

To: Newfoundland and Labrador Hydraulic Fracturing Review Panel

From: Peter Sutherland

Topics: Potential impacts on groundwater; potential impacts on surface water; impacts on land; seismicity and geological risks

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In this submission I make reference to 4 documents as provided on the public website for the Newfoundland and Labrador Hydraulic Fracturing Review Panel. The documents are:

- The Green Point Shale of Western Newfoundland
- Basis for Development and Guidance Related to Hydraulic Fracturing: Part 3
- Report of the Nova Scotia Independent Review Panel on Hydraulic Fracturing
- Environmental Impacts of Shale Gas Extraction in Canada

I first became aware of hydraulic fracturing approximately 2 years ago when the local media began to report on proposed plans to use the oil and gas extraction technique on the west coast of our province. Concurrently, the media began to report on the activities of a local group of citizens who had significant concerns with the impact of hydraulic fracturing on human health and the environment generally. I attended a presentation provided by the Port au Port/ Bay St. George Fracking Awareness Group during which information was provided on the basics of hydraulic fracturing, the risks associated with the technique, as well as, information on the unique geology of the Green Point Shale. Following this public presentation I spent considerable time researching hydraulic fracturing as practiced in the United States and western Canada.

I quickly learned that the Green Point shale is vastly different from the unconventional shale reservoirs known as the Marcellus, Bakken and Barnett shale reservoirs in the United States and the unconventional reservoirs found in western Canada. The document entitled The Green Point Shale of Western Newfoundland states:

The Green Point shale of western Newfoundland differs from other unconventional shale reservoirs being developed in North America:

a. The Marcellus, Bakken, and Barnett shales, like many other unconventional reservoirs in North America, are located in basins where the layers are deformed very little, in ways that are easy to map and understand. Thousands of wells, thousands of kilometres of seismic surveys, and a significant amount of research and testing support unconventional operations of this type. Much of the information was collected during multiple cycles of exploration, so that by now the locations and properties of the hydrocarbon-bearing layers are very well known.

b. Unlike the above, the Green Point shale is not a simple package in a consistently layered sequence. The Green Point shale is part of an allochthon – a large slice of the Earth's crust that was pushed by colliding tectonic plates and moved along huge faults to a location far

from its point of origin. As part of the allochthon, the Green Point shale has been folded, locally thrust over itself, thickened, or pinched out due to multiple tectonic events.

c. Scientific understanding of the Green Point shale is incomplete. Due to a lack of sufficient modern geological data, it is difficult to accurately depict or predict the extent, location, rock characteristics, or shape of Green Point shale layers below the surface.

The same document contains the following statements:

The Green Point shale has been proposed as a target for hydraulic fracturing in western Newfoundland, and the fact that it has been deformed by multiple orogenies must be taken into account when assessing the risks of such an activity.

Because of this long history of deformation, rock layers that were originally flat-lying and regular are now broken and distorted. Reconnaissance geological mapping of the shoreline along Port au Port Bay has shown that Green Point shale layers everywhere are tilted at moderate to steep angles – in some instances to a vertical position – because of the folding and faulting. Understanding the complex structure of the Humber Arm Allochthon in the Port au Port area is still in its preliminary stages. In the Cow Head and Parsons Pond areas too, further work is needed. But it is certain that nowhere does the structure of the Green Point shale follow the predictably simple, layer-cake style found in many other foreland basins of North America ...

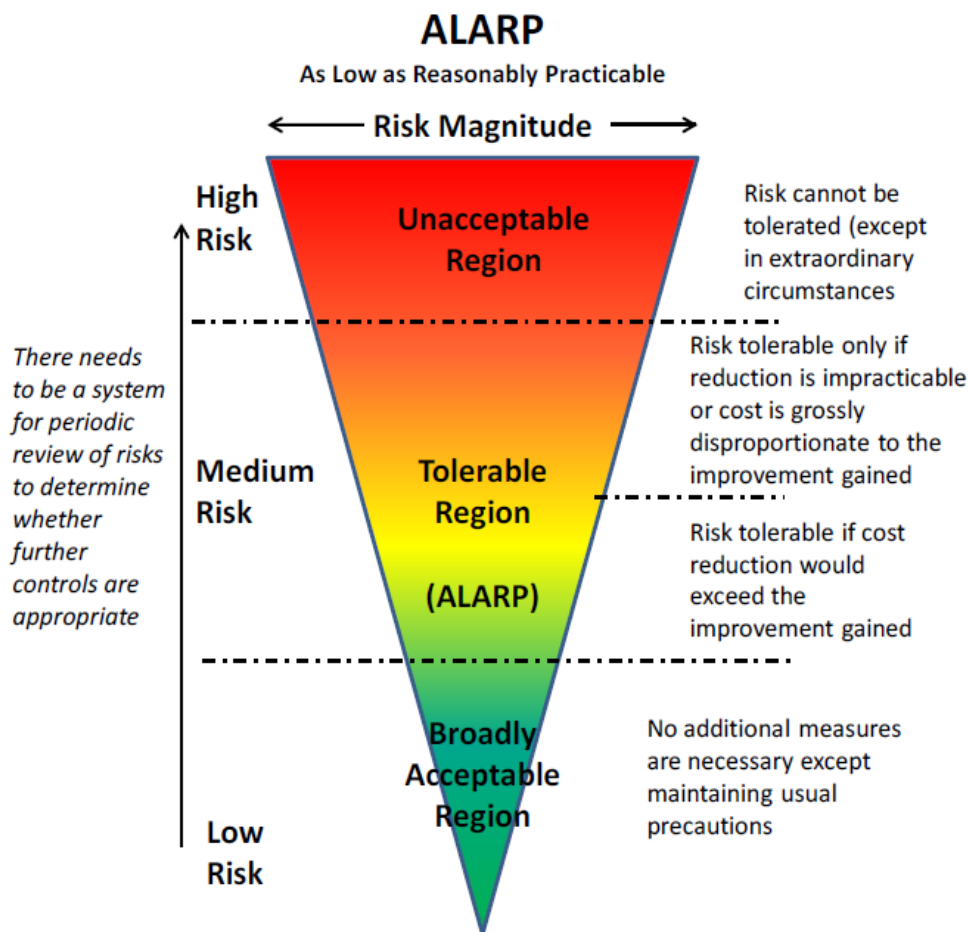


It seems logical that the unique geology of the Green Point shale significantly increases the risk of chemicals used in the hydraulic fracturing process migrating upwards towards the surface and perhaps reaching the surface. This poses serious risk to groundwater, surface water and land. Additionally, the risk of upward migration of greenhouse gases is far greater in the Green Point shale if hydraulic fracturing is permitted. This adds to the risks to groundwater and surface water, as well as, contributing to climate change.

The unique geology of the Green Point shale must be taken into account when considering the guiding principle known as ALARP (as low as reasonably practicable) as described in the document Basis for Development of Guidance Related to Hydraulic Fracturing: Part 3. This document states:

The key principle NL will adopt in regulating hydraulic fracturing operations is risk mitigation. The Minister of Natural Resources will expect operators in NL to ensure that risks are reduced to “as low as reasonably practicable” (ALARP). This principle requires operators to adopt a systematic approach to the identification of hazards and the application of quality engineered solutions and systems to develop the most effective techniques and approaches to best address those hazards. Early risk assessment and operational planning will play a key role in the hazard mitigation associated with hydraulic fracturing operations.

Figure 1: ALARP Risk Rating Schematic



Source: www.risk-assessment.org

As referenced earlier in this submission, the Green Point shale geology is significantly different from the layer – cake geology of the Marcellus, Bakken and Barnett shale deposits. The risk of chemical and gas migration upwards to the surface is far greater for the Green Point shale than the other unconventional shale reservoirs. In my view, this places the unconventional extraction of oil and gas from the Green Point shale in the High Risk/Unacceptable Region of the ALARP Risk Rating Schematic. If human health and environmental protection are top priorities for our province, I fail to see how hydraulic fracturing could be permitted in the Green Point shale given the high risk associated with its unique geology.

It is important to note that both the Council of Canadian Academies and the Nova Scotia Independent Panel on Hydraulic Fracturing both adopted a cautionary note with regards to new hydraulic fracturing developments in Canada. Neither the Council of Canadian Academies nor the Nova Scotia Independent Panel was focussed on a unique geological formation such as the Green Point shale. The cautionary tone of both reports arose from issues and concerns associated with hydraulic fracturing in areas where the geology was very similar to the layer-cake geology of well known unconventional reservoirs.

The Council of Canadian Academies report entitled Environmental Impacts of Shale Gas Extraction in Canada states:

Some of the possible environmental and health effects of shale gas development may take decades to become apparent. These include the creation of subsurface pathways between the shale horizons being fractured and fresh groundwater, gas seepage along abandoned wells, and cumulative effects on the land and communities. Similarly, monitoring strategies, data, and information on the effectiveness of mitigation measures take time to develop, acquire, and assess.

Few peer-reviewed articles on the environmental impacts of shale gas development have been published. The reasons include the young age of the industry (about 20 years old in the United States and only half that in Canada); the proprietary nature of much industry information (in part because technologies are evolving rapidly and are still being tested); the confidentiality surrounding settlement of damage claims; and the absence of U.S. regulations for many of the chemical additives used in hydraulic fracturing (the industry therefore has not had to monitor its impact). Where peer-reviewed studies have been published, they do not necessarily agree (e.g., on the extent of fugitive methane emissions).

Information concerning the impacts of leakage of natural gas from poor cement seals on fresh groundwater resources is insufficient. The nature and rate of cement deterioration are poorly understood and there is only minimal or misleading information available in the public domain. Research is also lacking on methods for detecting and measuring leakage of GHGs to the atmosphere.

The Report of the Nova Scotia Independent Review Panel on Hydraulic Fracturing states:

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.*
- *Independently conducted research of a scientific and public participatory nature is required to model economic, social, environmental, and community health impacts of all forms of energy production and use - including any prospect of unconventional gas and oil development in Nova Scotia - at both provincial and community levels.*
- *Nova Scotia 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 unconventional gas and oil resources. We strongly suggest that whatever time is needed for each of these steps that it should be taken, without any sense of deadline-setting or impatience by any actor. Some might interpret this as a “go slow” approach or even a de facto moratorium. However, we are not proposing a moratorium or any other political device e.g. a referendum, although we note that both have been proposed. Instead we encourage Nova Scotia municipalities, Aboriginal governments, and communities to spend whatever time is necessary learning about these issues, keeping an open mind on future developments, and research and engaging with the possibilities as well as the risks of this activity. We express the hope that this report is used as a basis for the informed debate which must now commence in Nova Scotia. And we note that time and effort must be devoted specifically to allow the Mi'kmaw community to deliberate and conclude their discussions respecting the recommendations in this report.*

The “go slow” approach recommended by the Council of Canadian Academies and the Nova Scotia Independent Review Panel must certainly apply to the province of Newfoundland and Labrador in light of the heightened risks associated with the possible extraction of oil and gas from the Green Point shale utilizing hydraulic fracturing.

The recent past has seen a number of countries ban hydraulic fracturing: Germany, Northern Ireland, France, Bulgaria and Scotland.

Moratoriums have been enacted in the United Kingdom, Romania, Denmark, Ireland, South Africa and the Czech Republic.

In the United States, New York, New Jersey and Vermont have moratoriums in place. Also, a large number of U.S. cities and counties have moratoriums.

In Canada, moratoriums are in place in Quebec, New Brunswick, Nova Scotia and Newfoundland and Labrador.

The widespread concern with the safety of hydraulic fracturing is obvious. In August 2014, an EKOS public opinion poll found that 70% of Canadians supported a hydraulic fracturing moratorium.

In my opinion, it is abundantly clear that hydraulic fracturing requires extensive, independent scientific study to determine its safety and long term risks to human health and the environment. It would be highly imprudent to permit hydraulic fracturing in the Green Point shale due to its unique geology. The risks are far too high. Our province needs to adopt a “go slow” approach as recommended by the Council of Canadian Academies and the Nova Scotia Independent Review Panel.