Gros Morne
Co-operating Association
B.P. 144, Bonne Bay, Terre-Neuve & Labrador, A0K 1P0

27 juillet 2016

Gouvernement du Québec
Commission de l'agriculture, des pêcheries, de l'énergie
et des ressources naturelles
par courriel : capern@assnat.qc.ca

Sujet: Consultations particulières et auditions publiques
sur le projet de loi # 106
Loi concernant la mise en oeuvre de la politique énergétique 2030
et modifiant diverses disponitions législatives

À qui de droit,

Je vous écris, au nom du Gros Morne Co-operating Association, afin d'enregistrer notre court mémoire dans le cadre de vos consultations concernant la politique énergétique du Québec 2030 et le projet de loi #106.

Notre association, organisation indépendante à but non-lucratif, ayant son siège social sur la côte ouest de Terre-Neuve, par l'entremise de son Conseil d'administration et de ses employés (ées), est engagée depuis déjà 23 ans, dans la protection et la promotion du Parc National de Gros Morne avec les communautés et les groupes du milieu touristique et des pêches.

Nous sommes d'opinion, que si jamais l'exploration et l'exploitation pétrolière seraient autorisées dans le Golfe du Saint-Laurent, les risques et impacts, tant au point de vue environnemental, économique, social et humain, en seraient très élevés, voir incalculables. Nous incluons à cela, une analyse de la réduction des gaz à effet de serre (changements climatiques) que nous avons tous à prendre en considération dans nos décisions communes et individuels.

Par la présentation de ce court mémoire, nous ne voulons certainement pas nous ingérer dans le dossier énergétique d'une autre province, car nous comprenons bien ce champ de compétence provinciale. Mais, nous tenons tout de même à faire part de nos commentaires en qualité ***de voisin***.

Car, nous sur la côte ouest de Terre-Neuve, nous ne sommes pas en mesure de contrer par des mesures d'urgence en cas de déversements, soient majeurs ou pas. De toute évidence, des recherches ont bien démontré que personne n'est prêt à un déversement majeur dans le Golfe. Particulièremnet sur la côte ouest de Terre-Neuve, aucun équipement est en place ou est planifié pour contrer à une marée noire. En d'autres mots, advenant un incident majeur du côté québecois dans le Golfe, nous serons grandement affectés, sans être en mesure de déployer un plan d'intervention, grand, petit, adéquat ou pas…Donc, c'est à y penser !

Comme vous le savez probablement, le gouvernement de Terre-Neuve a déclaré en novembre 2013 un moratoire sur la fracturation hydraulique, suivi le 10 octobre 2014 de la formation d'un Panel Indépendant (5 scientifiques) sur la Fracturation Hydraulique (côte ouest de Terre-Neuve). Ce Panel vient de soumettre son rapport le 31 mai 2016, dont je soumet le *Sommaire* à cette lettre (pièce jointe - *NLHFRP Unconventional Opportunities & Challenges*). Comme vous pouvez y lire, ce rapport comporte un total de 85 recommandations et suggère très fortement au gouvernement de continuer son moratoire, et en plus de faire l'implantation de toutes ces recommandations avant même de poursuivre avec cette technique. En plus, selon le scénario de travail utilisé dans ce rapport, basé sur dans des conditions optimales et ambitieuses d'exploitation des hydrocarbures sur la côte ouest de Terre-Neuve, et soutenu par un groupe de 27 scientifiques du milieu, il n'en serait pas finacièrement avantageux pour notre province de s'aventurer dans cet exercise. C'est peu dire! Le rapport complet est disponnible au www.NLHFRP.ca

Un autre point important, est celui de l'acceptabilité sociale. Je puis vous assurer, que dans les communautés de l'ouest de Terre-Neuve, le projet de l'exploration / exploitation des hydrocarbures, incluant Old Harry, est loin de faire l'unanimité ou même de susciter de l'intérêt. Que vous parliez aux communautés des Premières Nations, des gens d'affaires ainsi que ceux/celles des milieux touristique et de la pêche ou même des communautés, il en resort que ce genre de projet est **très mal reçu**. En

d'autre mots, l'acceptabilité sociale n'est pas au rendez-vous. Nous préfèrons, et de beaucoup, des projets durables, basés sur des énergies renouvelables.

Regardant le dossier québécois de notre "côté de la clôture", nous suggèrons :

a) d'avoir une **approche de collaboration entre les provinces**
b) de bien **écouter** les différents intervenants et communautés des **5 provinces** du golfe
c) de s'assurer qu'une **communication / consultation** efficace, sérieure et sincère soit mise en place entre les provinces.

Le tout ayant pour but de bien comprendre tous les enjeux, afin de prendre une décision éclairée. Car, votre décision, nous affectera…

En guise de conclusion, nous sommes d'opinion, en qualité de partenaire qui partage avec vous ce Golfe que nous aimons, que les **risques sont trop grands** pour justifier la mise en place d'une future exploration et exploitation des hydrocarbures dans le Golfe du Saint Laurent.

Prière s.v.p. d'accuser réception.

Sousmis pour votre considération.

Bien à vous,

Raymond Cusson
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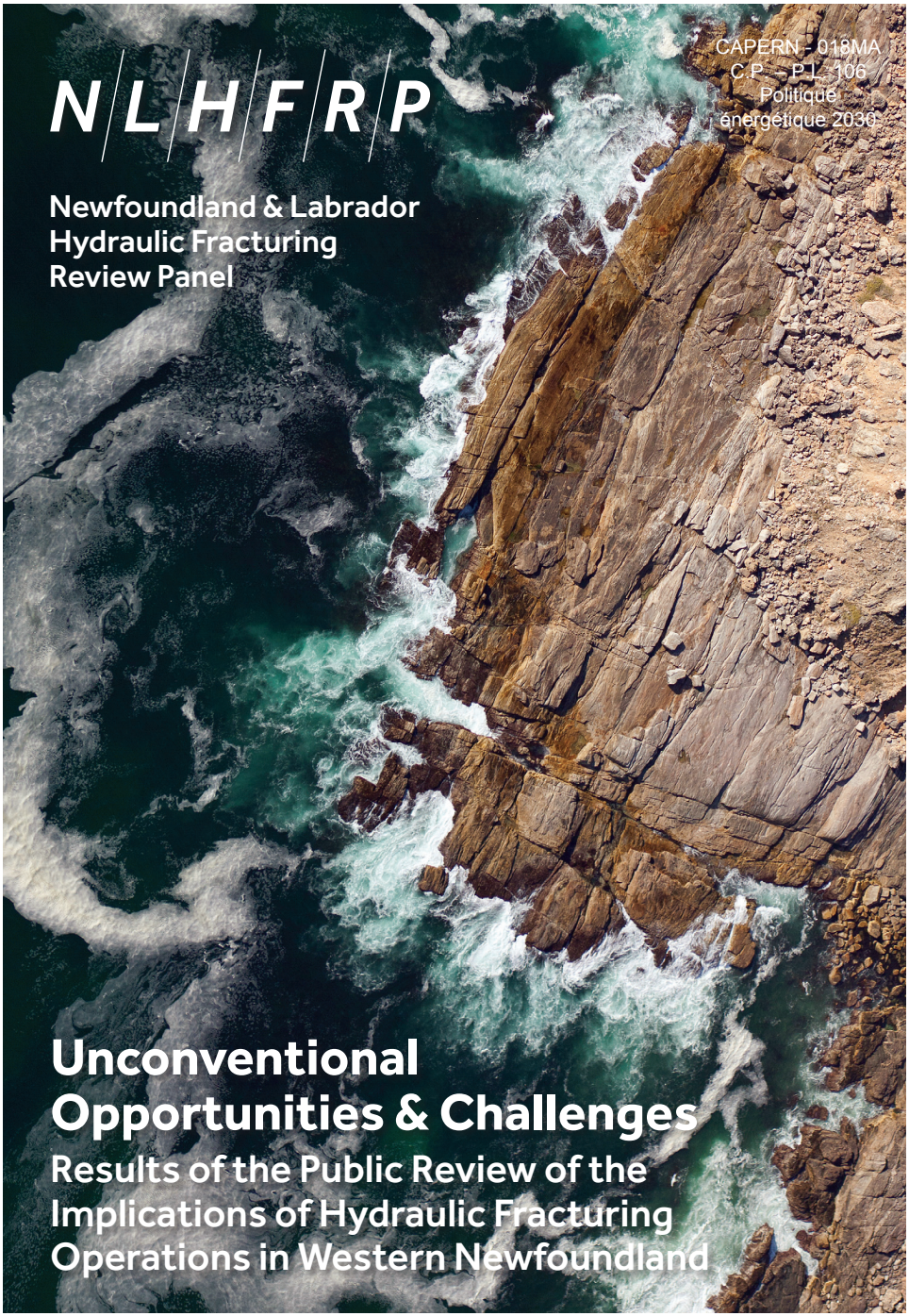
Pièce jointe : NLHFRP Sommaire

N L H F R P

Newfoundland & Labrador
Hydraulic Fracturing
Review Panel



Unconventional Opportunities & Challenges

Results of the Public Review of the Implications of Hydraulic Fracturing Operations in Western Newfoundland

Executive Summary

Dr. Ray Gosine *(Chair)*
Dr. Maurice Dusseault
Dr. Graham Gagnon
Dr. Kevin Keough
Dr. Wade Locke

Biographies of Panel Members

Dr. Ray Gosine is Professor and J.I. Clark Chair in the Faculty of Engineering at Memorial University, and Associate Vice-President (Research). His research is in the area of industrial automation with applications in the natural resource industries. He was awarded the President's Award for Outstanding Research by Memorial University, and he is a Fellow of the Canadian Academy of Engineering and a Fellow of Engineers Canada. Dr. Gosine is a Professional Engineer (P. Eng.) in Newfoundland and Labrador.

Dr. Graham Gagnon is a Professor in the Department of Civil and Resource Engineering at Dalhousie University. He is also the NSERC Industrial Research Chair in Water Quality and Treatment and the Director of the Centre for Water Resources Studies. Dr. Gagnon was awarded the George Fuller Award from the American Water Works Association in recognition of his engineering leadership and contributions to water quality. Dr. Gagnon is a Professional Engineer (P. Eng.) in Newfoundland and Labrador, and Nova Scotia.

Dr. Maurice Dusseault is a Professor of Engineering Geology in the Department of Earth and Environmental Sciences at the University of Waterloo. His research interests include thermal and non-thermal oil production, wellbore integrity, deep disposal technologies for solid and liquid wastes, hydraulic fracture mechanics, CO_2 sequestration in saline aquifers, shale gas and shale oil mechanics, and compressed air energy storage in salt caverns. Dr. Dusseault is a Professional Engineer (P. Eng.) in Newfoundland and Labrador, Ontario, and Alberta.

Dr. Wade Locke is a Professor and Head of Economics at Memorial University. He specializes in the Newfoundland and Labrador economy, resource economics, public finance, public policy, innovation indicators, productivity, economic impact assessment, and cost-benefit analysis. He is an honorary lifetime member of the Atlantic Canada Economics Association, and he was awarded the President's Award for Exemplary Community Service by Memorial University. Dr. Locke was awarded the Queen Elizabeth Diamond Jubilee Medal.

Dr. Kevin Keough is past-President and Chief Executive Officer of the Alberta Heritage Foundation for Medical Research, and he was Chief Scientist at Health Canada. At Memorial University, he was Professor and Head of Biochemistry and Vice-President (Research). As a former executive member of the Medical Research Council, he was instrumental in the creation of Canadian Institutes of Health Research. Dr. Keough is a Fellow of the Canadian Academy of Health Science.

Mandate & Purpose

This report reflects the views of the independent volunteer Review Panel that was appointed by the Minister of Natural Resources, Government of Newfoundland and Labrador under Terms of Reference that included the following mandate:

> *The mandate of the Panel is to conduct a public review and advise the Minister of Natural Resources on the socio-economic and environmental implications of the hydraulic fracturing process with respect to the possible exploration and development of the petroleum resources of Western Newfoundland.*

The report constitutes the results of the Panel's review and provides advice, with supporting evidence, to the Minister. In addition, the Panel hopes that this report will have more general value as a foundation for public education about hydraulic fracturing within the context of Western Newfoundland.

Terminology

In the oil and gas industry, the term "hydraulic fracturing" refers exclusively to the activities of well stimulation and does not include exploration, drilling, production, and other activities. The Panel uses the terms "hydraulic fracturing operations" and "unconventional oil and gas development" to describe the all-inclusive industrial process that includes:

- exploration activities, such as seismic and magnetic surveys, and the drilling of exploratory wells;
- development of infrastructure, including access roads, pipeline rights-of-way, and drill pads;
- construction of transportation and storage facilities, such as pipelines and storage tanks at ports;
- drilling and construction of production wells;
- well completion and stimulation using hydraulic fracturing technology, including the supply of make-up water and disposal of wastewater following stimulation;
- production activities, including disposal of water that is produced with the oil and gas;

- re-stimulation of wells;
- well decommissioning and abandonment; and
- site restoration.

Primary Task for the Panel 1

The primary task for the Panel, as outlined in the Terms of Reference, was to make a recommendation on "whether or not hydraulic fracturing should be undertaken in Western Newfoundland." Based on the scope of activity outlined in the Terms of Reference, the Panel interpreted this use of the term "hydraulic fracturing" to mean the all-inclusive industrial process described above.

To fully appreciate the Panel's report, it is important to understand the situation in Newfoundland and Labrador as it pertained to approvals of applications for hydraulic fracturing at the time the Panel was constituted. Specifically, as noted in the Panel's Terms of Reference:

> *In November 2013, the Minister of Natural Resources announced that no applications for onshore and onshore-to-offshore petroleum exploration using hydraulic fracturing would be accepted until government could undertake a balanced review of regulations, rules and guidelines in other jurisdictions; complete the technical work necessary to fully assess the geological impact in Western Newfoundland; and following this process, undertake public consultations to ensure that residents can comment and are fully informed before any decisions relating to hydraulic fracturing are made.*

Although formal moratoria have been legislated in Nova Scotia and New Brunswick, the "pause" in accepting applications involving hydraulic fracturing in Western Newfoundland is not a formal moratorium, despite sometimes being described as such by members of the public. Rather, the "pause" was an operational decision of the province's Department of Natural Resources.

Review Process

As a basis for making a recommendation to the Minister, the Panel considered a substantial body of information gathered during the review process, including:

- all documents provided to the Panel by Government upon the appointment of the Panel;
- all documents provided to the Panel by Government at the request of the Panel;
- all documents sourced by individual members of the Panel;
- expert reports on specific topics that were either commissioned by the Panel or prepared by individual members of the Panel; and
- over 600 documents that were received following a request by the Panel for submissions from the general public and stakeholder groups, including documents that were received following individual and group meetings, public consultation sessions, and several visits to Western Newfoundland by the Panel during the course of its work.

While the questions posed in the Terms of Reference provided a useful starting point for the review process, the Panel was not limited by these questions. The information-gathering phase of the review sharpened the Panel's focus on the more significant issues. Consequently, the Panel's work focused on the issues of most importance to the health and well-being of the people of, and environment within, Western Newfoundland. The analysis and recommendations presented in this report reflect the Panel's careful consideration of the information gathered throughout the entire review process.

To illustrate the scale of an unconventional oil and gas development project and to help understand the potential benefits and costs, the Panel developed a full-scale scenario for a development project in Western Newfoundland. Since the Green Point shale resource is the focus of current commercial interest, the Panel selected that resource as the basis for more detailed consideration. The illustrative scenario is based on the following:

- information provided by the Department of Natural Resources at the request of the Panel;
- knowledge in the public domain regarding exploration license (EL) 1070 held by Shoal Point Energy, a company with an interest in using hydraulic

fracturing to develop the Green Point shale resource;
- information submitted to the Panel by Shoal Point Energy;
- publicly available information about oil production from the Bakken formation in North Dakota, Montana, and Saskatchewan; and
- information from the Newfoundland and Labrador Community Accounts.

It is important to emphasize that the scenario developed by the Panel is not Shoal Point Energy's development plan. Rather, the scenario should only be considered to be illustrative of the general nature and scale of full-scale development of the Green Point shale from onshore-to-offshore wells in the Port au Port Bay area. As such, the scenario provided a context in which the Panel could consider some of the socio-economic and technical issues related to unconventional oil and gas development in Western Newfoundland.

Additionally, experts that the Panel felt would be able to offer valuable perspectives and insights on the report were asked to independently review a draft of the final report. The final report represents general agreement among all Panel members with respect to the background information presented in the report and its recommendations.

An Illustrative Scenario for a Development Project

The illustrative scenario developed by the Panel is a development project comprising 480 production wells that would be drilled from 30-40 onshore well pads geographically distributed near the coast around Port au Port Bay. These wells would drain approximately 282 km^2 of the Green Point shale resource with an estimated recovery of approximately 150 million barrels of oil and 75 billion standard cubic feet of gas. Each well would have a wellhead located onshore and a 2,000 m long horizontal well section that extends out under Port au Port Bay. The depth of the prospective Green Point shale resource is understood to be 1,000-3,000 m.

It is anticipated that it would take six years to drill, complete, and stimulate 480 wells. During these activities, each well pad would correspond to a cleared area of approximately 0.03 km^2 (i.e., 6-7 acres). Once all wells at a pad are put into production, the footprint of the pad could be reduced to an area of approximately 0.015 km^2 (i.e., 3-4 acres). Since the well pads would be connected by water, oil, and gas pipelines, rights-of-way with typical widths of 10-15 m would be constructed. The average initial production

per well would be 400 barrels of oil per day, with subsequent decline rates consistent with published horizontal well data from the Bakken formation. Each well would produce for 20 years.

There would also be a need to construct and operate central processing facilities, main gathering lines, central storage and loading facilities, and a marine terminal. In addition, field gathering lines and processing facilities at each pad would need to be constructed and connected to the wells. Again, for the purpose of this illustration, flowback and produced water transportation would utilize tanker trucks, while movement of oil would be via pipeline to a marine terminal for export to world markets.

In this illustrative scenario, the associated natural gas would be used to generate electricity, which would be necessary to run the production operations. Consequently, the project includes the construction and operation of a gas-to-electricity generating facility, gas flow lines, and an electricity distribution system. Any electricity produced in excess of the needs of the project would be placed into the regional grid.

Two options for handling flowback and produced water were considered. The first involves the construction and operation of eight deep disposal wells for wastewater reinjection, and the second involves the transportation and off-site treatment of the wastewater. Finally, the project incorporates the costs of well decommissioning and abandonment.

The Panel carried out extensive economic and fiscal analyses of the project. From an economic perspective, the analysis showed that the project is not viable at mid-2016 oil prices (i.e., approximately $49 US per barrel on May 16, 2016). The economic and fiscal analyses also indicated that the project is not attractive below an oil price of $85 US per barrel.

In addition to considering the economic feasibility from the perspective of the proponent and investors in the project, the Panel also felt that it was important to consider the annual contribution of the project to the provincial economy. The Panel assessed the potential impact on the fiscal position of the province and on employment, particularly in the Stephenville – Port au Port area.

Provincial government revenues are in the order of $6.8 billion annually.

The annual fiscal impact of the illustrative project is estimated to be $84-$136 million, which corresponds to 1.2-2.0% of revenues. While not an insignificant source of revenue, the annual contribution would be far less than the revenues normally attributed to offshore oil and gas activities, including royalties. The revenues would be more in line with revenues from lotteries, vehicle and driver licence fees, tobacco tax, and insurance company tax. In other words, the annual provincial revenues from the illustrative project, while perhaps very important to Western Newfoundland under certain revenue-sharing models, is not considered to be a "game changer" with respect to the fiscal position of Newfoundland and Labrador.

From an employment perspective, the analysis of the project shows that approximately 2,500 person-years of employment, or slightly more than 400 full-time equivalent jobs annually, could be created in the Stephenville – Port au Port area during the six-year period when construction of the wells and associated infrastructure, including the construction and upgrading of roads, would be carried out. When the construction is completed and the wells are in production, the number of jobs in the Stephenville – Port au Port local area could be in the order of 30-40 full-time jobs annually. This employment estimate does not include potential employment from operation of the electricity generation and distribution system nor from the operation of the marine terminal. The scale of both of these activities, and hence the level of employment, depends on a number of factors, including plans for the utilization of the associated gas and the possibility of on-island treatment of wastewater. Additionally, from an employment impact perspective, it will be important to understand the extent of impact, if any, on existing employment (e.g., from tourism) from the unconventional oil and gas development in Western Newfoundland. As well, for the individuals who benefit from employment opportunities, the benefits could extend beyond financial to include satisfaction from being engaged in stimulating and interesting work, and increased self-esteem resulting from employment.

Another significant issue highlighted by the illustrative project is the amount of truck traffic on the roads around Port au Port Bay during construction and production. Like most rural coastal communities in Newfoundland, the communities around Port au Port Bay are comprised of homes built along a single road that runs through the communities. If the primary mode of transportation is truck, the number of truckloads of

equipment, water, proppant, and chemicals is estimated to be in the order of 3,320 per well during construction and production. In the absence of significant new road infrastructure or alternative methods for transporting large volumes of fluids and materials around the coastal regions of Port au Port Bay, the impacts on the daily lives of people living around Port au Port Bay would likely be very significant and unacceptable to them.

What the Panel Heard & Learned

Based on the Panel's review of previous studies about the impacts of unconventional oil and gas development, reports prepared by experts consulted by the Panel, and public submissions to the Panel, a number of issues were identified as being of particular significance to the Panel's work. These include issues related to environmental, public health, and socio-economic risks associated with development.

The primary environmental issues include:

- potential negative impacts on climate change over time from natural gas leakage resulting from the loss of well integrity due to poor quality cement seals on wells;
- possible stress on the capacity of local water supplies if these sources are to supply the water required for the completion of wells;
- a poor understanding of the local geology and the potential risks associated with the contamination of local drinking water supplies as a result of natural gas and saline water migration via complex underground pathways;
- possible contamination of surface water and groundwater sources from surface spills during transportation and from handling flowback and produced water, chemicals, and petroleum products;
- potential land disturbance and impacts on groundwater and surface water flow as a result of the construction of roads, well pads, pipelines, and other infrastructure required for unconventional oil and gas development; and
- possible earthquakes that may be induced during hydraulic fracturing operations.

The primary public health issues, many of which follow from the environmental issues, include:

- potential exposure to airborne toxicants arising from spills of fracturing fluids, wastewater, and petroleum products; leaks from wells; and emissions from large numbers of diesel trucks and equipment used during the development of wells;
- possible degradation in drinking water quality due to surface spills and migration of gas and chemicals;
- potential exposure to wastewater or other hazardous fluids as a result of accidents; and
- increased anxiety about potential health risks from the immediate and cumulative effects of industrial development, including effects from an increase in truck traffic, an increase in the likelihood of accidents, and an increase in noise.

The primary socio-economic issues include:

- possible increased stress on the healthcare and social services systems as a result of boomtown effects;
- potential negative impacts on other economic sectors, such as the fishery, tourism, and agriculture;
- possible negative effects on recreational uses of land and water;
- inadequate fire and emergency services in the region;
- potential major changes to the way of life in the vicinity of development as a result of the intensity of industrial activity, particularly during well construction;
- potential negative effects on Qalipu Mi'kmaq culture in the vicinity of development due to impact on the environment; and
- lack of confidence that Government can provide effective regulatory oversight of unconventional oil and gas development.

When considering these general issues or attempting to quantify the associated risks, it is important to take local context into account. This includes considering factors such as geology; geography; existing infrastructure; and existing emergency response, healthcare, and social services capacity. To date, there has not been a formal assessment of risk for prospective unconventional oil and gas development in Western Newfoundland. For many of the issues listed above, the limited understanding of the Green Point shale geology will make it difficult to quantify the associated risks.

The Primary Recommendation

Returning to the primary task of making a recommendation on "whether or not hydraulic fracturing should be undertaken in Western Newfoundland", the Panel does not believe that a simple yes or no recommendation would be appropriate or responsible, especially given the unknown and unresolved issues related to unconventional oil and gas development in the context of Western Newfoundland. The Panel, however, unanimously recommends that a number of gaps and deficiencies must be addressed before the necessary conditions could exist that would allow for hydraulic fracturing, as an all-inclusive industrial process, to proceed reasonably and responsibly in Western Newfoundland.

Supplementary recommendations are proposed to address these gaps and deficiencies. The Panel believes that these supplementary recommendations represent a staged, cautious, and evidence-based approach that should facilitate a better understanding of the opportunities and challenges that unconventional oil and gas development in Western Newfoundland presents. Furthermore, implementation of these recommendations should allow for a better-informed decision with respect to whether hydraulic fracturing operations should be permitted in the future.

The Panel believes that, at this point, the "pause" in accepting applications involving hydraulic fracturing in Western Newfoundland should remain in effect while some of the supplementary recommendations are implemented.

The Rationale

The issues identified by the Panel encompass provincial and regional policy and planning shortcomings related to energy and climate change policies, regional economic development plans, social wellbeing, health status and protection, environmental protection, and the regulatory environment. In addition, there are information gaps of both a scientific and technical nature. For unconventional oil and gas development to proceed in Western Newfoundland, there must be an understanding by the public of the scale of such development and what it means to individuals and families, the region, and the province. Furthermore, there must be a clear understanding of the corresponding benefits and risks. There also needs to be public confidence in the actions taken to address these issues.

Unlike other jurisdictions where unconventional oil and gas development has taken place, the geology of the Green Point formation is complicated and does not offer the well-defined layer-cake structure that is often portrayed for other developments. The complicated geology of the Green Point shale, coupled with a limited understanding about the geology, underlies public concerns about health risks and damage to the environment that could result from the migration of chemicals and hydrocarbons through geological structures that are not well understood. This also gives rise to uncertainty with respect to the technical and commercial viability of development.

While the Green Point shale may be an economically viable source of oil and gas, it is not an energy resource that is important to meeting the current or anticipated energy needs of Newfoundland and Labrador. In this respect, the situation is different from that which exists in other jurisdictions, such as Nova Scotia and New Brunswick, where shale gas is a potential domestic source of fuel for gas-fired power generation facilities and home use.

Oil from the Green Point shale, however, represents an export commodity that could, at sufficiently high prices, return modest revenues to the province, relative to revenues from other oil exports. Through an appropriate revenue sharing model, some of these revenues could be available for investment within the region where development takes place. Although development of the Green Point shale resource would not likely transform the province fiscally, it could have potential to generate local employment and economic benefits over a 26-year period. Given the potential economic and employment impact, a project of the scale illustrated by the Panel's scenario could be a regional economic development opportunity of significance to the people of Western Newfoundland, and, in particular, to the people of the Stephenville – Port au Port area.

A Way Forward

The Panel believes that there is a way forward that would allow for better-informed consideration of whether hydraulic fracturing operations should be permitted in Western Newfoundland. The first step is to consider unconventional oil and gas development in the context of up-to-date and forward-looking provincial policies and regional plans in which there is public confidence.

Next steps must also include a comprehensive evaluation of the risks and benefits of development. In addition, basic geoscience research, including experiments and field testing, is required to understand the Green Point shale resource and the technical risks of full-scale development of that resource. An effective regulatory system and appropriate risk management approaches would help ensure that unconventional oil and gas development in Western Newfoundland, should it proceed, will be carried out in a manner that supports public health, protects the environment, and maintains the public confidence of the people most affected by a development. The way forward is predicated on a comprehensive and balanced program of public education.

Since Gros Morne National Park is adjacent to the Green Point shale resource, clarity with respect to how development potentially affects the Park is important. Restrictions on development around the Park will limit the amount of oil and gas that might be recovered from the Green Point shale, with an impact on the economic and fiscal analyses for a project. There are concerns that industrial activity around Gros Morne National Park could threaten its designation as a UNESCO World Heritage Site or could negatively impact the enclave communities around the Park that have developed a tourism industry based largely on Gros Morne. An appropriate buffer zone around Gros Morne National Park must be established.

If unconventional oil and gas development is to take place in Western Newfoundland, the Panel believes that it is critical that appropriate scientific studies are first undertaken. This includes, but is not limited to, studies required to understand the Green Point shale. These studies will facilitate the understanding of the local geology and hydrogeology that is required to quantify the public health, environmental, socio-economic, and commercial risks and to determine whether mitigation of these risks is feasible within a specific development context. Some of the required baseline studies, for example the assessments of seismicity and coastal change, have to take place for several years prior to a development. The results of these studies will be important to consider when deciding whether to permit unconventional oil and gas development, and when specifying regulations and conditions related to a development. Also, as suggested in many submissions to the Panel, a Health Impact Assessment must be carried out as part of Government's consideration whether to permit unconventional oil and gas development in a particular region.

To avoid issues encountered in other jurisdictions, baseline health and environmental data must be collected in advance of development activity. Monitoring programs, including interpretation of collected data, must be designed and incorporated into exploration and development plans. Data and interpretations for key environmental and public heath impact indicators must be available in the public domain. These monitoring programs must be continued throughout production and beyond well decommissioning and abandonment. A robust, comprehensive, and transparent regulatory system for unconventional oil and gas development must also be developed and implemented. Best practices must be employed by industry to minimize the occurrence of incidents and accidents that could negatively affect public health, worker health and safety, or the environment.

Risks must be identified, assessed, and effectively managed. While the Panel recognizes that there may not always be alignment between actual and perceived risks, effective community engagement in processes related to risk assessment and risk management will be a critical part of earning and maintaining public confidence.

Public confidence and trust must be treated as a priority by Government and industry. Government must gain and maintain public confidence as it considers whether it will move forward from the current "pause" in accepting applications involving hydraulic fracturing in Western Newfoundland. The public must have confidence that an industry will be managed and regulated in a manner that protects the health of people and the environment and that advances the interests of the communities most affected by development. Gaining and maintaining such confidence is a shared responsibility of Government, which is responsible for the regulatory framework, and industry, which manages industrial activity and operations. If the public is to gain confidence that industry will be a good partner, early engagement by proponents of development must also be done with transparency, honesty, and integrity.

A critical early step will be for Government to provide leadership in facilitating the necessary scientific research and public education relevant to the Western Newfoundland context, including education about the scale, benefits, and risks. There is a need for a balanced-approach to public education around the socio-economic, health, and environmental costs and benefits of unconventional oil and gas development. Furthermore,

issues arising from a comprehensive analysis of more detailed Western Newfoundland development scenarios must inform the education program.

Public education must not become an effort to persuade people toward a particular position, for or against development. Rather, public education must advocate for the facts about unconventional oil and gas development set within the context of Western Newfoundland. Where decisions are to be made on scientific or technical matters, these decisions must be science-based. The province's post-secondary education system, in partnership with other national and international institutions with expertise in issues related to unconventional oil and gas, should play an important role in public education.

As outlined in the mandate letter to the Minister of Natural Resources from the Premier, social licence is a factor with respect to future decisions about hydraulic fracturing in Western Newfoundland. Government, therefore, must develop and communicate clearly the process by which social licence will be gauged and monitored.

The Panel believes that better-informed decision-making by all stakeholders, including Government, the public, and industry, is the "way forward". In particular, the Panel feels that its supplementary recommendations outline a process to give full and fair consideration to unconventional oil and gas development in Western Newfoundland and to provide a better basis for a decision about whether such an approach to oil and gas development should be permitted.

Supplementary Recommendations

Supplementary recommendations are presented as advice to the Minister about actions to be taken if further consideration is to be given to permitting unconventional oil and gas development in Western Newfoundland. These supplementary recommendations are listed at the end of this Executive Summary and are discussed in more detail in the Panel's main report. Except where explicitly noted, the Panel believes that the responsibility for implementing the recommendations rests with Government. In some cases, the supplementary recommendations create expectations and obligations for the regulator and for project proponents.

The supplementary recommendations are colour-coded (red, yellow, or green) to indicate the stage at which they should be implemented. In some cases, supplementary recommendations have decision-gates, designated by "?". The implementation of recommendations that include decision-gates could lead to a determination that, from a public policy, public health and safety, environmental, socio-economic, or fiscal perspective, the "pause" in accepting applications involving hydraulic fracturing in Western Newfoundland should remain in effect.

The Panel feels strongly that in acting on the supplementary recommendations in this report, Government should use a transparent, robust decision-making framework that includes a roadmap for the actions arising from the recommendations, the time-frame for such actions, and defines the roles to be played by various stakeholders. By being open, transparent, and inclusive of key stakeholders, Government has the opportunity to build public confidence in the actions and in any subsequent decisions.

The **'red-stage'** recommendations describe actions, primarily related to public policy and processes, that the Panel feels must be undertaken before the "pause" can be lifted. These recommendations include:

- identify, adopt, and demonstrate best practices in community engagement;
- create and implement an ongoing program of public education about the scale, risks, and benefits of unconventional oil and gas development in Western Newfoundland;
- review and update public policy and regional development plans that describe the role, if any, of unconventional oil and gas development in the province;
- decide whether Government will make the investment required to better understand and mitigate key risks;
- safeguard Gros Morne National Park from development, and initiate the process to establish a buffer zone;
- undertake the basic scientific studies required to understand the potential impacts and geological-based risks of development, particularly risks related to health, environment, and seismicity;
- complete Health Impact Assessments for potential development regions;
- require that all engineering and geoscience work be undertaken by licenced professionals and companies with permits to practice in Newfoundland and Labrador;

- study potential development sites from a land-use perspective and with consideration to short-term and long-term coastal change;
- participate in national and international research programs related to well integrity; and
- establish an appropriate regulatory framework for unconventional oil and gas development.

If the results of implementing the red-stage recommendations lead to a decision that Government will give further consideration to permitting unconventional oil and gas development, the **'yellow-stage'** recommendations should be implemented. These recommendations include:

- model realistic full-scale development scenarios, including a plan for use of excess associated gas and a requirement for substantial local benefits, to better understand the costs and benefits of development;
- collect the baseline environmental, public health, and ecological data and model the effects of development;
- carry out further scientific studies related to understanding how the Green Point shale will respond to hydraulic fracturing operations, including an assessment of the prospect of using deep disposal wells for wastewater;
- review and update the environmental impact assessment process;
- complete an independent assessment of the associated environmental and public health risks;
- develop ongoing monitoring programs for collecting relevant environmental and public health data, for interpreting the data, and for publicly reporting on impacts;
- assess the potential impacts on civil infrastructure and services;
- develop an adaptive risk management framework, including an approach for monitoring and managing seismicity risks;
- undertake a review of the existing healthcare, fire and emergency services, and social services systems to identify the necessary improvements;
- implement additional elements of the regulatory framework, including mechanisms for meaningful public participation, participation by population and public health experts, and processes for review and continuous improvement of regulations;
- require proponents to implement community engagement plans that demonstrate public confidence has been attained and is maintained throughout a project;

- secure an equity position in future developments; and
- develop a well integrity monitoring program and require an appropriate security deposit from proponents.

These recommendations relate primarily to more site-specific studies or assessments needed in advance of industrial activity. During the yellow stage, the "pause" in accepting applications involving hydraulic fracturing could be removed so that some preparatory work could proceed (e.g., planning for exploration by proponents, and reviewing proposals from proponents by government and the regulator). Proponents, however, would need to understand that some of the yellow-stage recommendations include decision-gates that could result in a decision by Government not to proceed further. For example, a more comprehensive cost-benefit study by the province, an independent assessment of risk, or new scientific knowledge, could lead to a decision that there is no basis to proceed with development.

The **'green-stage'** recommendations reflect the actions that the Panel believes need to be taken if, as a result of implementing the red-stage and yellow-stage recommendations, a decision is made by Government to permit unconventional oil and gas development in Western Newfoundland. There are numerous recommendations, primarily related to operational processes and practices, that the Panel feels will be straightforward to implement, assuming public confidence and support from the various community, industry, and Government stakeholders has been achieved. The green-stage recommendations must be implemented before industrial activities commence and remain in place throughout a project. These recommendations include:

- require best practices to be followed by industry, including minimizing GHG emissions and installing groundwater monitoring wells;
- provide appropriate resources for heathcare, social services, fire and emergency services, and community support;
- implement regular testing and reporting on population heath, air quality, water resources, and ecological species populations and health in areas where there is development;
- disclose the composition of all hydraulic fracturing fluids in a database that is in the public domain;
- plan development to minimize impacts on local residents;

- use best practices for site development, management, and decommissioning;
- minimize development impacts on lands, including footprints of well pads;
- minimize the risks to aquatic species;
- develop an abandoned well program;
- implement plans for waste and wastewater management, including seismic risk management if deep disposal wells are to be utilized;
- ensure health professionals have immediate access to accurate information about the composition of fluids used or produced at each development site; and
- ensure transparency in the management of risks, and engage independent experts in the oversight of the regulatory process, including the monitoring and evaluation requirements.

Implementing these staged recommendations constitutes a cautious way forward without pre-judging the impact and potential of unconventional oil and gas development in Western Newfoundland. Some of the recommendations give rise to decision points, where further evidence will inform Government decisions about whether to permit development. Some of the proposed recommendations can be pursued simultaneously, while others are interdependent. Recommendations related to public policy, planning, and science considerations must be acted upon first. The other recommendations can then be evaluated against up-to-date public policies that reflect economic development, energy planning, and climate change objectives, as well as an improved understanding of the fundamental geology of the resource.

Concluding Comments

In concluding its work, the Panel would like to leave the readers with some final thoughts. The Panel believes that safe and responsible development of natural resources requires a combination of sound public policies; credible science; good technology; effective regulatory oversight; competent and ethical professionals working for Government, the regulator, and industry; and good will from communities and other stakeholders. These are the things that should be expected and that Newfoundland and Labrador has experienced with its established offshore oil and gas industry. These sentiments were also reflected in the public opinion survey carried out as part of the review process.

When the review process began, the Panel was neutral with respect to its opinion about whether unconventional oil and gas development should proceed in Western Newfoundland. As the review process concludes, based on what has been learned through the process, the Panel remains neutral with respect to an opinion since more information is required for a full and fair assessment of the development challenges and opportunities.

Based on the information available through the review process, the Panel does not know whether the development of the Green Point shale represents a single project around Port au Port Bay or the start of a much larger and geographically diffuse industry in Western Newfoundland. The Panel believes that studies, similar to those carried out by Government scientists and reported on for the Green Point shale and to those commissioned or undertaken by the Panel, would provide important knowledge and experience in support of an evaluation of the costs, benefits, risks, and scale of other potential developments.

The Panel's work has raised issues that are unique to the circumstances of the region and the province. Some issues are scientific and technical, while others relate to public policy.

Within the context of Western Newfoundland, if the cost and technological barriers are too high, development will not happen; if supportive public policy and regional economic development frameworks and a robust regulatory regime are not implemented, development should not be permitted; and if the science of the geological formation continues to be poorly understood, the technical risks associated with development will remain unacceptably high. Without a better scientific understanding the geological formations of commercial interest, it will not be possible to successfully address the challenges of unconventional oil and gas development in Western Newfoundland. As a consequence, the potential opportunities that could accompany developments cannot be realized for the benefit of the people of the region.

The Panel believes that the Green Point shale resource, and other oil and gas resources that may be present in Western Newfoundland, represent unconventional opportunities and challenges for industrial development and economic growth in the region. These opportunities and challenges deserve more detailed investigation and consideration than has been given to date.

SUMMARY OF RECOMMENDATIONS

Public Policy, Planning & Science Considerations

Provincial & Regional Planning

Panel Recommendation (PR1): Update the Regional Economic Development Plans – Update or develop economic development plans for regions in Western Newfoundland that might be affected by unconventional oil and gas development and determine whether unconventional oil and gas development is consistent with the economic development priorities for specific regions. This should include an impact analysis on the relationship between unconventional oil and gas development and industries such as tourism, agriculture, and fisheries. Also, the process of developing economic development plans should include land-use planning. The planning process must be designed in such a way as to result in public confidence and support for the resulting plans.

Panel Recommendation (PR2): Update the Provincial Energy Plan – Review and update the provincial Energy Plan to consider and articulate the role, if any, that unconventional oil and gas development in Western Newfoundland will have among priorities related to energy development in the province. The review should also consider the future potential for non-energy applications of oil and gas resources.

Panel Recommendation (PR3): Develop a Plan to Use Excess Associated Gas – If there is a role for unconventional oil and gas development in Western Newfoundland, identify economic opportunities and a plan for utilization of excess associated gas from unconventional oil development.

Climate Change

Panel Recommendation (PR4): Evaluate the GHG Emissions Associated with Development – Engage the Office of Climate Change and Energy Efficiency to undertake a complete well-through-use assessment of the GHG emissions associated with a representative unconventional oil and gas development in Western Newfoundland. Careful consideration must be given to the results of this assessment and to the

impact of development on the province's aspirations with respect to GHG emissions. It should also form the basis for specifying best practices of industry necessary to meet provincial GHG emissions objectives.

Panel Recommendation (PR5): Require Best Practices for Controlling GHG Emissions – Require industry to adopt best practices with respect to minimizing GHG emissions. This could include using "cleaner" fuel sources for vehicles and equipment, utilizing Reduced Emission Completions (RECs) or "green completion" techniques to capture produced gas during well completion, minimizing fugitive emissions associated with leaking wells, and prohibiting venting and flaring of gas associated with oil production or with the storage of chemicals or products.

Gros Morne National Park & UNESCO World Heritage

Panel Recommendation (PR6): Confirm a Ban on Hydraulic Fracturing Operations in Gros Morne National Park – Confirm a ban on hydraulic fracturing operations, as per the Panel's all-inclusive definition of hydraulic fracturing, in Gros Morne National Park. This includes not only hydraulic fracturing surface operations within the Park boundaries but also includes hydraulic fracturing under Gros Morne National Park.

Panel Recommendation (PR7): Establish a Buffer Zone around Gros Morne National Park – Establish an appropriate buffer zone around Gros Morne National Park so as to ensure that future industrial activity, including both onshore and offshore oil and gas development, does not negatively impact on the Park, its World Heritage Site designation, or the tourism industry that is developing around the Park. The establishment of a buffer zone should follow an open and transparent process that is informed by the UNESCO 2015 Operational Guidelines and involves relevant stakeholders, including the provincial and federal governments, local communities and businesses, local NGOs, and other relevant experts.

Understanding the Geology

Panel Recommendation (PR8): Undertake a Modern Geoscience Study of the Green Point Shale – Initiate a geoscience program, led by the Department of Natural Resources and Nalcor Energy, to collect the modern seismic and stratigraphic well data necessary to increase

knowledge of and model the Green Point shale, or any other prospective resource, in the region of any potential development. This will lead to a better understanding of the geological-based risks of development, particularly those related to health and environment. The results of such a geoscience program should be available in the public domain.

Panel Recommendation (PR9): Assess the Prospect of Using Deep Disposal Wells for Wastewater – Initiate a geological assessment, led by the Department of Natural Resources and Nalcor Energy, of the potential opportunity and risks of using Class II disposal wells for the disposal of wastewater associated with hydraulic fracturing operations.

Panel Recommendation (PR10): Enhance Seismograph Network Coverage for Western Newfoundland – Enhance the seismograph network coverage in Western Newfoundland to improve monitoring capabilities for baseline seismicity. Given the current station distribution, at least one new station north and east of Anticosti Island would provide a significantly better geometry for event detection.

Panel Recommendation (PR11): Carry Out Baseline Seismicity Monitoring – Collect and analyze at least two years of baseline seismicity data from an enhanced seismograph network prior to development. The seismicity data, and its interpretation, should be available in the public domain.

Panel Recommendation (PR12): Complete a Geomechanical Investigation of the Green Point Shale – Conduct a geomechanical investigation that considers all available stress data and realistic structural models to address site-specific issues that pertain to the unique structural environment of the Green Point shale. The results of the geomechanical investigation should be available in the public domain.

Panel Recommendation (PR13): Implement a Pilot-Scale Stimulation Program – Based on the improved understanding developed through the recommended geoscience program, plan and execute a minimal-risk, pilot-scale well stimulation program, in cooperation with Nalcor Energy, to understand how the Green Point shale responds to stimulation and to further understand the associated risks. Such a stimulation pilot program should take place at a location significantly far

from communities and utilizing best practices in risk assessment and management so as to reduce the environmental and health risks, and the associated public concern, to an acceptable level. The results of such a pilot program should be available in the public domain.

Panel Recommendation (PR14): Secure Equity in Industry-led Programs – Secure an equity position for Nalcor Energy in any industry-led exploration, development, and production programs. Such an equity position will serve as an influence mechanism to help ensure that any unconventional development best serves the interests of the people of the province.

Socio-Economic Considerations

Community Engagement

Panel Recommendation (PR15): Develop a Program of Public Education About the Benefits, Risks, and Scale of Development – Develop an ongoing program of public education with a focus on benefits, risks, and scale of unconventional oil and gas operations, with a particular focus on Western Newfoundland. This could involve Memorial University of Newfoundland, in partnership with other institutions and organizations, developing an independent centre for education and research similar to the Penn State Marcellus Center for Outreach and Research.

Panel Recommendation (PR16): Assess the Support for Public Investments Required to Understand and Mitigate Key Risks – With confidence that there is an appropriate level of public understanding of the issues associated with hydraulic fracturing operations in Western Newfoundland, develop a process to determine whether there is sufficient public support, particularly from the individuals living and working in the communities most directly affected by development, to proceed with the public investment to undertake the work necessary to understand and mitigate outstanding key risks.

Panel Recommendation (PR17): Require Proponents to Demonstrate Effective Community Engagement and Public Confidence – Require any potential industry proponent to develop and implement a plan for meaningful and ongoing community engagement

throughout the life of a project. The plan must include processes, metrics, and a reporting framework to demonstrate that public confidence has been achieved prior to undertaking development and that it is maintained throughout the life of a project. Such a plan and the associated reporting would be subject to approval and review within the framework of regulation of the industry.

Panel Recommendation (PR18): Review and Adopt Best Practices in Community Engagement – Review and adopt best practices in community engagement, supported by independent assessment and review to ensure that evidence-based decisions are made at key future decision points associated with unconventional oil and gas development in Western Newfoundland.

Risk Assessment & Management

Panel Recommendation (PR19): Assess the Environmental and Public Health Risks – Supported by baseline environmental and health data, initiate an independent assessment, with meaningful stakeholder engagement, of environmental and public health risks associated with a representative scenario for industrial-scale hydraulic fracturing operations in Western Newfoundland. This assessment, which should be available in the public domain, should identify the primary risks, and identify further research required.

Panel Recommendation (PR20): Implement an Adaptive Management Framework to Manage Risks – Identify risk management measures appropriate for each identified risk. The work would put in place the elements of an Adaptive Management framework, supplemented as appropriate with elements of the Precautionary Approach and including meaningful stakeholder engagement, that could be utilized in the assessment and management of risks associated with any future full-scale unconventional oil and gas development in Western Newfoundland. The resulting risk management framework should be available in the public domain.

Economics of Full-Scale Operations

Panel Recommendation (PR21): Update the Development Scenario as a Basis for a More Complete Cost-Benefit Analysis – With greater clarity with respect to geological, health, and environmental risks and risk management, review and revise the scenario considered by the Panel in order to carry out a more detailed cost-benefit analysis, with particular consideration to the costs and benefits to the province and the people of Western Newfoundland. This analysis should be based on a more detailed scenario for unconventional oil and gas development that offers a fair rate of return to project proponents. The analysis should include a thorough assessment of the impact on other established and developing industries, with a particular focus on employment impacts, and should also include a detailed assessment of the impacts on public and social services. The costs associated with environmental and public health monitoring, including interpretation of data, must also be included in the analysis. This analysis should be made available in the public domain.

Civil Infrastructure & Services Impacts

Panel Recommendation (PR22): Assess Impacts on Civil Infrastructure and Services – Undertake a comprehensive civil infrastructure and services assessment in view of a detailed full-scale development scenario. This assessment should account for the impacts associated with development and identify the required physical infrastructure and service upgrades. The required upgrades should be carried out in advance of stresses on the existing infrastructure and services. This should include a plan for maintaining the physical infrastructure and services during the project lifecycle and consideration of implications of maintaining the physical infrastructure and services, as required, beyond the lifetime of the activity.

Panel Recommendation (PR23): Assess the Fire and Emergency Services Capacity – Undertake a comprehensive assessment of the fire and emergency services associated with a full-scale unconventional oil and gas industry in Western Newfoundland. This should include an assessment of the existing regional emergency management plan.

Panel Recommendation (PR24): Enhance the Fire and Emergency Services Capacity – Ensure that the necessary capacity to provide the required fire and emergency services is developed in advance of unconventional oil and gas development.

Panel Recommendation (PR25): Mitigate Risks to Local Populations by Careful Planning for Development – Select sites for well pads, central facilities, and access roads with consideration to proximity to homes and populated areas, including sight lines from roadways and other public sites in the vicinity of well pads.

Environmental Considerations

Air Quality Impacts

Panel Recommendation (PR26) Complete Baseline Testing of Air Quality – Undertake baseline testing of air quality in the vicinity of anticipated hydraulic fracturing operations. This should include establishing a database of baseline data that would be in the public domain.

Panel Recommendation (PR27): Model Potential Air Quality Effects – Utilize best available air dispersion modeling techniques to understand and predict the movement of air pollutants in the atmosphere most affected by hydraulic fracturing in Western Newfoundland. Utilize this knowledge in the design of effective strategies to monitor air quality and to mitigate risks of air pollution.

Panel Recommendation (PR28): Require Regular Testing and Reporting of Air Quality – Implement ongoing regular testing and public reporting of air quality data, including interpretation of the results, in areas associated with hydraulic fracturing operations. Maintain these data in an emissions inventory that would be in the public domain.

Water Impacts

Panel Recommendation (PR29): Complete Baseline Testing and Modelling of Water Resources – Undertake baseline testing and modeling of water resources, including groundwater and surface water, in the vicinity of anticipated hydraulic fracturing operations. This would

include establishing a database of baseline data in the public domain.

Panel Recommendation (PR30): Require Regular Testing and Reporting on Water Resources – Implement ongoing regular testing and public reporting of groundwater and surface water resources in areas associated with hydraulic fracturing operations.

Panel Recommendation (PR31): Implement a Wastewater Management Plan – Implement a wastewater management plan that requires samples of hydraulic fracturing fluids, flowback, and produced water to be analyzed regularly by the regulator to ensure compliance with the approved plan. The regulator should include the analysis results in the disclosure report for each well.

Panel Recommendation (PR32): Minimize the Risks to Aquatic Species – Identify and implement mitigation strategies and wastewater handling and treatment approaches that minimize risks associated with immediate and cumulative effects to aquatic species in any "at risk" bodies of water.

Land Impacts

Panel Recommendation (PR33): Complete Baseline Testing of Ecological Species Populations and Health – Undertake baseline testing of ecological species populations and their health, including interpretation of the results, in the vicinity of anticipated hydraulic fracturing operations. This should include establishing a database of baseline data in the public domain.

Panel Recommendation (PR34): Require Regular Testing and Reporting of Ecological Species Populations and Health – Implement ongoing regular testing and public reporting of ecological species populations and their health, including interpretation of the results, in areas associated with hydraulic fracturing operations.

Panel Recommendation (PR35): Require Best Practices for Site Development, Management, and Decommissioning – Employ standards, certification processes, and best practices for the development, management, and decommissioning of all sites and infrastructure associated with unconventional oil and gas development.

Panel Recommendation (PR36): Minimize the Development Impacts on Lands – Select sites and designs for well pads, central facilities, and access roads to minimize the short-term and long-term impact on land, including wildlife habitat and other ecologically sensitive areas.

Panel Recommendation (PR37): Minimize Site Footprints Following the Construction of Wells – Optimize the planning of drilling, completion, and well stimulation to "shrink" development footprints on land back to some appropriate minimum size during production.

Coastal Change & Erosion

Panel Recommendation (PR38): Undertake a Study of Coastal Change Near Potential Infrastructure Sites – Undertake a comprehensive study of coastal change at sites around Port au Port Bay, and other coastal areas, where temporary and permanent infrastructure associated with unconventional oil and gas development may be located. This study would include an analysis of aerial photographs over time and a series of beach/bluff surveys, for example using Real Time Kinematic (RTK) topographic survey technology.

Panel Recommendation (PR39): Require Appropriate Setback Limits for Infrastructure – Determine and require appropriate setback limits, with particular consideration to the permanent nature of well infrastructure, from coastlines that are subject to short-term and long-term changes.

Panel Recommendation (PR40): Conduct Geotechnical Engineering Assessments Prior to Construction of Infrastructure – Undertake thorough geotechnical engineering assessments of all potential locations of well pads and other infrastructure (e.g. gathering lines and product pipelines) to ensure that siting and construction approaches are appropriate.

Other Environmental Considerations

Panel Recommendation (PR41): Review the Environmental Impact Assessment Process – Review the environmental impact assessment process to ensure that it provides for a comprehensive review of issues unique to unconventional oil and gas development that may not have been considered in processes to date.

Panel Recommendation (PR42): Require Full Disclosure of the Composition of Hydraulic Fracturing Fluids – Require full disclosure to the regulator of additives and concentrations of hydraulic fracturing fluids as part of an approved plan to hydraulically fracture a well; to handle, treat, and dispose of flowback and produced water; and to manage and mitigate the impacts of any spills. Any deviations from an approved plan should require prior approval by the regulator. The regulator should make a disclosure report for each well available in the public domain.

Panel Recommendation (PR43): Require Best Practices in Development and Management of Sites and Infrastructure – Employ standards, licensing and certification processes, and best practices in the development and management of all sites and infrastructure associated with unconventional oil and gas development.

Health Considerations

Health Impact Assessment

Panel Recommendation (PR44): Complete Health Impact Assessments – Undertake an independent Health Impact Assessment of any proposed unconventional oil and gas development in Western Newfoundland. The assessment should be for the local region involved in a potential development and must involve representatives of local residents, industry, and Government, together with appropriate experts. Government should provide financially for the assessment and provide access to content experts, but it should not perform or lead the assessment. The results of the Health Impact Assessment should be available in the public domain.

Monitoring

Panel Recommendation (PR45): Monitor and Publicly Report the Impacts of Released Toxicants on Human Health – Establish an ongoing, real-time monitoring system, including interpretation of the data collected, with strategically selected sites to measure potential toxicants released into the environment. Ensure that baseline measurements at the sites are completed in advance of industrial activity. The data should be interpreted periodically by appropriate health experts to assess the potential impact on human health. The data and the interpretation should be available in the public domain.

Composition of Fluids

Panel Recommendation (PR46): Ensure Access by Health Professionals to Compositional Information for all Fluids Used or Produced – Make it a condition of licensing that the compositions of all fluids used or produced during hydraulic fracturing operations are available to the regulator and to monitoring and health authorities. Timely access to compositional information must be provided to health professionals to enable proper treatment of patients with illnesses from suspected exposure.

Best Practice in Regulation

Panel Recommendation (PR47): Engage Public and Population Health Experts in Setting Standards and Regulations – The regulator must establish, monitor, and enforce regulations and standards for all aspects of unconventional oil and gas development that are based upon the best-available evidence from other jurisdictions and that take local factors into account. Public and population health experts must be involved in setting standards and regulations.

Adaptive Management

Panel Recommendation (PR48): Require Transparency in Adaptive Management – Ensure that adaptive management of a project is practiced by the regulator and the operator and that transparency about risks and benefits and the factors affecting them is maintained at all times.

Realizing Health Benefits

Panel Recommendation (PR49): Require Development Plans to Demonstrate Substantial Local Benefits – Ensure that there are substantial local benefits that are accessible across the socio-economic spectrum to realize health benefits from unconventional oil and gas development.

Improving the Ability to Respond to Health Impacts

Panel Recommendation (PR50): Review the Healthcare and Social Services Systems – Undertake a comprehensive review of the healthcare and social services systems to identify any deficiencies in the ability to respond to increased demands associated with unconventional oil and gas development.

Panel Recommendation (PR51): Ensure Appropriate Resources for the Healthcare and Social Services Systems – Ensure that healthcare and social services systems are resourced to be able to respond to increased demands associated with unconventional oil and gas development.

Panel Recommendation (PR52): Ensure Appropriate Support for First Responders and Health Professionals – Provide education, training, and support for first responders and health professionals to enable them to recognize and treat conditions that might arise through environmental contamination during development.

Panel Recommendation (PR53): Ensure Appropriate Resources for Public Heath Education and Community Support – Ensure that high quality information about public health is available and that there is appropriate resourcing and engagement of community support systems, including law enforcement.

Panel Recommendation (PR54): Require Ongoing Monitoring of the Health Status of People Living Near a Development – Monitor the physical and mental health status of the local population using standard reporting mechanisms, and proactively establish a cohort representative of the local population that is monitored regularly for health status over an extended period.

Regulatory Considerations

Regulatory Readiness & Capacity

Panel Recommendation (PR55): Review Best Practices from Other Jurisdictions in Developing a Regulatory Framework – Consider and build upon the expertise and experience of jurisdictions that have the most experience in building and administering a comprehensive regulatory framework for unconventional oil and gas development. This does not mean that other frameworks should be blindly adopted, but, where relevant work has been done elsewhere, this should be leveraged and modified to deal with any required variation associated with local environmental, health, socio-economic, and geological factors.

Panel Recommendation (PR56): Establish a Comprehensive Regulatory Framework – Ensure that a comprehensive regulatory framework, which includes an appropriate mix of performance-based and prescriptive regulation, is in place before unconventional oil and gas development is permitted and provide for the evolution of regulations as new knowledge is gained. This will provide for a higher level of confidence that concerns are being addressed through regulations and monitoring while offering clarity to proponents about the ground rules for development.

Panel Recommendation (PR57): Provide for Meaningful Public Participation in Decision-Making – Ensure that the regulatory framework provides opportunities for those potentially affected by a proposed development to participate, for example through formal consultation, in the regulator's decision-making process. This is in addition to, and separate from, the requirement for proponents to demonstrate effective community engagement throughout a project.

Panel Recommendation (PR58): Provide Appropriate Resources to Ensure Effective Regulation – Ensure that the regulatory framework is appropriately resourced, including the necessary resources to provide effective oversight and monitoring, before unconventional oil and gas development is permitted. This will lead to confidence that matters of concern are being addressed through regulations and monitoring and will offer clarity to proponents about the ground rules for development.

Panel Recommendation (PR59): Implement a Program for Monitoring the Effects of Development – Ensure that regulations require a comprehensive and effective program for monitoring the effects of unconventional oil and gas development, including cumulative health and environmental effects, to be in place prior to commencement of development, with provision for halting development when necessary to prevent irreversible harm.

Panel Recommendation (PR60): Implement a Waste Management Program – Ensure that regulations require a comprehensive and effective waste management program to be approved for all waste associated with unconventional oil and gas development.

Regulatory Oversight

Panel Recommendation (PR61): Require Licenced Professionals and Companies for All Engineering and Geoscience Work – Require that all future engineering and geoscience work, including reviews and assessments associated with unconventional oil and gas development, be carried out by individuals and companies that are licensed to practice and operate in Newfoundland and Labrador. Such professionals and companies would be subject to standards for competence and ethics under the regulation of the Association of Professional Engineers and Geoscientists of Newfoundland and Labrador.

Panel Recommendation (PR62): Involve Public Health Officials in Developing Regulations and Monitoring – Require that public health officials be involved in developing regulations and in monitoring for potential environmental and health impacts.

Panel Recommendation (PR63): Communicate Regulatory Requirements Clearly – Communicate regulatory requirements in a style, form, and medium that best facilitates an understanding of the regulations by those most immediately responsible for compliance with them.

Panel Recommendation (PR64): Engage Stakeholders in the Review and Continuous Improvement of Regulations – Work with representatives of communities, environmental organizations,

public health officials, other economic sectors, academia, and society more generally, to provide effective mechanisms to advise industry and the regulator on the adequacy and effectiveness of regulations, and on improvements to regulations and the regulatory process, including compliance and enforcement.

Panel Recommendation (PR65): Ensure the Regulator has Access to Information About the Status of Each Well – Ensure that the regulator has continuous access to the critical data on the status of work taking place under regulatory approvals at all stages of each well's life cycle, from initial drilling to abandonment and capping, including any post abandonment obligations that may be placed on operators.

Panel Recommendation (PR66): Engage Independent Experts in the Review of Information Provided by Industry – Require that the assessments, evaluations, and plans that proponents and operators are required to provide, including those related to community engagement, are completed, validated, and certified by independent third party experts, as appropriate.

Panel Recommendation (PR67): Engage Independent Experts in the Review of Monitoring Data and Evaluations – Require validation or certification, as appropriate, by qualified and independent third parties of the results of broader monitoring of impacts, including environmental and health monitoring, and of performance against standards and objectives, including objectives for community engagement.

Panel Recommendation (PR68): Provide Adequate Resources for Monitoring – Ensure that adequate resources for regulatory compliance monitoring, and environmental and heath monitoring are provided.

Regulatory Transparency & Continuous Improvement

Panel Recommendation (PR69): Support the Ongoing Research Needed for Improvement in Regulation – Ensure that the regulator actively seeks opportunities to support the research that is needed to improve the understanding of the risks associated with hydraulic fracturing operations, to improve the effectiveness of measures that are used to manage risks, and to improve upon regulatory measures.

Panel Recommendation (PR70): Complete a Regular Independent Review of Regulations – Ensure that there is regular review and evaluation of regulations related to unconventional oil and gas development that is done arms-length from the regulator and that follows an open and transparent process that seeks and considers input from all parties with a direct interest in the effectiveness of the regulations in achieving the desired regulatory outcomes.

Panel Recommendation (PR71): Develop Comprehensive Monitoring Regulations – Ensure that there are comprehensive regulations implemented related to environmental, health, and seismicity monitoring, including requirements for establishing relevant baseline data, for interpreting the collected data, and for making the data and interpretation available in the public domain. This should also include ongoing monitoring of the effectiveness of community engagement plans.

Panel Recommendation (PR72): Involve Researchers in the Design, Governance, and Evaluation of Monitoring Programs – Include researchers in the design, governance, and evaluation of monitoring programs to ensure that monitoring produces the data needed for the research that will improve monitoring and interpretation over time.

Panel Recommendation (PR73): Implement Continuous Monitoring and Interpretation Processes – Structure monitoring and interpretation processes to be continuous throughout and beyond the lifetime of approved projects, adjusting the scale and methods for monitoring and interpretation to the level of corresponding risks.

Panel Recommendation (PR74): Clarify the Responsibilities of Different Parties for Monitoring and Interpretation – Ensure that the responsibilities of Government, the regulator, and industry with respect to monitoring and interpretation are well-defined in regulations and are communicated clearly, including to the public.

Panel Recommendation (PR75): Implement Transparent Monitoring and Interpretation Processes – Ensure that the monitoring and interpretation processes are implemented and are transparent, openly conducted, and include the public disclosure of the results. Require, support, and enable certified independent third party involvement in monitoring and interpretation.

Regulatory Jurisdiction

Panel Recommendation (PR76): Establish a Single Regulator – Establish a single regulator for unconventional oil and gas development, including onshore-to-offshore operations, in Newfoundland and Labrador.

Abandoned Well Program

Panel Recommendation (PR77): Implement a Well Integrity Monitoring Program – Develop and implement a monitoring and interpretation program to assess well integrity coincident with the pilot well activity to reduce the risk of well integrity problems and to ensure that appropriate well completion programs are implemented. Information from this monitoring program should be available in the public domain for use by researchers working on techniques to improve well integrity.

Panel Recommendation (PR78): Implement an Abandoned Well Program – Ensure that an effective "abandoned well" program is established with the financial capacity to cover future costs associated with regular monitoring and remediating of any wells that encounter integrity issues post-abandonment, including the need to remediate wells into perpetuity.

Financial Security

Panel Recommendation (PR79): Assess the Potential Impacts of Spills or Other Incidents – Undertake a thorough assessment of the potential damage that could result from spills, leaks, or other incidents in Port au Port Bay, or in any other offshore areas that may be affected by development. This should include a particular focus on impacts on tourism and fisheries.

Panel Recommendation (PR80): Require an Appropriate Security Deposit from Industry – Require an appropriate security deposit and evidence of financial capacity from the companies holding leases to ensure that there are readily available financial resources and financial capacity to deal effectively with any onshore or offshore spills, leaks, or other incidents that may occur during exploration, development, production, and abandonment of a well.

Other Scientific & Technical Considerations

Seismicity Risks During Hydraulic Fracturing Operations

Panel Recommendation (PR81): Require Microseismic Monitoring – Require the use of microseismic monitoring methods, including during initial hydraulic fracturing tests, to verify the effectiveness of operations and containment of fractures. A summary report of the monitoring results should be submitted to the regulator and released publicly.

Panel Recommendation (PR82): Implement a Traffic Light Protocol for Induced Seismicity Management – Implement a Traffic Light Protocol (TLP) for induced seismicity monitoring and management. The provisions of subsurface order #2 from the Alberta Energy Regulator provides a well-documented template. Any reported seismic events should be investigated by the regulator and publicly reported.

Panel Recommendation (PR83): Implement a Seismic Risk Management Framework for Deep Well Disposal – Should deep disposal of wastewater be considered feasible, implement a seismic risk management approach that utilizes data from monitoring pore pressure in disposal wells prior to, and during, wastewater injection.

Well Integrity

Panel Recommendation (PR84): Participate in Research Activities Related to Well Integrity – Since the issue of well integrity is not limited to unconventional oil and gas wells, the province should actively participate in regional, national, and international research efforts to increase long-term well integrity through advances in well construction, monitoring, and remediation techniques and technologies.

Panel Recommendation (PR85): Require Groundwater Monitoring Wells at Each Well Pad – Require a multi-level groundwater monitoring well to be installed at each well pad by a licenced, third-party professional before any drilling of oil and gas wells is commenced. The groundwater should be independently monitored on behalf of the regulator prior to drilling of oil and gas wells and monitored annually thereafter. The

monitoring results, including interpretation of the collected data, should be publicly available through the regulator.

ACKNOWLEDGEMENTS

The Newfoundland and Labrador Hydraulic Fracturing Review Panel would like to thank the many individuals, groups, and organizations that provided important input to the public review process. This input has been substantial and valuable to our work.

We would like to thank the individuals who served as subject-matter experts for the Panel and who completed a "peer review" of a draft of our report. The careful work and feedback from these individuals contributed significantly our final report. We would like to thank Ms. Lorraine Busby for her thorough proofreading of the final report and for her suggestions to improve its readability.

As a volunteer Panel, we would not have been able to complete our work without the efforts of Mr. Don Belanger, whose careful coordination and management of the business of the Panel allowed the members of the Panel to focus our efforts on the substance of our mandate. Also, we wish to thank Memorial University staff and students who provided assistance to the Panel throughout the review process. These individuals include students John Churchill and Carolyn Suley, and staff members Tina Winsor, Melissa Brothers, Tess Burke, Jeff Green, Eileen Bruce, and Joanne Samson.

We also would like to acknowledge the excellent work by John Devereaux, Kimberley Devlin, Christopher Postill and staff at Perfect Day for developing the Panel's website and for creative and production support to the development of our final report.

Finally, we would like to thank Memorial University of Newfoundland, Dalhousie University, the University of Waterloo, Alberta Innovates Bio Solutions, and the Alberta Prion Research Institute for their support of our participation in this important process.

PANEL RECOMMENDATIONS

Primary Recommendation

With respect to "whether or not hydraulic fracturing should be undertaken in Western Newfoundland", a simple yes or no recommendation is not appropriate nor responsible given the unknown and unresolved issues. A number of gaps and deficiencies must be addressed before the necessary conditions could exist that would allow for hydraulic fracturing operations to proceed reasonably and responsibly. At this point, the "pause" in accepting applications involving hydraulic fracturing should remain in effect while some of the following supplementary recommendations are implemented.

Supplementary Recommendations

The supplementary recommendations represent a cautious, evidenced-based, and staged approach to better-informed decision-making with respect to whether hydraulic fracturing operations should be permitted. Recommendations with decision-gates (indicated by ?) may lead to a decision that development should not proceed. Government should use a transparent, robust decision-making framework that includes a roadmap and time-frame for actions arising from the recommendations, and defines the roles of various stakeholders.

These red-stage recommendations, which are related primarily to public policy and processes, must be implemented before lifting the "pause" on accepting applications for hydraulic fracturing.

If a decision is made to proceed to the yellow stage, these recommendations relate to more site-specific considerations and actions. Applications from proponents may be accepted at this stage.

If a decision is made to proceed to the green stage, these recommendations describe operational processes and practices that must be implemented before industrial activities commence.

PUBLIC POLICY, PLANNING & SCIENCE CONSIDERATIONS

Provincial & Regional Planning

PR1: Update the Regional Economic Development Plans

PR2: Update the Provincial Energy Plan

PR3: Develop a Plan to Use Excess Associated Gas

Climate Change

PR4: Evaluate the GHG Emissions Associated with Development

PR5: Require Best Practices for Controlling GHG Emissions

Gros Morne National Park & UNESCO World Heritage

PR6: Confirm a Ban on Hydraulic Fracturing Operations in Gros Morne National Park

PR7: Establish a Buffer Zone Around Gros Morne National Park

Understanding the Geology

PR8: Undertake a Modern Geoscience Study of the Green Point Shale

PR9: Assess the Prospect of Using Deep Disposal Wells for Wastewater

PR10: Enhance Seismograph Network Coverage for Western Newfoundland

PR11: Carry Out Baseline Seismicity Monitoring

PR12: Complete a Geomechanical Investigation of the Green Point Shale

PR13: Implement a Pilot-Scale Stimulation Program

PR14: Secure Equity in Industry-led Programs

SOCIO-ECONOMIC CONSIDERATIONS

Community Engagement

PR15: Develop a Program of Public Education About the Benefits, Risks, and Scale of Development

PR16: Assess the Support for Public Investments Required to Understand and Mitigate Key Risks

PR17: Require Proponents to Demonstrate Effective Community Engagement and Public Confidence

PR18: Review and Adopt Best Practices in Community Engagement

Risk Assessment & Management

PR19: Assess the Environmental and Public Health Risks

PR20: Implement an Adaptive Management Framework to Manage Risks

Economics of Full-scale Operations

PR21: Update the Development Scenario as a Basis for a More Complete Cost-Benefit Analysis

Civil Infrastructure & Services Impacts

PR22: Assess Impacts on Civil Infrastructure and Services

PR23: Assess the Fire and Emergency Services Capacity

PR24: Enhance the Fire and Emergency Services Capacity

PR25: Mitigate Risks to Local Populations by Careful Planning for Development

ENVIRONMENTAL CONSIDERATIONS

Air Quality Impacts

PR26: Complete Baseline Testing of Air Quality

PR27: Model Potential Air Quality Effects

PR28: Require Regular Testing and Reporting of Air Quality

Water Impacts

PR29: Complete Baseline Testing and Modelling of Water Resources

PR30: Require Regular Testing and Reporting on Water Resources

PR31: Implement a Wastewater Management Plan

PR32: Minimize the Risks to Aquatic Species

Land Impacts

PR33: Complete Baseline Testing of Ecological Species Populations and Health

PR34: Require Regular Testing and Reporting of Ecological Species Populations and Health

PR35: Require Best Practices for Site Development, Management, and Decommissioning

PR36: Minimize the Development Impacts on Lands

PR37: Minimize Site Footprints Following the Construction of Wells

Coastal Change & Erosion

PR38: Undertake a Study of Coastal Change Near Potential Infrastructure Sites

PR39: Require Appropriate Setback Limits for Infrastructure

PR40: Conduct Geotechnical Engineering Assessments Prior to Construction of Infrastructure

Other Environmental Considerations

PR41: Review the Environmental Impact Assessment Process

PR42: Require Full Disclosure of the Composition of Hydraulic Fracturing Fluids

PR43: Require Best Practices in Development and Management of Sites and Infrastructure

HEALTH CONSIDERATIONS

Health Impact Assessment

PR44: Complete Health Impact Assessments

Monitoring

PR45: Monitor and Publicly Report the Impacts of Released Toxicants on Human Health

Composition of Fluids

PR46: Ensure Access by Health Professionals to Compositional Information for all Fluids Used or Produced

Best Practice in Regulation

PR47: Engage Public and Population Health Experts in Setting Standards and Regulations

Adaptive Management

PR48: Require Transparency in Adaptive Management

Realizing Health Benefits

PR49: Require Development Plans to Demonstrate Substantial Local Benefits

Improving the Ability to Respond to Health Impacts

PR50: Review the Health Care and Social Services Systems

PR51: Ensure Appropriate Resources for the Health Care and Social Services Systems

PR52: Ensure Appropriate Support for First Responders and Health Professionals

PR53: Ensure Appropriate Resources for Public Heath Education and Community Support

PR54: Require Ongoing Monitoring of the Health Status of People Living Near a Development

REGULATORY CONSIDERATIONS

Regulatory Readiness & Capacity

PR55: Review Best Practices from Other Jurisdictions in Developing a Regulatory Framework

PR56: Establish a Comprehensive Regulatory Framework

PR57: Provide for Meaningful Public Participation in Decision-Making

PR58: Provide Appropriate Resources to Ensure Effective Regulation

PR59: Implement a Program for Monitoring the Effects of Development

PR60: Implement a Waste Management Program

Regulatory Oversight

PR61: Require Licenced Professionals and Companies for All Engineering and Geoscience Work

PR62: Involve Public Health Officials in Developing Regulations and Monitoring

PR63: Communicate Regulatory Requirements Clearly

PR64: Engage Stakeholders in the Review and Continuous Improvement of Regulations

PR65: Ensure the Regulator has Access to Information About the Status of Each Well

PR66: Engage Independent Experts in the Review of Information Provided by Industry

PR67: Engage Independent Experts in the Review of Monitoring Data and Evaluations

PR68: Provide Adequate Resources for Monitoring

Regulatory Transparency & Continuous Improvement

PR69: Support the Ongoing Research Needed for Improvement in Regulation

PR70: Complete a Regular Independent Review of Regulations

PR71: Develop Comprehensive Monitoring Regulations

PR72: Involve Researchers in the Design, Governance, and Evaluation of Monitoring Programs

PR73: Implement Continuous Monitoring and Interpretation Processes

PR74: Clarify the Responsibilities of Different Parties for Monitoring and Interpretation

PR75: Implement Transparent Monitoring and Interpretation Processes

Regulatory Jurisdiction

PR76: Establish a Single Regulator

Abandoned Well Program

PR77: Implement a Well Integrity Monitoring Program

PR78: Implement an Abandoned Well Program

Financial Security

PR79: Assess the Potential Impacts of Spills or Other Incidents

PR80: Require an Appropriate Security Deposit from Industry

OTHER SCIENTIFIC & TECHNICAL CONSIDERATIONS

Seismicity Risks During Hydraulic Fracturing Operations

PR81: Require Microseismic Monitoring

PR82: Implement a Traffic Light Protocol for Induced Seismicity Management

PR83: Implement a Seismic Risk Management Framework for Deep Well Disposal

Well Integrity

PR84: Participate in Research Activities Related to Well Integrity

PR85: Require Groundwater Monitoring Wells at Each Well Pad

N/L/H/F/R/P

31 May 2016