurisdictions are not suffice. We encourage the Province to carefully weigh the economic, social and energy security / reliability outcomes in order to establish the policy and regulatory framework to address potential shale gas development in a staged and meaningful approach versus banning a certain aspect of development.

As part of this approach, Nova Scotia must consider the benefits of expanding its supply of natural gas as clean burning fossil fuel alternate to higher emitting energy sources, as part of its environmental policy and regulations.

The stability, predictability and efficiency of the policy and regulatory framework in any jurisdiction is a key consideration for investors. The Canadian natural gas industry has established a long history of sound practices designed to protect human health and safety as well as the environment. With the benefit of decades of unconventional gas development in western Canada, and a progressive approach to regulation of the onshore natural gas industry in Nova Scotia, CAPP views that Nova Scotia's onshore natural gas resources can be developed in a manner that concurrently advances environmental performance, economic growth and energy security and reliability to the benefit all Nova Scotians.

The path forward announced by the Nova Scotia government is a missed opportunity for the people of the province. The Wheeler report has outlined the potential economic benefits responsible onshore natural gas development could generate in Nova Scotia. The report's "lower medium case" estimates that about $1 billion annually would be invested in Nova Scotia if hydraulic fracturing were allowed to proceed, and that as many as 1,500 direct jobs would be created in the development phase. About one third of this $1 billion in annual investment would be spent on what the report calls "local content." This is a significant economic benefit to a province with an unemployment rate higher than in many other parts of Canada.

Building on Nova Scotia's long track record of responsible resource development, the development of natural gas from shale rock utilizing hydraulic fracturing can and should be a part of Nova Scotia's economic and energy future.

Protecting the health and safety of the public, our employees and the environment is of paramount importance to industry. We want to attract workers to our industry, and the industry as a whole has an excellent and world class reputation for its safety training, work practices and tools, all of which are continually being refined

In closing, we look forward to working with government and various stakeholders to develop a measured and responsible path forward to realize the benefits of developing Nova Scotia's onshore natural gas resources.

Yours truly,

R. Paul Barnes

Paul Barnes
Manager, Atlantic Canada and Artic

Attachment (CAPP's Key Points about Hydraulic Fracturing in Canada)

Appendix A – CAPP's Perspectives on Hydraulic Fracturing in Canada

The opportunity for sustainable development of Nova Scotia's onshore natural gas resources is reliant on a robust and efficient regulatory framework and the commitment of industry to ensure a high standard for environmental and safety performance through continuous advancement of technology and operating practices. In existing producing jurisdictions in Canada, our industry successfully operates in an environment of increasing expectations among stakeholder and aboriginal groups expectations.

Broadly, CAPP views there are several areas where industry, government and regulators must focus to ensure that natural gas resources are developed responsibly:

1. Ground Water Protection

Protection of Nova Scotia's groundwater resources is of paramount importance to the natural gas industry. This sentiment is equally evident in all areas of natural gas development in Canada. There are strict government regulations and industry practices relating to the drilling and construction of natural gas wells to ensure that deep gas bearing zones have no adverse contact with shallow potable water resources. These practices include the installation and cementing of steel casing, usually two layers of casing and cement, to fully isolate shallow water zones from deeper onshore natural gas zones.

Hydraulic fracturing of onshore natural gas zones, which are several hundred to thousands of meters deeper than shallow potable water bearing zones, has been shown, through the use of micro-seismic monitoring, to be well isolated from and to not extend upwards into any sources of potable groundwater. Furthermore, there has been no evidence in the history of hydraulic fracturing to indicate that upward migration of hydraulic fracture or formation fluids to potable water bearing zones can happen over a long period of time.

More than 175,000 wells have been hydraulically fractured in British Columbia and Alberta over the past 60 years safely. Similarly, companies in New Brunswick have operated safely and responsibly and there have been no reports of drinking water contamination related to the 49 hydraulic fracturing operations that have taken place since 1985. Currently in New Brunswick, 29 natural gas wells are producing in the Sussex area and 18 oil wells are producing in the Stoney Creek area near Moncton.

Further, in New Brunswick, the University of New Brunswick studied the groundwater and water wells near the McCully field. The study was released by the Geologic Survey of Canada in 2013 (ftp://s5-bsc-faisan.cits.rncan.gc.ca/pub/geott/ess_pubs/292/292762/of_7449.pdf) and concluded: "there is no indication that development and production at the McCully gas field has affected the water wells." A presentation featuring highlights of this study can be found on the website of the New Brunswick Energy Institute (NBEI).
http://nbenergyinstitute.ca/sites/default/files/files/Tom%20Al%20RT%20Nov%2021%202013.pdf

To the extent that any incidents have occurred, they are almost always related to well construction issues where there has been a loss of wellbore integrity causing gas and/or fluids to migrate from one geological zone to another. In such wellbore construction circumstances, companies are required, by regulation, to undertake necessary repairs. A combination of sound Canadian industry practices and industry regulation has made hydraulic fracturing a very safe procedure used in the recovery of natural gas from onshore resources.

Comprehensive government regulations and industry operating practices for shale gas exploration and development are already in place in Canada and throughout North America to ensure public safety and protection of the environment. Where areas for improvement are identified in the recent Canadian Council of Academies (CCA) report, entitled "Harnessing Science and Technology to Understand the Environmental Impacts of Shale Gas Extraction" we expect regulators to modify regulations and industry to change operating practices accordingly. http://www.scienceadvice.ca/en/assessments/completed/shale-gas.aspx

This has always been the case and will continue to be the manner in which our industry operates. We can and should continue to seek improvement from a sound baseline. Industry has a sound track record of safety and performance and it is one that is continuously improving based on sound science.

Industry supports a responsible approach to hydraulic fracturing and water management.Protecting water resources during sourcing, use and handling is a key priority for our industry. We support and abide by all regulations governing hydraulic fracturing operations, water use and water protection. In addition, we commit to following these guiding principles.

1. Safeguard the quality and quantity of regional surface and groundwater resources, through sound wellbore construction practices, sourcing fresh water alternatives where appropriate, and recycling water for reuse as much as practical.

2. Measure and disclose our water use with the goal of continuing to reduce our effect on the environment.

3. Support the development of fracturing fluid additives with the least environmental risks.

4. Support the disclosure of fracturing fluid additives.

5. Continue to advance, collaborate on and communicate technologies and best practices that reduce the potential environmental risks of hydraulic fracturing.

2. Land Use

Industry best practices call for land-use practices that integrate environmental, low-impact techniques, species conservation and biodiversity considerations in the planning and development of Canada's oil and natural gas resources. Canada's thorough and longstanding regulatory system for energy development, combined with industry best practices, ensure that land is reclaimed and returned to an acceptable state after use. Advancements in resource finding and extraction technology help reduce the industry's environmental footprint on the land, especially for the production of Canada's abundant supply of unconventional natural gas.

Additionally, natural gas companies are also changing from a well-by-well approach to a project- or area-based planning approach. By working in this way, companies improve operational efficiency and streamline industrial activities in an area. An example of companies working together to manage development is the Horn River Basin Producers Group. Eleven oil and gas companies currently developing in the Horn River Basin in British Columbia have come together to ensure that this area is responsibly developed, and that cumulative impacts on the land are minimized. The group works together to coordinate access and infrastructure development, to collaborate on research and to share information.

The natural gas industry is continually assessing its land-use practices and adopting new technologies to improve the efficiency and effectiveness of its work.

3. **Stewardship of Fresh Water Resources**

In addition to the protection of groundwater resources, the industry is also cognizant of the intensity of use of fresh water in natural gas development. Both operators and service companies alike are evaluating and progressively implementing new water management strategies in recognition of the water use and waste water disposal needs for some types of onshore natural gas development. These strategies include the use of non-potable groundwater water instead of potable water, the recycling of used fracture fluids and produced water to reduce the use of potable water and, in some situations, the use of fluids other than water in the hydraulic fracturing process.

In most cases it is not practical to implement these strategies during testing and evaluation or pilot stages of natural gas development; however, commercial resource development brings economies of scale that improve the potential for application of water treatment, desalination, and re-use of water. For example In New Brunswick the new *Rules for Industry*, launched in February 2013 have outlined the preferred sources for water as (from most to least preferred):

1. Treated/recycled wastewater from municipal sources, including flowback and produced water from oil or gas wells;
2. Ocean water;
3. Non-potable groundwater (e.g., from deep, saline aquifers);
4. Dugouts or catchments or other man-made features that capture run-off or rainwater;
5. Lakes or water courses (including municipal water supplies drawn from lakes, watercourses or impoundments); and
6. Potable ground water (including municipal supplies drawn from ground water).

As part of the approval process, industry must develop a water management plan that includes an assessment of proposed water sources to be used that must be approved by the regulator.

4. **Management of Waste Water Fluids**

Waste water management is a necessary component of oil and natural gas development, and its management represents a significant portion of drilling expenses. Water handling and disposal can impact operations substantially because the costs associated with it (e.g., acquisition, transportation, and disposal) can vary significantly from region to region. Therefore, the effective treatment for reuse or disposal is a critical aspect for industry development. In mature jurisdictions, waste water fluids are dealt with in one of several ways; including, but not limited to: disposal by underground injection, treatment followed by disposal to surface water bodies, or recycling (with or without treatment) for use in future hydraulic fracturing operations. Each of these solutions offers safe handling and disposal options for waste water.

As regulators and industry look to the future, the necessary regulations, infrastructure and support mechanisms must be put into place to steward and enable resource development in Nova Scotia. With a longstanding history of expertise, innovation and success in Canada, best practices from more mature producing jurisdictions can be leveraged to provide industry with a means to safely and responsibly treat and dispose of fluids from hydraulic fracturing operations.

5. **Health-Risk Assessment**

We understand that the public and health officials have concerns and want a greater understanding about how the natural gas industry operates and which processes industry uses, and we support steps that increase the understanding of our industry. Protecting the health and safety of the public, employees and the environment is of paramount importance to industry.

CAPP is not aware of adverse health impacts as a result of natural gas development from shale. However, we recognize that the Chief Medical Officer of New Brunswick, Dr. Elish Cleary, issued a report in 2012 *Executive Summary Chief Medical Officer of Health's Recommendations Concerning Shale Gas Development in New Brunswick (http://www2.gnb.ca/content/dam/gnb/Departments/h-s/pdf/en/HealthyEnvironments/ExecutiveSummary.pdf)* containing recommendations regarding potential health and socio-economic impacts of industry development in the province. To this end, Dr. Cleary will be undertaking a further detailed review, but the specific details of the review and its timeline have not been made public at the time of this correspondence.

The Government of British Columbia has also commissioned a health-risk assessment of oil and natural gas development. The Ministry of Health identified the following categories for potential concern: personal health issues, environmental pathways of exposure, related environmental issues, changes to community, community service issues, oil and gas operational issues, and institutional framework issues. The report is expected to be completed early in 2014 and will consist of a health risk assessment and scientific review of evidence.

CAPP's *Operating Practices for Hydraulic Fracturing* already address several of the recommendations included the aforementioned health-risk reports from New Brunswick and British Columbia (http://www.capp.ca/canadaIndustry/naturalGas/Pages/default.aspx)

6. **Technology and Innovation**

Technology innovations are a key cornerstone of this industry. Recently a group of University of Calgary researchers was awarded funding for their *Hydraulic Fracturing Innovation (HFI) Initiative research project to build a multidisciplinary research cluster that will become a world-leading centre for the advancement of hydraulic fracturing science, engineering, policy, and industry practice.* (http://www.ucalgary.ca/utoday/issue/2014-05-07/researchers-bring-unique-canada-perspective-hydraulic-fracturing)

Nova Scotia is home to world class research institutions which are strategically positioned to carryout research and development based on the existing research model that was applied to the offshore Play-Fairway Analysis. During this program, new and preexisting offshore data was collected; processed and analyzed using new technology and innovative techniques to analyze Nova Scotia's offshore research potential with direct involvement of Nova Scotia researchers. This is a collaborative model that could be applied to further examining Nova Scotia's onshore resource potential.

In conjunction with the release of Nova Scotia's onshore petroleum atlas in 2015 we encourage the government to permit onshore exploratory drilling to include the use of hydraulic fracturing that would accelerate research and development under terms similar to those outlined in the offshore Play Fairway Analysis. This type of partnership would allow local and international researchers equipped with hands-on knowledge to liaise effectively with public and private groups affected by hydraulic fracturing.

7. Stakeholder Consultation

Industry works closely with stakeholders and aboriginal groups to analyze, monitor, and address the consequences of its activities. As an example in the Western Canadian provinces of Alberta and British Columbia, there are government regulations and industry best practices to conduct consultations with landowners and occupants and other stakeholders before projects are undertaken. For example, in Alberta, there are requirements to address stakeholder or aboriginal group concerns as a pre-requisite as part of the environmental assessment process.

Industry supports respectful, effective and meaningful public dialogue and engagement. CAPP and its members developed a "*Guide for Effective Public Involvement*" in 2003 that is widely used to this day

within industry to help foster positive and productive relationships with all stakeholder with whom companies interact. Key stakeholders must be engaged for technical discussion, such as those who possess the unique technical expertise, knowledge and on-the-ground experience (e.g. CAPP, industry members, suppliers, etc.).

The process of public consultation must be undertaken in an appropriate manner, using professional methods and mediums for execution to facilitate stakeholder and aboriginal group engagement, which manage expectations and help, avoid misunderstandings and disagreements about perspective outcomes or decisions on the Hydraulic Fracturing in the Province of Nova Scotia.

Further, we will industry continues to work collaboratively with governments and any other stakeholders to help increase the understanding of our industry, but also to ensure continued advancement of new technologies and innovations to mitigate potential environment and health impacts.

8. Onshore Natural Gas Development: Economic Opportunity for Nova Scotia

The oil and gas sector in Canada is a vital part of the economy, both nationally and regionally. It is a key component of Canada's energy system, critical to the security of and reliable access to energy supply by all Canadians. Crude oil and natural gas and their by-products are a part of almost every aspect of our lives. The sector and its supply chain employs Canadians in every part of the country, offering highly-skilled and well-rewarded employment. The emergence of a successful natural gas industry onshore in Nova Scotia affords the Province with the opportunity to localize these benefits for its citizens.

In 2013, the upstream oil and natural gas industry supported more than 550,000 jobs across Canada; represented $67 billion in capital spending; and paid $18 billion in taxes and royalties to governments (Statistics Canada). For additional statistics on the impact of Canada's upstream oil and natural gas sector, please see: http://www.capp.ca/library/statistics/basic/Pages/default.aspx.

If we look at regional impacts from activity in Nova Scotia and Newfoundland since 1996:

- employs more than 6,000 directly and thousands indirectly;
- supports more than 800 local service companies;
- cumulative expenditures: $37 billion in Newfoundland and Nova Scotia; and
- GDP contributions: oil accounts for 28% of GDP in Newfoundland, and mining, oil and gas accounts for 2.5% of GDP in Nova Scotia.

Similarly, onshore natural gas represents a significant opportunity for New Brunswick according to a 2013 study conducted by Deloitte on behalf of the New Brunswick Business Council. According to the study, one well development costs include (direct, induced and indirect):

- total gross output of $21 million
- total impact to New Brunswick GDP of $9 million; and
- total of 75 full-time equivalent jobs.

9. Competitive Challenges to Onshore Natural Gas Development in Nova Scotia

Underlying these economic opportunities, however, is the increasingly competitive nature of natural gas development in North America. The emergence of huge onshore natural gas plays in the United States and Western Canada has afforded a great deal of optionality in capital markets. Investment opportunities in Nova Scotia, and, indeed, in the rest of Canada, must be very cognizant of the competition amongst natural gas investment opportunities. Competition is forcing investors to scrutinize opportunities more closely on all factors bearing on rate and risk of return, including above-ground risks. Competitiveness is critical in attracting industry's interest in exploration and evaluation of resource potential and is

paramount in creating business opportunities for any jurisdiction. The fiscal and regulatory framework must work for investors.

In particular, the stability and predictability of the policy and regulatory system is a key consideration for potential investors. It is important that Nova Scotia develop a regulatory system for development of its onshore natural gas that is effective, efficient and predictable as to process, while ensuring responsible environmental and social outcomes.

The competitiveness of a regulatory regime is largely influenced by the following factors:

- **Jurisdictional Arrangements and Coordination**

Effective coordination within government (e.g., across government departments and regulators) and between governments (e.g., between the federal and provincial governments) is critical to ensure sound policy and regulatory decisions are delivered in an effective and efficient manner.

To this end, CAPP strongly recommends Nova Scotia leverage the proven experience of other oil and gas regulatory jurisdictions such as (New Brunswick and Western Canada), and also the exhaustive research recently conducted by the New Brunswick government, which resulted in their incorporation of best practices found within industry.

- **Regulatory Process Performance**

A critical determinant of competitiveness is the timeliness of regulatory reviews and decisions (e.g., the regulatory timelines from exploration success to commercial production). This applies, not only to large complex projects, but also to medium and smaller projects which are very sensitive to incremental costs and delays arising from inefficiencies in the regulatory review process.

- **Regulatory Complexity**

In other producing jurisdictions in Canada, regulatory complexity has arisen from new laws of general application, largely aimed at improving environmental performance, which have overlain the oil and gas regulatory regime with new requirements and restrictions. Associated administrative and regulatory processes have impacted some companies business practices, reduced their competitive advantage, and impacted their investment opportunities. Access to land has also been restricted as a consequence of policy or planning that does not take into account resource interests and investment implications. Greater coherence is needed between environmental policy and the realities of the business decisions required to maintain a competitive Nova Scotia natural gas industry. It is this balance that will provide the opportunity to realize the economic benefits of the emerging natural gas industry in Nova Scotia while protecting the environment, addressing social impacts and ensuring public safety.

- **Regulatory Enhancement**

CAPP understands that the Province of Nova Scotia has studied other regulatory regimes to determine best practices for implementation in Nova Scotia and has provided this information to the Expert Panel.

Alberta, BC, and Saskatchewan have established regulations that have been tested by natural gas resource play development. Regulations in both provinces have addressed onshore natural gas exploration, evaluation, and development activities. Efforts by both industry and government on an ongoing basis seek to identify and capture further opportunities to reduce industry impacts and improve regulatory efficiency while providing for sustainable development in the public interest.

All three western Canadian provinces have many years of experience and success in forming a regulatory framework which serves to protect the environment, ensuring the safety of the general public and its

industry workforce while allowing the economic development of natural gas resources for the public good. These three jurisdictions have a high level of regulatory harmonization which allows exploration companies to efficiently dispense services, maximizing the economic competitiveness in all areas.

In recent years BC and Alberta have moved substantially toward a single regulatory body to approve and provide oversight of exploration and production activities. Also, BC and Alberta both regularly review the appropriateness of regulations and amend or change to reflect new resource types, technology, and industry practices.

In 2013, New Brunswick concluded a review of its regulatory regime and launched their *New Rules for Industry* on February 15, 2013. These rules encompassed a broad spectrum of issues and concerns raised in recent years by the public about the practice of Hydraulic Fracture Stimulation. Industry now has a direction to move forward, but will continue to work with government as these rules are implemented and as they transition into the final regulations to create an operating environment that is efficient, effective and competitive in New Brunswick.

Furthermore, industry, in all jurisdictions, encourages regulatory frameworks that are based on sound science, eliminate duplication and overlap, are predictable and stable, and ensure efficient and timely decision making. The regulatory framework must also consistently deliver responsible environmental outcomes. These considerations avoid placing undue process and related costs on resource exploration and development opportunities, and help to attract investment capital. Experience consistently demonstrates that investors avoid jurisdictions with costly, unnecessary and uncertain regulations.

LAW AMENDMENTS COMMITTEE

Red Room, Province House

Monday, October 27, 2014

Bill #38 - Pooled Registered Pension Plans Act

4:00 pm

1. Ian Johnson, Services Co-ordinator/Policy Analyst
   Corinne Carey, Pension & Benefits officer
   NSGEU

2. Carol Ferguson, Researcher
   CUPE NS

Bill #49 - Economic Development in Nova Scotia, An Act to Improve

4:00 pm

1. Bob Parker DIDN'T APPEAR
   students NS

Bill #6 - Petroleum Resources Act (amended)

Deferred from previous meeting

Bill #18 - Canada-Nova Scotia Offshore Petroleum Resources Accord Implementation (Nova Scotia) Act (amended)

no representation

Bill #22 - Maritime Provinces Harness Racing Commission Act (amended)

no representation

Bill #25 - Housing Act (amended) and Housing Nova Scotia Act (amended)

no representation

Bill #26 - Animal Protection Act (amended)

no representation

Bill #50 - Halifax Regional Municipality Charter (amended)

no representation

From: Kassinda Tolliver <Kassinda@halifaxchamber.com> on behalf of Valerie Payn <valerie@halifaxchamber.com>
Sent: Monday, October 27, 2014 2:02 PM
To: Office; Justice Minister; info@andrewyounger.ca
Cc: clerks@halifax.ca
Subject: Submission to the Law Amendments Committee - Please confirm receipt
Attachments: Letter to Law Amendments - Hydraulic Fracturing.docx

Good afternoon Minister Diab and members of the Law Amendments Committee,

Attached is the Halifax Chamber of Commerce's written submission to the Law Amendments Committee for their meeting on October 27, 2014 in relation to the discussion of Bill 6.

Please confirm receipt of this letter.

Kind regards,

Valerie A. Payn
President and CEO

Halifax Chamber of Commerce
656 Windmill Road, Suite 200, Dartmouth, NS B3B 1B8
Direct: (902) 481-1229 Fax: (902) 468-7333
Web: www.halifaxchamber.com
E: valerie@halifaxchamber.com

Assistant: Kassinda Tolliver
Direct: (902) 481-1235
E: kassinda@halifaxchamber.com

Attach: 1 – Letter to Law Amendments – Hydraulic Fracturing

HALIFAX CHAMBER
OF COMMERCE
stronger together

October 27, 2014

Law Amendments Committee
c/o Gordon Hebb, Q.C.
Chief Legislative Counsel
CIBC Building
1809 Barrington Street, Suite 802
P.O. Box 1116
Halifax NS, B3J 2X1

Dear Minister Diab and members of the Law Amendments Committee,

One of the three main goals of the Chamber's 2013-2018 Strategic Plan is to 'Create a Positive Business Environment'. The goal resonates very strongly with our membership, as they all want to live and work in a province that seeks to maximize the wellbeing of its citizens through new opportunities and investment.

Many businesses have expressed their concern to us over the past few weeks about the government's proposed moratorium on hydraulic fracturing. Our concern is focused not so much on the benefits and drawbacks of fracking, the Wheeler Report made it clear that more research on both is needed, but on the way this decision was reached and communicated. Too many people saw the announcement of the moratorium as yet another example of how Nova Scotia is closed for business.

Our consideration of this opportunity started well, as Nova Scotians we paid for an expert panel to review this issue and Dr. Wheeler produced a balanced response that opened the door for our province to consider this economic opportunity. While more research on Nova Scotia's specific situation is needed, we do know hydraulic fracturing has been an important economic contributor to other jurisdictions with appropriate regulation and community support.

The fact is, as the members of this Committee are all aware, Nova Scotia needs all of the economic opportunity it can get. Our demographic and out-migration issues will never be solved if we cannot keep our young people here and that will not happen without new economic opportunities. While immigration is an important part of our growth and will play a key role in enriching our culture and bringing new ideas and diversity to our communities, even if we double our numbers this will not solve our demographic issues on their own.

We agree that the government should invest in new research but do not believe that the door should be closed on hydraulic fracturing forever. Implementing a strong regulatory regime, funding more research, and talking to communities to see if any of them are interested in the opportunities hydraulic fracturing presents would be a more balanced approach.

To champion a more positive business environment the Chamber started its 'YES' campaign to show the benefits of being open to new ideas. We are calling on the government to say 'YES' to new opportunities and then work out the necessary conditions that will allow these new ideas to go ahead.

HALIFAX CHAMBER
OF COMMERCE
stronger together

The One Nova Scotia Report made it clear that our province is in serious trouble if we do not change our current course. Specifically, our declining population and lack of economic growth will threaten our province's standard of living and level of government services in the years ahead. If we are not willing to at least examine new opportunities, how can we truly hope to change our province's course? If you would like to meet to discuss these issues please do not hesitate to contact me.

Kind regards,

Valerie Payn, President and CEO
Halifax Chamber of Commerce

From: Zwicker, Darren <DZwicker@newalta.com>
Sent: Saturday, October 25, 2014 9:55 PM
To: Office; Premier
Subject: Bill No.6

Dear Sirs/Madams

I am writing with respect to the upcoming vote on Bill No.6, considered by many to be a vote against the development of onshore Oil and Gas in Nova Scotia. Although I am a relative newcomer to the Oil and Gas Industry, I have been involved in the Natural Resource industry since graduating from an Atlantic Canadian University almost 25 years ago. I have watched as the Forestry Industry in Atlantic Canada all but disappeared. I have watched as the outmigration of young talent (and not so young talent) has continued to increase.

I am concerned about Bill No. 6 and the vote against high volume hydraulic fracturing as a tool to develop onshore oil and gas for three reasons:

1. I am a father of two University aged children. If there is any hope that they return to Nova Scotia, or Atlantic Canada for that matter, then we need a robust economy so they have a place to return to.
2. I am a member of the oil and gas industry. An industry that has responsibly managed resources for many years, and has done it with a safety and environment record that outshines many other industries
3. I am a tax payer in Nova Scotia and I am seeing more and more of my earnings be clawed away to the provincial coffers to pay to keep the province afloat

Bill No. 6 does not support the development of the oil and gas industry in Nova Scotia. It actually is seen by industry as a blocker to responsible development and investment. Bill No. 6 will deter current and future investment in onshore oil and gas exploration. Companies see this legislation as a vote against development and will seek other, more investment friendly jurisdictions, in which to operate.

I would argue that legislation banning high volume hydraulic fracturing in Nova Scotia is like "swatting a fly with a Mac Truck". A progressive government, one who has the courage to lead, would consult industry and other jurisdictions to develop responsible regulations, that provide a framework within which Industry can operate. We are not re-creating the wheel in Nova Scotia. There are many jurisdictions where the responsible management of onshore oil and gas is carried out using high volume hydraulic fracturing. In fact, a recent statistic states that, "15 million Americans live within 1 mile of a fracked oil and gas well". Facts do not lie. Let's use well developed regulation and allow responsible companies to use state of the art technologies to employ Nova Scotians and grow an industry that will see our province prosper.

In a recent speech, Frank McKenna said, "The bottom line is that we cannot allow public policy to be decided by the biggest blowhard. We need facts, good communication and leadership." He went on to say, "Good governments do not allow mob rule. They seize control of the agenda, they communicate, they make decisions and they lead."

I agree with Mr. McKenna. I challenge our elected politicians in Nova Scotia to have the courage to lead. Legislation that places a moratorium on high volume hydraulic fracturing is not leading. It is passing the buck to the next guy to figure out how to lead Nova Scotia out of the financial hole in which we find ourselves. Use the facts to develop solid regulation that facilitates the responsible development of our natural resources, before it is too late and my children end up living in Alberta, or Newfoundland, or BC, or Saskatchewan.

Thank You
Darren Zwicker

From: Stephen <stephen@saylegroup.com>
Sent: Friday, October 24, 2014 12:50 PM
To: Premier; Office; info@andrewyounger.ca
Subject: Bill No. 6, Petroleum Resources Act (amended)

Dear Mr. Premier, Mr. Minister and Members of the Law Amendments Committee:

My name is Steve Sayle and I am writing to you today regarding Bill #6 calling for the ban of onshore high volume hydraulic fracturing in Nova Scotia. I am commenting from three personal perspectives:

1. A representative of the Oil & Gas Industry Supply Chain in Nova Scotia.
2. An Entrepreneur passionate about establishing and growing start-up businesses in Nova Scotia.
3. A family man with a wife and two young children who have lived around the world and returned 6 years ago to raise our family here in our home of Nova Scotia. We want economic development in an environmentally responsible manner.

I have worked in the O&G sector for almost 20 years in Nova Scotia, Newfoundland, Western Provinces, Southeast Asia, North Africa and the Middle East. I have started two companies here in Nova Scotia (SayleHSE Inc. and SayleGroup Inc.) and am about to start a third (SayleSafety Inc.) with local partners. Starting and attempting to grow a business in our struggling Nova Scotia economy is very challenging. I absorbed the Ivany Report with great interest.

It is well documented that our province is in desperate times. At SayleGroup we are trying to take some small measures into our own hands to help grow the private sector, as called for in the Ivany Report. We have grown to over a dozen highly talented individuals, mostly with revenue from Western Canada.

I deal regularly with Nova Scotians who have left our province to work out West where the Oil & Gas industry is thriving. Based on local industry feedback I am hearing, others are contemplating leaving now that the proposed ban on hydraulic fracturing has sent a clear message that Nova Scotia is closed for responsible onshore petroleum drilling resource development. This skills resource loss is a grave concern for growing our business in Nova Scotia, and we have already been impacted by it.

Your proposed ban on hydraulic fracturing has left me frustrated, disillusioned and deflated. Onshore shale gas development has been a positive game changer for responsible economic development throughout many regions of North America, with tens of thousands of wells safely drilled and fractured.

No industry is free from risk. The Oil and Gas sector, like other high reliability industries, operates under the principles of Risk Management throughout their entire business life cycles. This includes front end commercial investment risk assessment all the way through to site/task specific risk analysis and controls.

In fact, risk management is a core service line of our Sayle start-up companies, all under a mantra of "Operational Excellence" and "Continuous Improvement", which are common themes adopted throughout our industry. For this reason I was encouraged to see the Risk Matrix and associated discussions of risk mitigation within the Wheeler report. I had the opportunity to discuss this with a panel representative in the days before your announcement to ban onshore hydraulic fracturing. At that time we were hopeful that our

government would take a responsible risk management approach to this issue and adopt the principles of the Risk Matrix, as do companies throughout our industry.

In the wake of the Ivany Report and the Wheeler Report, I was astonished at your moratorium announcement which soon followed. I had hoped for a forward thinking approach to develop a thorough regulatory framework which would promote environmentally responsible onshore drilling and hydraulic fracturing in the future.

I ask you to please reconsider shutting this door on an industry that is creating responsible economic development in provinces that currently contribute to equalization transfer payments to Nova Scotia.

Industry wants strong regulatory leadership, not legislated moratoriums that will send their investment dollars to other jurisdictions.

Thank you,
Steve

Stephen Sayle
CEO
stephen@saylegroup.com
+1-902-719-8555

Submission to law Amendments re Hydraulic fracturing (fracking)

Harriet McCready
3768 Eastern Ave. PO Box 234
Parrsboro NS
B0M 1S0

harrietmccready@eastlink.ca

23Oct 2015

First, I am very pleased that Nova Scotia will adopt a ban on fracking. This is a responsible and necessary step in planning for a future in which protection of the environment is recognized as a priority.

My suggestions on the Act itself.

1. Definition: The term "high volume hydraulic fracturing" was new to me, even though I have paid close attention to issues around fracking. I think "hydraulic fracturing" is a more general term and propose it be defined in the act, not left to regulations.
2. Community consultation: Communities, including First Nations, should be not only consulted but should have the right to disallow/ ban/ limit shale gas fracturing, in the event the ban is ultimately lifted.
3. The legislation should clearly define responsibility for any damages, restoration etc., where the property or use /enjoyment of property is compromised by any related activities, including exploration or testing.
4. The act should require environmental assessment of any area considered for testing before any such testing is carried out. (potential harm to water, wildlife, etc.) The impact on water is particularly important, and serious consequences of unexpected results of testing could be irreversible.
5. Any future consideration of lifting the ban should require public consultation.

Thank you for the opportunity to comment.

From:	Valerie Roy <valerie@apcc.ca>
Sent:	Friday, October 24, 2014 11:22 AM
To:	Office
Cc:	barry.zwicker@scotianwindfields.ca; 'Dave Kerr'; John.Ouellette@bellaliant.ca; 'Paul Beasant'; 'Gauvin, Pete'; 'Richie Mann'; 'Don Hay'; 'Hunt, Jeffrey'; 'Frank Likely'; 'Tracy Dauphinee'; Barbara@maritimesenergy.com
Subject:	Attention: Members of the Law Amendments Committee re Bill No. 6, Petroleum Resources Act (amended).
Attachments:	Letter to Premier McNeil Oct. 3, 2014.pdf

Good morning: on behalf of the Atlantic Chamber of Commerce please find attached a copy of a letter sent to Premier McNeil on October 3rd, wherein we offer our thoughts on the Government of Nova Scotia's announcement that it would introduce legislation to prohibit high volume hydraulic fracturing for onshore shale gas.

We understand that Bill no. 6 has received second reading in the House and is now before the Committee.

We respectfully request that members to take our concerns into consideration as they deliberate on proposed amendments to the Petroleum Resources Act.

Sincerely,

Valerie Roy
Chief Executive Officer \ Directrice générale
Atlantic Chamber of Commerce Inc. \ Chambre de commerce de l'Atlantique Inc.
200-1273, rue Main Street, Moncton, NB, Canada, E1C 0P4
T:(506) 866-9260 Web: www.apcc.ca
Twitter @vpmsacc

Atlantic Chamber of Commerce | Chambre de commerce de l'Atlantique

Atlantic Chamber of Commerce
Representing business since 1896

Chambre de commerce de l'Atlantique
Représentant les affaires depuis 1896

October 3, 2014

Hon. Stephen McNeil, Premier of Nova Scotia
7th Floor, One Government Place
1700 Granville Street
P.O. Box 726
Halifax, NS
B3J 2T3

CC :
Hon. Andrew Younger, M.L.A.
Minister of Energy
PO Box 2664
Halifax, NS B3J 3J9

Dear Mr. Premier:

Since 1896, the Atlantic Chamber of Commerce and its predecessors have been championing the cause of business in Atlantic Canada. We represent upwards of 16,000 businesses through member Chambers of Commerce across the region and advocate on a variety of issues, such as population, productivity, policy and partnership.

We are writing today to offer our thoughts on the Government of Nova Scotia's announcement that it will introduce legislation to prohibit high volume hydraulic fracturing for onshore shale gas.

Please allow me to begin this letter by outlining the ACC's views on a few key premises relevant to this and other topics:

- Governments have a clear role and responsibility to take reasonable measures to ensure the health and safety of their citizens;
- The regulation of natural resource industries is expected and welcomed, as industry players as well as the general public have a clearer understanding of the expectations of all involved in regulated environments; and,
- Public policy decisions must be made on evidence, and decisions should be re-visited when evidence indicates a rationale for change.

As you are aware, there is a history of safe and responsible resource development, including hydraulic fracking, in Canada. Equally, we understand that it is the intention of government to prohibit high volume fracking only. We understand that your government is seeking to strike a balance in its public policy decisions – encourage some level of exploration and development while capping the amount of activity so as to limit potential negative effects.

However, the ACC wishes to send a note of caution on just how wide-ranging or permanent a moratorium might be. What we are requesting is undoubtedly difficult, given the recent public statement on this emotional and divisive issue.

October 3, 2014

Hon. Stephen McNeil, Premier of Nova Scotia
CC: Hon. Andrew Younger, M.L.A.

We are asking that your government not close the door completely on fracking that is responsibly conducted. The concerns are real, and we share them as citizens. Business leaders are not immune from contaminated water, seismic events, or human health concerns. We are citizens first.

But we are concerned about the message this sends to industry about how information is balanced when making policy decisions. There has been no concrete evidence to support a ban. We are concerned that other jurisdictions with onshore resources, such as Alberta, now use our young people to develop their industry for their benefit. And we are certainly concerned with the fiscal situation and the 'pass' government has taken on improving it through increased revenues.

Premier, we would like government to re-consider its decision to bring forward legislation which would ban high volume hydraulic fracturing for onshore shale gas. We believe such legislation is unnecessary, as government has under its control existing legislation and regulations by which it could control and regulate the industry.

At the very least, we would strongly encourage government to introduce a clause that would require frequent reviews of the legislation based on independent evidence presented to government. This would ensure that any ban is – based on evidence – completely necessary or conversely is revoked if the environmental and health risks can be mitigated. We do believe that through existing government regulation and industry best practices these risks can reasonably be mitigated; we want to ensure that those regulations and best practices can be exercised should a reasonable and responsible proposal to conduct high volume fracking be proposed in Nova Scotia.

Like many other industries that have proven to be commercial successes as well as environmentally safe, real world practice must be enabled. Regulation and oversight is vital, but we cannot know the full benefits and costs where an industry is prohibited. A ban accomplishes a goal of ensuring no risk, but also no return. We believe a more balanced approach can be beneficial to all Nova Scotians and as a result of that worldview we are respectfully requesting that you re-consider your legislation.

In summary, we believe that it is vitally important that the province remain open to energy investment and support the development of a domestic oil and gas industry. Should you go ahead with a moratorium, we encourage you ensure that it is clearly and narrowly defined as anything that is broad and vague is damaging for business confidence and investment.

Thank you in advance for your time and consideration. On behalf of our members I extend our best wishes as you deliberate on this and other topics of importance to Nova Scotians.

Sincerely,

Valerie Roy
Chief Executive Officer

200-1273 Main Street, Moncton NB E1C 0P4 - (506) 866-9260 - valerie@apcc.ca - www.apcc.ca

From: Bruce Strum <bstrum@strum.com>
Sent: Friday, October 24, 2014 10:43 AM
To: Office
Cc: Premier
Subject: [PROBABLE-SPAM] Opposition to Bill 6

October 24, 2014

To Whom it May Concern

Re: Concerning Bill 6, Law Amendment

Dear Sir/Madame

I am forwarding to you a letter of concern regarding the planned legislation Bill 6. I am the owner of a Professional Consulting firm, Strum Consulting of Bedford, Nova Scotia. Strum employs 45 professional engineers, hydrogeologists and environmental scientists along with technical staff on a wide range of commercial and industrial projects across Nova Scotia. Our clients include commercial land developers, manufacturers, builders, mining entities, waste handlers and industrial processors to name a few.

Among other restrictive covenants, Bill 6 proposes a moratorium on High Volume Fracturing associated with On Shore Shale Gas Development. My personal view and that of most if not all of my clients is that this legislation will result in loss of local business opportunities as well as discourage outside investors from coming here to explore and develop our clean energy resources.

My thoughts are as follows:

Bill 6 Sends Message That We Don't Want On Shore Energy Investment: Currently, the potential for production of Shale Gas in Nova Scotia is largely unexplored. Exploration is needed to ultimately determine whether commercially viable resources exist here. Bill 6 sends the message from the Nova Scotia political arena that discourages exploration companies from coming to Nova Scotia. The loss of this exploration activity in and of itself, likely to be caused by Bill 6 will result in the loss of millions of dollars to local service providers, such as Strum and other in addition to taxes, employment and lost product sales.

Bill 6 Suggests Nova Scotia Hasn't Done Our Homework: Around the globe, development of Shale Gas resources has been very successfully implemented through Industry driven protocols and Best Management Practices. The role of resource development rests with that of industry through development of safe, environmentally sustainable Industry

Practices. The best use of legislation should be to place the mantle of that responsibility on a willing and safety driven development industry, not to stand in its way by closing its doors to the arrival of that investment. Without the support of a Government that encourages safe development practices, sustainable investment, rural employment and the resulting benefits we see enjoyed elsewhere through existing "Industry Best Management Practices" Nova Scotia sends the message that we have ignored scientific and fact based decision making process.

Bill 6 Will Undermine Investment Confidence in Nova Scotia Energy Projects: Recently, in discussions with Oil Industry developers, it was indicated that Off Shore Oil and Gas producers also feel threatened. Off Shore benefits, totaling in the billions have flowed into Nova Scotia coffers for years through safe, sustainable Off Shore Industry Practices. If On Shore development is strongly discouraged such as by Legislation like Bill 6, confidence in Off Shore producers will suffer as well. No company wants to invest millions and billions in infrastructure, building the local economy and supporting Nova Scotian employment if they think the local Government is closed to business as suggested by Bill 6.

Bill 6 Ignores Sustainable Development Recommendations From the Wheeler Report: The Wheeler report is a lengthy and complex document but as clearly stated, Shale Gas Development can be undertaken in a clean, safe , sustainable and economically rewarding fashion. In Alberta, of the tens of thousands of well drilled and fractured, few if any cases of well damage has been shown to have occurred. Through responsible exploration and development well construction practices, the people of Alberta and Saskatchewan have benefited greatly. Those wells have since been connected to pipelines ensuring safe and sustainable delivery to markets. The placement of that infrastructure has benefited the people of western Canada tremendously! Nova Scotia has an opportunity to share in that prosperity but by developing initiatives that ensure responsible and sustainable practices are implemented. Those benefits will take place in rural Nova Scotia where drill sites might exist, where pipelines might transport Gas safely and where our sons and daughters, the pipefitters, truckers, welders and government inspectors currently can only dream about being able to live near their parents and where they grew up!

Bill 6 Flies in the Face of the Ivany Report: Even the Ivany Report challenged Nova Scotians to action. Ivany tells us to stand up, look for opportunities, develop them sustainably and challenge government to assist if not even lead in these initiatives; not stand in the way and act as an impediment. Here lies a tremendous opportunity for development of Best Industry Practices that will ensure safe sustainable clean energy developments, not curtail them! We can't afford to lose this opportunity!

In closing, an opportunity for all Nova Scotians exists through exploration and valuation of our resources, to develop best management practices that ensure safe sustainable development and to take advantage of an excellent source of clean energy to help replace dirtier fuels.

We don't need legislation that discourages and acts as a disincentive to energy developers, but rather a committed effort by our political leaders to take those steps that support economic development in clean, sustainable manner that will make us all proud to be Nova Scotians.

Please consider this carefully as your ruminations proceed.

Thank you

A Bruce Strum, President

Strum Consulting

1355 Bedford Highway, Bedford, NS

--
A. Bruce Strum, P.Geo.
President

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www.strum.com

Presentation to Law Amendments Committee on Bill 6, Amending Petroleum Resources Act 21 October 2014

Ken Summers Minasville, Hants County

Leaving the definition of hydraulic fracturing to the regulatory process turns the ban ultimately into a matter of Ministerial or Cabinet discretion. This fundamentally contradicts the government's intention to put any possible future decision to end the ban, to debate and a vote in the Legislative Assembly. [See 22 October Law Amendments presentation by Barbara Harris.]

The fundamental weakening of Bill 6 is rendered more problematic due to the history in Nova Scotia of highly contingent oil and gas industry regulatory enforcement.

The intent of Bill 6 is to build public confidence through transparency and public accountability. Government discretion in whether regulations are actually enforced in a timely fashion further removes decisions about hydraulic fracturing from spheres of transparency and public accountability.

The Petroleum Directorate of the Department of Energy is deeply committed to promoting the development of an onshore oil and gas industry in Nova Scotia. This commitment includes civil servants who are active advocates for companies, working closely with colleagues charged with regulating those companies.

This has led to a historical practice in Nova Scotia where the actual enforcement of regulations on companies seeking to develop onshore oil and gas resources is known to be a matter of negotiation.

There are many documented instances of these phenomena in the exploration for shale gas by Triangle Petroleum that began with drilling in 2007. Ministers of the previous NDP government often attributed these enforcement "gaps" to the unfamiliarity of government, at that early time, with development that relies on hydraulic fracturing as the main means of extraction. Those Ministers also showed an awareness of the difference made by the public attention to hydraulic fracturing that only became visible in 2011.

But we have right now a continuing lack of willingness by the Depart of Energy or Minister Younger to compel Triangle Petroleum to meet its clear outstanding obligations.

- Triangle Petroleum has responsibility for the clean-up and site reclamation of a 2002 oil well in Cogmagun, Hants County. Residents who have questioned about the site since May have repeatedly been given the excuse that the Department of Energy cannot find the landowners to get permission to inspect the site. There has been no answer to questions of whether or when Triangle will be compelled to reclaim the site.

- Triangle has publicly said that it will reclaim the Cogmagun site after it has drained the two fracking waste ponds in Kennetcook, but there is no technical or business case connection to reclamation at the Cogmagun site. There has been no answer to questions whether the Minister finds it acceptable that Triangle Petroleum is allowed to wait in definitely on rectifying a now 12 year old failure to reclaim the site.

- There are the two Triangle Kennetcook well sites that cannot be reclaimed until the fracking waste ponds have been drained. But the company has 3 more abandoned well sites from the 2008-2009 exploration program that do not have waste ponds, and which Triangle has said publicly it will not use again, even if the company returns to active drilling and development on the Windsor Block lease.

- Again, there is no technical or business case reason that these 3 well sites should not be reclaimed now. But the company also puts off that reclamation until after the draining of the two Kennetcook waste ponds, which has no timeline.

- Minister Younger has also not answered residents' questions of whether he finds it acceptable that Triangle is not compelled to reclaim these 3 well sites in a timely fashion.

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Council of Canadians comments to Law Amendments re: Bill 6
Petroleum Resources Act (amended)
21 October 2014

Madam Chair, members of the committee and members of the public here today,

Thank you for this opportunity to comment. My name is Angela Giles and I am the Atlantic Regional Organizer with the Council of Canadians based here in Halifax.

Just to give you a sense of who I am representing, The Council of Canadians was founded in 1985, and is Canada's largest citizens' organization, with over 100 000 supporters and approximately 60 grassroots chapters across the country. We are a social justice organization and address environmental issues through an environmental justice lens. We promote progressive policies on fair trade, clean water, energy security, public health care, democracy and other issues of social and economic concern to Canadians. The Council has 5 grassroots chapters and approximately 1000 members in Nova Scotia, but many more across the country fighting fracking on a variety of levels and angles, given the complexity of this issue.

I requested to present to your committee on Bill #6, "Petroleum Resources Act (amended)" or "An Act to Amend Chapter 342 of the Revised Statutes, 1989, the Petroleum Resources Act.

We were compelled to present before your committee because we wanted to take the opportunity to participate in this democratic process, first: in order to commend the government for hearing the public's concerns on this issue and, despite pressure from the oil and gas lobby as well as the right-wing Chronicle Herald, seeing the bill through to fruition; and secondly, we felt we needed to take this one last opportunity to strengthen this bill, in the hopes that once again our voices might be heard.

1. Definition within the bill

We would advocate for a clear definition of the term 'hydraulic fracturing' to be included in the bill itself, not in the regulations.

2. Exemption for research and testing

The Bill should define the meaning of "for the purpose of testing and research".

We would propose then that section 11 A (2) add the following:

"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."

One brief additional comment to make here, which is that we would like to see a requirement for the disclosure of any and all chemicals by the companies who perform any "testing or research".

3. Community consent

One of the key findings of the Wheeler review, as you are all likely familiar, was an acknowledgement that community consent is required prior to ever allowing hydraulic fracturing to occur.

This was unfortunately not reflected in the language of this bill, and so we propose the addition of wording to acknowledge that,

(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.

4. Ministerial review must include public consultation

We are concerned with the language of 11 B, which states under part (1) "The minister may review the prohibition under Section 11 A". Part (2) as you can see, goes into further detail about what would be considered by the Minister before lifting it if she or he ever so chose.

These considerations, however detailed, do not include some form of public consultation. This makes it appear that the Minister might make these considerations however briefly the Minister so desires, after which they could lift this amendment.

We recommend an addition under Section 11 a new point (3), stating, "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."

This of course takes us beyond the duty to consult with first nations, which is the law and required as such. More generally however, public consultation is important in a democracy and as we have seen in the example of the wheeler review process, allowed the public to truly express concerns and share science in a way that is not otherwise seen so undeniably.

I would like to recognize the efforts of members of the NOFRAC Steering Committee (of which we are a part) for all of the efforts in ensuring strong legislation, and of course appreciate the efforts of all of you on the committee as well.

Thanks again for your time and attention. I welcome any questions the committee may have.

Respectfully submitted,

Angela Giles

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