Subset for Presentation to NLHFRP

October 14th, 2015

4:00 p.m. at Day's Inn

Presenter: Peter Sutherland

I will make reference to these documents in my presentation:

- 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

Part 1: Overview of the Green Point shale geology (*italicized statements* are copied from "The Green Point Shale of Western Newfoundland" , Department of Natural Resources, Government of Newfoundland and Labrador; I have underlined and bolded key points.)

- *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.

Part 2: Specific reference to lack of geological data for the Green Point shale (*italicized* statements are copied from "The Green Point Shale of Western Newfoundland" , Department of Natural Resources, Government of Newfoundland and Labrador)

- *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.*

- *Where visible at the surface, the Green Point shale is heavily fractured. These structures crisscross the rock layers at various angles, forming an interconnected network of weaknesses throughout the formation. The fractures are likely responsible for the leaking of hydrocarbons out of the formation to the surface, resulting in abundant seeps and shows (Figures 1 and 6). Similar leakage explains how hydrocarbons from the Green Point shale could have migrated to conventional reservoirs like the ones explored in the carbonate shelf sequence (see sections 2.2, 2.3, and Appendix B).*

- *Evaluating the amount and kind of deformation and fracturing at each proposed site will be an important part of the risk assessment for any hydrocarbon exploration of the Green Point shale.* ***The greater the abundance of interconnected crosscutting fractures, the easier it is for hydrocarbons– or any fluid – to leak out of the formation.***

- *As computers have become faster and more powerful, larger and more detailed seismic surveys have become possible. In the mid 1990s, small 2-D surveys were still common; but since then large-scale, high-resolution 3-D surveys have become routine. In consequence, geologists' understanding of sedimentary basins based on seismic surveys has improved and evolved. True 3-D seismic data have yet to be acquired in western Newfoundland (see Area 1 in CNLOPB, 2010). Nonetheless, sophisticated computer programs can rework 2-D seismic data into quasi-3-D models with some success, and this technique has been used for the region.*

- *Approximately 12 000 line-kilometres of 2-D seismic data have been collected in offshore regions of western Newfoundland since 1969. Onshore, the approximately 1100 line-kilometres of seismic data provide sporadic coverage, and existing data are concentrated in specific regions, namely Parsons Pond, Port au Port Peninsula, northern St. George's Bay and the Deer Lake area lowlands of the upper Humber River (Figure 11). Most of the seismic data were collected in thelate-1980s to mid-1990s and are not up to modern standards.*

- ***Because the available seismic data do not provide effective images of the Humber Arm Allochthon or the Green Point shale, a modern seismic program in the region would greatly improve the ability to predict where the Green Point shale occurs at depth, how the composition of the HumberArm Allochthon varies internally, and how it was affected by regional deformation and faulting. Such higher quality data would also be crucial for designing – and predicting the effects of – an initial hydraulic fracturing program as well as any future production operations.***

- *On the Port au Port Peninsula, several visible faults oriented northeast–southwest or north–south cut rocks of the Lower Paleozoic carbonate platform. These can be traced for some distance into Port au Port Bay using enhanced aeromagnetic data (Figure 15), even though several of these faults cannot be mapped with confidence in the overlying Humber Arm Allochthon rocks onshore. Strong linear features oriented nearly north–south occur in East Bay, and from these it is possible to project the Piccadilly Bay Fault northward dissecting Port au Port Bay as proposed by Stockmal and others (2004). The structure within the bay, however, may be much more complicated than previously shown because the magnetic data indicate that there are several similarly oriented faults that have not been identified previously.*

Part 3: Overview of ALARP (as low as reasonably practicable)

- Basis for Development of Guidance Related to Hydraulic Fracturing: Part 3, page 3
- *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.*
- The provincial government has stated the protection of human health and the environment generally are of paramount importance.
- In order to protect health and the environment accurate risk assessment is essential.
- Green Point shale geology is unique and not well understood. More geological data is required so that a significantly improved model of the Green Point shale is achieved.
- Accurate risk assessment can only be accomplished with accurate geological data.

Part 4: Overview of cautionary recommendations in recent Canadian reports

- Report of the Nova Scotia Independent Review Panel on Hydraulic Fracturing
- Environmental Impacts of Shale Gas Extraction in Canada

- Both reports recommend a “go slow” approach with respect to hydraulic fracturing in Canada.
- Considerable independent scientific study is required to assess the impact of hydraulic fracturing on human health and the environment.

Part 5: Rationale for higher level of caution in our region

- Lack of geological data for the Green Point shale must be addressed.

  I emphasize that the statements made in parts 1 and 2 of my presentation are taken directly from a provincial government document produced by the Department of Natural Resources. The authors of “The Green Point Shale of Western Newfoundland” are professional geologists and engineers employed by the Government of Newfoundland and Labrador. The statements addressing the unique geology of the Green Point shale and the lack of up-to-date geological data are not my opinions or the opinions of the Port au Port/Bay St. George Fracking Awareness Group. The statements are scientific conclusions based on available data.

  On October 1st, 2015 the Premier of Newfoundland and Labrador announced the discovery of a massive oil and gas reservoir off the east coast in the region known as the Flemish Pass. In the Premier’s press release he stated the province had obtained seismic data on the region by contracting a global petroleum consultancy firm (Beicip – Franlab) to collect the seismic data and that the data would be sold to oil and gas companies.

  If the potential for oil and gas development on the west coast of the province is as substantial as claimed by government and industry, then it seems logical for similar seismic study to be conducted on the west coast in order to address the lack of data as identified by the authors of “The Green Point Shale of Newfoundland”. This up-to-date seismic data should be commissioned by the provincial government before a new policy decision is taken on the hydraulic fracturing issue.

  A modern seismic program will be invaluable for deliberations on the question “Is the Green Point shale a suitable target for hydraulic fracturing?” The extensive deformation of the Green Point shale through geological time frames may have created an unsuitable target zone for hydraulic fracturing.

- Accurate, quantitative risk assessment cannot be undertaken in the absence of modern geological data. Consequently, the risks to human health and the environment cannot be properly assessed. If government’s commitment to the protection of human health and the

environment is genuine, then valid risk assessment is mandatory. This risk assessment must be based on the best seismic data that does not exist at this juncture.

- More scientific study is required on the effects of hydraulic fracturing. The Nova Scotia Review Panel and the Council of Canadian Academies have highlighted this requirement. Many studies on the effects of hydraulic fracturing have been published in the past few years. Many more studies are ongoing worldwide. Serious questions have been raised about the effects on human health and the environment.

Part 6: Recommendations to the NLHFRP

1. Recommend to government that it maintain the current policy respecting hydraulic fracturing (Applications from industry for hydraulic fracturing are not being accepted.) Also, experimental/exploratory hydraulic fracturing programs will not be considered either. This policy is to be maintained until hydraulic fracturing is scientifically proven to be safe.
2. Recommend to government that it commission a modern seismic program on the west coast of the province to obtain data on the Green Point shale. The data and conclusions of this program will be made public at the earliest opportunity.
3. Recommend to government that it review the studies on the effects of hydraulic fracturing on human health and the environment. These studies should be reviewed by health and environmental officials, as well as, by independent academics. The results of the review process will be made public at the earliest opportunity.
4. Recommend to government that if a decision is made to permit hydraulic fracturing, then further public consultations be conducted before hydraulic fracturing applications are considered by government.

Original Submission:

http://nlhfrp.ca/wp-content/uploads/2015/01/Letter-from-P.-Sutherland.pdf