

**Newfoundland & Labrador
Basis for Development of
Guidance
Related to Hydraulic Fracturing:
Part 3**

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Introduction

This is the third of a trilogy of papers addressing hydraulic fracturing regulation in the context of Newfoundland & Labrador (NL). The first paper provided a high-level overview of the NL legislative framework relevant to hydraulic fracturing, and it also discussed some of the regulatory challenges and regulatory goals associated with hydraulic fracturing. The second paper discussed a number of examples of regulatory approaches used in Canadian jurisdictions to address these regulatory challenges and meet these regulatory goals respecting hydraulic fracturing.

This final paper, the most extensive of the trilogy, will provide draft Guidelines that NL may adopt:

- to provide greater clarity to its existing legislative and regulatory framework,
- to ensure this framework will adequately and comprehensively ensure hydraulic fracturing operations in NL's onshore, and
- to ensure that any hydraulic fracturing operations that occur in the LN onshore can be conducted safely, while protecting the environment and meeting resource conservation goals.

Overview

These Guidelines have been designed to build upon existing regulations governing oil and natural gas industry activities in Newfoundland & Labrador (NL) with the very specific purpose of ensuring hydraulic fracturing operations onshore NL are conducted in a manner that ensures and maximizes safety, environmental protection and resource conservation. Hydraulic fracturing is the fracturing of rock by a pressurized liquid. As applied in the oil and gas industry, it involves a controlled operation that pumps fracturing fluid and a propping agent through the wellbore to a geological formation at high pressure in multiple intervals or stages in order to create fractures in the formation to facilitate production of hydrocarbons. As a form of well stimulation conducted as part of completing a well and preparing that well for production, hydraulic fracturing is clearly subject to NL's *Petroleum and Natural Gas Act* (P&NGA), even though the term "hydraulic fracturing" may not explicitly appear in the P&NGA or its regulations.

The Minister of Natural Resources has primary authority to regulate and approve petroleum exploration and production activities under the P&NGA. The Minister of Environment and Conservation has broad legislative authority to regulate and approve activities that may adversely affect the environment and that involve the use of water. Because hydraulic fracturing is a petroleum activity which may have environmental effects and involves the use of water, both Ministers will have regulatory responsibilities respecting hydraulic fracturing.

Legislative Authority

Oil and gas activities cannot proceed without approvals under the P&NGA and its regulations. The granting of these approvals is based on the content of the detailed description of the activity as provided

in the application for approval, and may also be based on the authority to prescribe terms and conditions necessary to ensure the protection of the public interest. The requirements outlined in these Guidelines for the most part will be implemented as requirements in the applications for or as terms and conditions to:

- approval of a development plan under the *Petroleum Regulations*, a drilling program, an authority to drill a well or a well termination plan under the *Drilling Regulations* or any other approval granted under the P&NGA¹,
- a release of an undertaking granted under Part X of the *Environmental Protection Act*, or
- a licence for water use or water rights granted under the *Water Resources Act*.

Subsection 73(1) of the *Petroleum Regulations* authorizes the Minister to “*issue guidelines in respect of these regulations*”, and Subsection 35(1) of the *Drilling Regulations* authorizes the Director to “*issue and publish, in the manner the director considers appropriate, guidelines and interpretation notes with respect to the application and administration of the regulations*”. These Guidelines are not subordinate legislation, and the relevant NL legislation will always prevail over the Guidelines. The Guidelines are intended to assist operators in complying with the regulations by providing greater clarity on:

- the expectations of the Minister and the Director in terms of the detailed content of applications for petroleum activities, and
- the manner in which the regulations will be administered and applied.

Neither the regulations nor these Guidelines exhaustively list the requirements to be met in conducting hydraulic fracturing operations in onshore NL. Operators undertaking hydraulic fracturing operations in NL are responsible for meeting all applicable requirements under all relevant legislation and for identifying and addressing all potential safety, environmental and resource conservation risks of conducting hydraulic fracturing operations.

A more complete overview of relevant legislative authority underlying these Guidelines is found in Appendix 2, and the end of this paper.

Scope

These Guidelines address nine specific aspects of hydraulic fracturing, all of which have been the subject of public concern. The objective of these Guidelines is to ensure that each aspect is thoroughly and transparently addressed in the regulatory process, providing greater clarity for the operators and the public as well as enhancing the manner and extent of regulatory purview. The greater clarity and regulatory enhancements are:

- to ensure efficient production and conservation of NL petroleum resources,

¹ For an onshore to offshore well, this could also be implemented as a term or condition under an authorization granted by the C-NLOPB under the *Canada-Newfoundland and Labrador Atlantic Accord Implementation Newfoundland and Labrador Act*.

- to ensure that risks to public safety and the environment are eliminated, reduced or mitigated, and
- to do so in a manner that will provide greater assurance to the public that they are being addressed.

The nine aspects of hydraulic fracturing addressed in these Guidelines are:

1. Stakeholder Engagement
2. Surface Infrastructure Development
3. Water Protection and Management
4. Water Sourcing and Measurement
5. Seismology and Geological Risk Assessment
6. Well Construction, Operation and Integrity
7. Chemical Disclosure
8. Air Quality Management
9. Fluid Handling, Storage, Transportation and Disposal.

In developing these Guidelines, NL has benefited from the work of a number of jurisdictions and organizations and acknowledges it has relied in a number of areas on the following:

- Government of New Brunswick, in particular its “Responsible Environmental Management of Oil and Natural Gas Activities in New Brunswick: *Rules for Industry*”, published February 2013²,
- The Alberta Energy Regulator (AER), in particular its “Directive 083: Hydraulic Fracturing – Subsurface Integrity”, published May 2013³, and other relevant AER Directives,
- BC’s Oil and Gas Commission (OGC), in particular its “Fracture Fluid Disclosure Manual”, published January 2012⁴, and other relevant OGC Manuals and Bulletins,
- Canadian Association of Petroleum Producers’ (CAPP) Guiding Principles and Operating Practices for Hydraulic Fracturing⁵, published December 2012.

The primary regulator of onshore oil and gas activities is the Director, who is defined in the *Drilling Regulations* to be “the officer that the minister has made responsible for the administration of these regulations”, and this officer is normally the Assistant Deputy Minister, Petroleum Development in the Department of Natural Resources.

² <http://www2.gnb.ca/content/dam/gnb/Corporate/pdf/ShaleGas/en/RulesforIndustry.pdf>.

³ <http://www.aer.ca/documents/directives/Directive083.pdf>.

⁴ <http://www.bcogc.ca/content/fracture-fluid-disclosure-manual>.

⁵ <http://www.capp.ca/canadaIndustry/naturalGas/Pages/default.aspx>.

ALARP: A Guiding Principle

Use of hydraulic fracturing operations by the oil and gas industry has generated considerable public concern in many parts of Canada, and in many parts of the world. The NL Minister of Natural Resources believes that hydraulic fracturing in recovery of oil and gas in NL onshore can be used safely if done properly within an appropriate regulatory framework and with effective oversight by the regulator. Use of oil and gas is important in all modern economies, and will continue to be so for the foreseeable future. Production of oil and gas is important to the NL economy, and that importance may increase even further if there are discoveries in onshore NL to complement those in the offshore.

The key principle NL will adopt in regulating hydraulic fracturing operations is risk mitigation. The Minister of Natural Resources will expect operators in NL to ensure that risks are reduced to “as low as reasonably practicable” (ALARP). This principle requires operators to adopt a systematic approach to the identification of hazards and the application of quality engineered solutions and systems to develop the most effective techniques and approaches to best address those hazards. Early risk assessment and operational planning will play a key role in the hazard mitigation associated with hydraulic fracturing operations.⁶

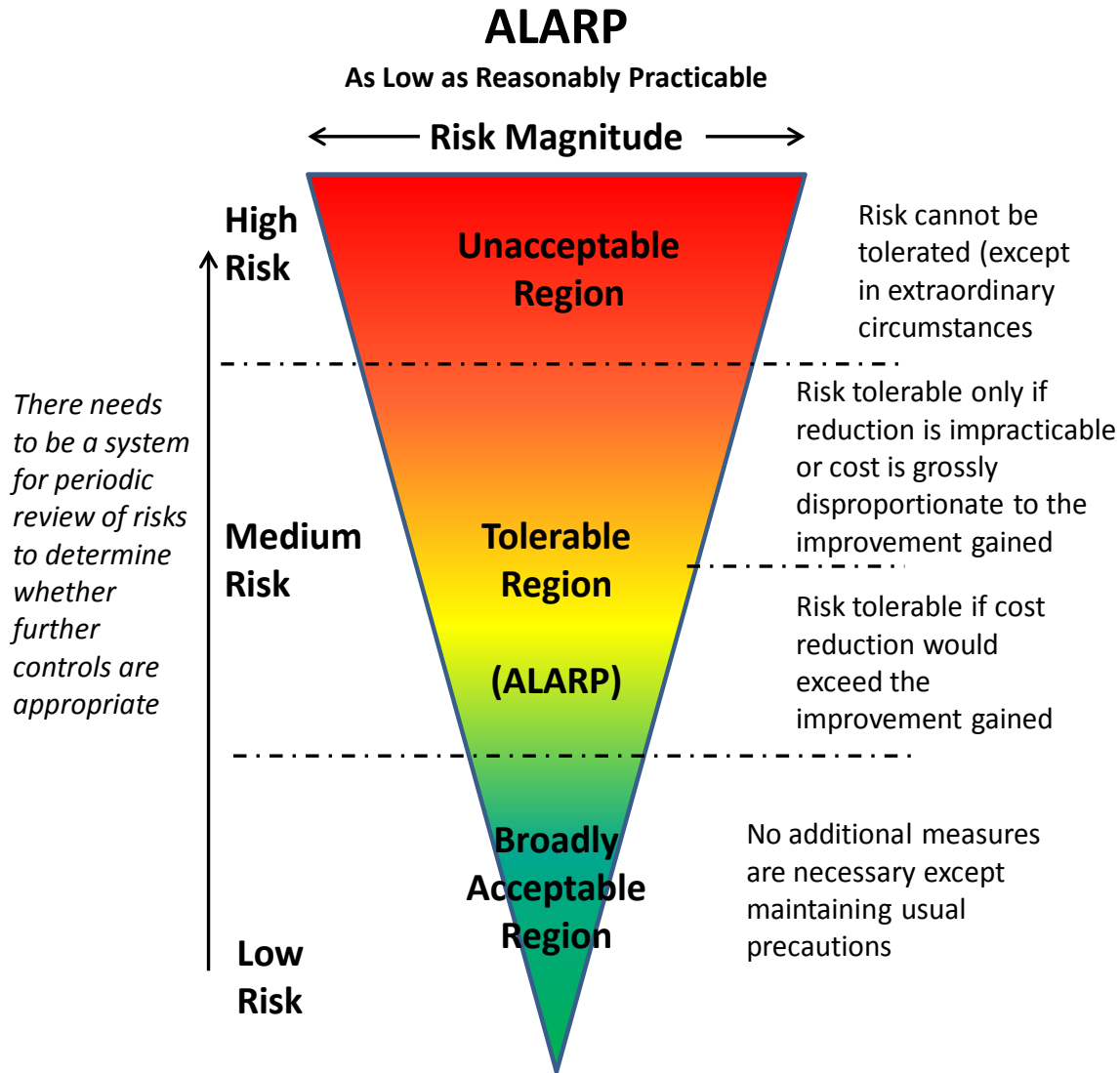
As Low as Reasonably Possible

The ALARP principle is often adopted in the context of performance-based regulation of safety-critical or environmental-critical activities. ALARP was first developed and applied to safety issues in the UK offshore petroleum industry. The objective of ALARP is to ensure that *the residual risk of an activity shall be as low as reasonably practicable*. For a risk to be ALARP it must be possible to demonstrate that 1) the risk is tolerable, and 2) the cost of reducing the risk further would be grossly disproportionate to the benefit gained. The ALARP principle arises from the recognition that infinite time, effort and money could be spent on the attempt of reducing a risk to zero, and those costs would far exceed the benefits of the reduction. ALARP requires a quantitative assessment of benefit against detriment, and the objective of ALARP is to find the best balance between acceptable risk and societal benefit.

Figure 1 depicts the levels of risk in an activity, indicating the unacceptably high risks at the top and the low, broadly tolerable risks at the bottom. The region in between is sometimes called the ALARP region, although the ALARP principle applies to all regions. A better name is the 'Tolerable Region', because risks in this region can sometimes be tolerated, if they cannot practically be reduced, in return for the benefits provided by the activity that causes the risks.

⁶ For more information on ALARP see <http://www.hse.gov.uk/risk/theory/alarpglance.htm>.

Figure 1: ALARP Risk Rating Schematic



Source: www.risk-assessment.org

1. Stakeholder Engagement

During any petroleum operation, creating increased awareness and understanding of the activity and providing opportunities for constructive input into the process will open up more opportunities for effective, two-way communication between industry and stakeholders, leading to both the reduction of risks and of the level of public concerns regarding those risks.

Play developments suitable for hydraulic fracturing operations generally operate over several years, making it important that companies build relationships that can endure the lifecycle of a project within communities. Operators in a play must develop a comprehensive stakeholder engagement plan that addresses how they will involve the public, landowners, and local authorities at each stage of the play development, including hydraulic fracturing operations.

1.1 Goal

The goal of stakeholder engagement is to ensure that:

- stakeholders understand the potential scope of the activity as a result of early and comprehensive disclosure of development plans,
- stakeholders are provided with timely, clear, and fair opportunities for engagement,
- industry processes provide stakeholders with opportunities to effectively engage in meaningful interaction and two-way communication,
- engagement efforts demonstrate understanding by industry and the regulator of local community and stakeholder concerns and how to best address those concerns,
- communication with stakeholders extends beyond traditional notification procedures to building productive relationships, and
- stakeholders have opportunities to provide input and express concerns about how the activity may affect their community.

Operators planning to conduct hydraulic fracturing operations should consider and/or address the following in their field development and hydraulic fracturing plan:

- identify key stakeholders, specific concerns and preferred methods of communication,
- develop options to engage, understand, receive input and respond to the needs of various stakeholders,
- proactively disclose development plans as they evolve,
- conduct open dialogue about real and perceived impacts of development activities and opportunities to mitigate them, and
- develop methods of evaluating engagement activities.

1.2 NL Legislation

There are authorities to require direct stakeholder engagement through public briefings or public hearings under the *Petroleum Regulations* or the *Drilling Regulations*. Because the conduct of public briefings and expectations of the operator are not provided in these respective regulations, this

Guidance will seek to provide greater clarity on how the operator is to relate the public and to conduct these public briefings.

The *Environmental Protection Act* also requires stakeholder engagement and public consultation, and this Act and its regulations provide considerably greater clarity on expectations of the operator in the conduct of these consultations. Because the NL Government would not want to see two separate public briefing or consultation processes, or public hearings, respecting the same project, it will be necessary for the Minister of Natural Resources and the Minister of Environment and Conservation to work together to achieve their respective goals regarding stakeholder consultation in respect of the proposed activity or undertaking.

Petroleum Regulations

Section 7 of the *Petroleum Regulations* authorizes the Minister of Natural Resources, if he decides it is in the public interest, to initiate public briefings or hearings concerning

- the issuance of an exploration licence, permit or lease, or
- proposed petroleum operations, including the approval of a development plan.

Also, Sections 61, 62 and 63 require operators to give first consideration to NL residents and suppliers for goods and services and employment for oil and gas operations in NL.

61. (1) Every reference to "goods" in these regulations includes, significant structures, construction materials, plant equipment and all other facilities required by an interest holder in its petroleum operations.

(2) When acquiring goods and services for work relating to petroleum operations, an interest holder shall give first consideration to

(a) goods manufactured in the province or, where not so manufactured, provided from within the province; and

(b) services provided within the province,

but only if the goods and services are competitive in terms of fair market price, quality and delivery.

62. When hiring employees and contractors, an interest holder shall give first consideration to qualified persons ordinarily resident in the province.

63. An interest holder shall require and ensure that its contractors and subcontractors comply with sections 61 and 62.

Drilling Regulations

The *Guideline for Drilling Application Submissions*⁷ advises operators that it may be necessary to initiate public briefing sessions or hearings concerning proposed drilling activities when

- the proposed activity has the potential to have a significant effect on the environment or local population, or

⁷ http://www.nr.gov.nl.ca/nr/energy/petroleum/onshore/drilling_guideline_june_07.pdf.

- the Minister of Natural Resources deems it desirable to inform the public of proposed activities in this manner to help facilitate a mutual understanding and cooperation between the operator and local residents.

The Public Briefing Session envisioned under this Guideline is held jointly by the operator and the Department. The Guideline also states the operator should be prepared for the possibility of participating in public briefing sessions or hearings.

Environmental Protection Act

Section 48 of the *Environmental Protection Act* prohibits an undertaking from proceeding unless it has been exempted or “released” under this Act. The Minister of Environment and Conservation will determine whether the undertaking must complete an environmental preview report or an environmental impact statement before being released. If an environmental preview report or an environmental impact statement is required, the Minister will appoint an assessment committee to prepare guidelines for the required environmental preview report or environmental impact statement, to be approved by the Minister and provided to the proponent⁸, who will prepare the required environmental preview report or environmental impact statement in accordance with the guidelines and submit it to the Minister.

Before the environmental impact statement guidelines are approved, the Minister will make the draft guidelines available to interested members of the public who may review them and submit written comments to the Minister with respect to the guidelines. During an environmental assessment, the Minister may invite interested persons to submit written comments with respect to the environmental effects of the undertaking, and the Minister will forward the written comments submitted to him to the proponent to respond to those comments.

Section 58 requires that *“during the preparation of an environmental impact statement, the proponent shall provide an opportunity for interested members of the public to meet with the proponent at a place adjacent to or in the geographical area of the undertaking, or as the minister may determine, in order to*

- provide information concerning the undertaking to the people whose environment may be affected by the undertaking; and*
- record and respond to the concerns of the local community regarding the environmental effects of the undertaking”.*

The procedure for conducting this public contact and involvement is as determined by the Minister and by regulation, and *“a proposed program of public information”* must be included in the environmental impact statement.

⁸ In the *Drilling Regulations*, the term “operator” means an individual or company that seeks or has been granted approval under these regulations to conduct a drilling program. In the *Environmental Protection Act*, the term “proponent” means a person who (i) carries out or proposes to carry out an undertaking, or (ii) is the owner or person having charge, control or management of an undertaking. These Guidelines will generally use the term “operator”, except in the context of the *Environmental Protection Act*, when they will use the term “proponent”.

Section 63 provides that “*Where the minister believes there is a strong public interest in an undertaking for which an environmental impact statement is required, the Lieutenant-Governor in Council may, on the advice of the minister, order public hearings and appoint an environmental assessment board for the purpose of conducting public hearings relating to the environmental assessment of the undertaking*”. The public hearing will enhance the opportunity for public engagement by:

- (a) examining the contents of the environmental impact statement that has been prepared regarding the undertaking, and
- (b) facilitating exchange of information between the operator and the public.

The board conducting the public hearing will record comments and questions of persons regarding the content of the environmental impact statement prepared for an undertaking and, where possible, provide answers to the questions. At the conclusion of the public hearing, the board will submit to the Minister a report containing the proceedings of a public hearing, recommendations made at a public hearing and the recommendations of the board, and the Minister will make a copy of the board’s report available to interested persons.

A public hearing is to be held within or adjacent to the geographical area of the undertaking and at a time the Minister considers appropriate.

Where appropriate, the Lieutenant-Governor in Council is authorized to establish a review panel jointly with the government of another province or territory, or of Canada, or with a combination of them, to carry out an environmental assessment of undertakings. This may be appropriate, for example, in a situation of onshore to offshore drilling.

Environmental Assessment Regulations

Section 32 of the *Environmental Assessment Regulations* (EA Regulations) requires “*an undertaking that will be engaged in crude oil, natural gas or petroleum production facilities shall be registered*”. The EA Regulations require the Minister to publicly announce the registration of an undertaking within 7 days of that registration and to make copies of the registration documentation available to interested members of the public.

The EA Regulations include a number of provisions adding clarity to the manner of public engagement on environmental preview reports, environmental impact statements and public hearings.

- Section 6 requires the Minister to make the approved guidelines available to the public within 10 days of the guidelines being issued to the proponent, and sets a deadline of 40 days for interested members of the public to submit written responses and comments to the Minister respecting the draft guidelines.
- Section 7 requires the Minister to make copies of an environmental preview report available to interested members of the public within 7 days receipt of the report and a person wishing to respond to or comment on an environmental preview report to have 35 days to submit written responses or comments to the Minister.

- Section 10 requires an operator to notify the Minister and the public of a meeting scheduled with the public (under section 58 of the Act) not fewer than 7 days before that meeting.
- Section 11 requires the Minister to make copies of the an environmental impact statement available to interested members of the public within 7 days of receipt of that statement, and a person wishing to respond to or comment on an environmental impact statement to submit written responses or comments to the Minister within 50 days.
- Section 12 authorizes the Minister to require an operator to prepare and submit a study which describes and provides data on specific components of the environment as required by the guidelines for the environmental impact statement. Upon receipt of a component study the Minister shall make copies of the study available to interested members of the public within 7 days, and a person wishing to respond to or comment on a component study shall submit written responses or comments to the Minister within 35 days.
- Section 13 provides that when the Lieutenant-Governor in Council has appointed a board, within 10 days the Minister shall announce the persons appointed to and terms of reference for the board, a proposed date for the start of public hearings, a deadline for receiving notices of an intention to appear and an invitation to the public to advise the chairperson of the board of their intention to appear at those hearings.
- Section 14 requires a proponent to provide a board with adequate answers to all questions asked at a public hearing that the board considers to be pertinent, either during the hearings or within 30 days of the closing date of the hearings, and requires copies of all written briefs submitted to a board and copies of the proceedings of hearings be made available to the proponent and to interested members of the public.

These EA Regulations must be adhered to in the conduct of public engagement, and these Guidelines add further clarity to this process for public engagement.

1.3 Guidance

As noted under 1.2, processes for public consultation and stakeholder engagement are available under both the *Petroleum and Natural Gas Act* (through its regulations) and the *Environmental Protection and Conservation Act*. The respective Ministers and Departments will consult with each other to ensure any required processes are coordinated and non-duplicative.

1.3.1 Notification Overview

The Director will ensure that any notification and stakeholder engagement required under the *Petroleum Regulations* or the *Guideline for Drilling Application Submissions* is carried out in accordance with the principles and procedures outlined in these Guidelines. Before requiring any public consultation under the *Petroleum Regulations* or the *Guideline for Drilling Application Submissions*, the Director will consult with the Department of Environment and Conservation to ensure coordination and non-duplication with any public consultation that may be required in association with an environmental impact assessment. A reference to the Director in these Guidelines in regards to notification will include the Minister of Environment and Conservation.

The Director may require an operator applying for a drilling program approval or an authority to drill a well that includes hydraulic fracturing operations, including applications for amendments or alterations to approvals or authorities, to:

- meet with local residents in order to
 - provide information concerning the hydraulic fracturing operations to the people whose environment may be affected by the activity, and
 - record and respond to the concerns of the local residents regarding the environmental effects of the activity, and
- participate in public hearings on the proposed activity, if they are held, including answering questions raised by the public at the hearing.

1.3.2 Determining Obligations to Notify

Notifying local residents of proposed hydraulic fracturing operations may result in public concerns respecting potential for adverse risks to public safety or the environment. The *Petroleum Regulations* and the *Guideline for Drilling Application Submissions* advise applicants that public briefing sessions and hearings may be required when the Minister deems it desirable, and these Guidelines provide further guidance on the nature and extent of the required public consultation and stakeholder engagement processes.

1.3.2.1 Notification

An operator must notify local residents within a minimum specified distance of a site where hydraulic fracturing is proposed to occur, as stated in these Guidelines or as otherwise determined by the Director, based on other factors, such as the nature and extent of the proposed operation and the nature of other land uses and developments in proximity of the proposed operations.

The timing, content and nature of notification will be in accordance with directions from the Director. The Director may also specify a deadline for local residents to respond to the operator regarding a notification. The Director will require a description of the notification program, including a list of the persons notified and a copy of the notification letter, and documentation of the responses to the notification program.

1.3.2.2 Local Residents

For an operator applying to conduct hydraulic fracturing operations onshore NL, these Guidelines consider local residents to be those persons residing or owning property, or having a right to use Crown lands, within 1.8 km of the well site of the proposed operations, as well as persons whose environment may be directly affected by the hydraulic fracturing operations. The operator will also notify any local government having jurisdiction over lands within 1 km of the proposed hydraulic fracturing operations, or such greater distance of notification as determined by the Director.

1.3.3 Aboriginal Consultation

NL's Aboriginal Consultation Policy⁹ details its policies and procedures for consulting with the province's Aboriginals before and during any petroleum activity within NL. This practical consultation process, falling under the purview of the Minister Responsible for Aboriginal Affairs, is to ensure that potentially adverse impacts on asserted rights from hydraulic fracturing operations are minimized or, where reasonably practicable, eliminated. It will also maintain, foster and improve effective working relationships among Aboriginal organizations, project proponents and the NL government.

Under this Policy, project proponents are required to undertake consultations with Aboriginal groups in accordance with the following principles:

1. *Consultation shall be meaningful and must be conducted in good faith by all consulting parties.*
2. *Consultation should be conducted with the objective of helping ensure that land and resource development decisions minimize or, where reasonably practicable, eliminate adverse impacts on asserted rights.*
3. *NL is ultimately responsible for the conduct of Aboriginal consultation, has the constitutional mandate to manage lands under its jurisdiction and must develop natural resources in accordance with provincial legislation.*
4. *Consultation will occur at the earliest possible occasion before land and resource development decisions are made that potentially adversely impact asserted rights.*
5. *While each party has different roles, the consultation process requires the participation of Aboriginal organizations, the project proponent and the NL government.*
6. *NL's consultation practices will be coordinated across Government by a lead department or agency.*
7. *A party is expected to provide pertinent information to the other parties and allow adequate time for the other parties to review it.*
8. *The nature of the consultation will depend on factors such as the nature of the activities involved, the extent of potentially adverse impacts on asserted rights and the communities affected.*
9. *Consultation will occur within timelines identified in any applicable Consultation Guidelines.*
10. *This Policy and any form of Aboriginal consultation conducted by NL or its delegates, does not constitute acceptance or recognition of asserted rights. The process of consultation does not create any Aboriginal or treaty rights.*
11. *Where appropriate and necessary, any consultation support or capacity required by a consulted party will be the responsibility of the proponent.*

⁹ The Government of Newfoundland and Labrador, *Aboriginal Consultation Policy on Land and Resource Development Decisions*, April, 2013, http://www.exec.gov.nl.ca/exec/igas/publications/aboriginal_consultation.pdf.

12. Any financial consideration in regard to accommodation of the infringement of Aboriginal rights will be the responsibility of the proponent.

Proponents are also expected, where practicable, to resolve any outstanding issues between the proponent and Aboriginal organizations, including, where and when appropriate, any consultation support or capacity funding reasonably required by Aboriginal organizations.

1.3.4 Onshore to Offshore Drilling

Some wells in Western NL have been drilled from an onshore well site or well pad to target an offshore reservoir, when the offshore reservoir is in close proximity to the onshore. In these circumstances, the offshore reservoir is under the jurisdiction of the Canada Newfoundland and Labrador Offshore Petroleum Board (C-NLOPB) so the NL Department of Natural Resources must work with the C-NLOPB, as they both have responsibilities for aspects of this activity, which could potentially include hydraulic fracturing. In the case of onshore to offshore drilling, all relevant C-NLOPB legislation, regulations and Guidelines will have to be followed. The C-NLOPB requires operators to engage with stakeholders through its environmental assessment processes.

1.3.4.1 C-NLOPB's Strategic Environmental Assessment

A strategic environmental assessment is a general assessment that may cover several phases of petroleum exploration, development and production, and is described by the C-NLOPB as follows:

“Strategic Environmental Assessment (SEA) is a broad-based approach to environmental assessment that examines the environmental effects which may be associated with a plan, program or policy proposal and that allows for the incorporation of environmental considerations at the earliest stages of program planning. SEA typically involves a broader-scale environmental assessment (EA) that considers the larger ecological setting, rather than a project-specific environmental assessment that focuses on site-specific issues with defined boundaries.”

As part of this process, the C-NLOPB prepared a SEA for the Western NL Offshore Area, initially completed in 2005 and subsequently amended in 2007 to extend its geographic coverage. The C-NLOPB is committed to reviewing and updating the SEAs as required, and in late 2011 commenced an update for the Western NL Offshore Area SEA. This update, prepared in early 2013 and still in draft form¹⁰, indicates the nature of consultation the C-NLOPB engages in, as well as its recognition of and concerns for onshore-offshore inter-relationships in the coastal areas.

1.3.4.2 C-NLOPB's Project-Based Environmental Assessment

The C-NLOPB also requires project specific environmental assessments for each project seeking an authorization. A recent example is the draft scoping document issued Mar 13, 2013 for the “Shoal Point Energy Ltd/Black Spruce Exploration Corp. Western Newfoundland Drilling Program, 2013-2019”¹¹, a proposed onshore to offshore drilling project in western Newfoundland that proposes to use hydraulic

¹⁰ <http://www.cnlopb.nl.ca/pdfs/wnlsea/wnlseaupdateen.pdf>.

¹¹ <http://www.cnlopb.nl.ca/pdfs/bsespe/drscopedoc.pdf>.

fracturing stimulation. This draft scoping document formally delegates the responsibility for preparation of an acceptable environmental assessment report to the project proponents.

The environmental assessment for the project is required to address the following factors, which includes public consultation:

- environmental effects of the project, including those due to malfunctions or accidents that may occur;
- cumulative environmental effects likely to result from the project in combination with other projects or activities that have been or will be carried out;
- measures, including contingency and compensation measures, that are technically and economically feasible to mitigate significant adverse environmental effects of the project;
- significance of adverse environmental effects following the mitigative measures, including the feasibility of additional or augmented mitigative measures;
- need for, and the requirements of, any follow-up programs in respect of the project; and
- consultations by the proponents with affected parties and/or the general public respecting the matters described above.

The Director will consult with the C-NLOPB to ensure any required processes for public consultation and stakeholder engagement are coordinated and non-duplicative.

1.3.5 Benefits Plans

Sections 61, 62 and 63 of the *Petroleum Regulations* require operators to give first consideration to NL suppliers of goods and services and NL residents for employment in the petroleum operations. Economic opportunities for local residents may be identified in stakeholder engagement and consultation processes, and operators are encouraged to use the processes as opportunities to initiate actions towards fulfilling these requirements. The Director will require each operator to report periodically, as specified by the Director, on use of local suppliers and local employees.

2. Surface Infrastructure

2.1 Goal

The goal respecting surface infrastructure development is to reduce and mitigate the effects of hydraulic fracturing operations on nearby NL residents, communities and municipalities by:

- locating well and pad sites to minimise impacts on the local community, heritage sites, existing land use, individual livelihoods and ecology,
- using well pads where possible to minimize surface footprints and community disturbances,
- managing noise,
- managing vehicular traffic, and
- providing satisfactory financial security respecting potential damages inflicted.

2.2 NL Legislation

Drilling Regulations

Surface infrastructure issues are partially addressed in the *Drilling Regulations*. Section 21 requires a drilling base used in a drilling program to be designed and constructed so that it can:

- withstand the environmental conditions and effects that may reasonably be anticipated,
- provide a base on which drilling and related operations can be conducted safely and efficiently, and
- protect against erosion and corrosion.

Section 27 states that “*The location of a well is subject to the approval of the director*”, and this approval requirement can be used to reduce and mitigate the effects of hydraulic fracturing operations on nearby NL residents, communities and municipalities. Section 28 includes a number of specific provisions relating to proximity to surface improvements:

- prohibiting the drilling of a well within 100 metres of a surface improvement unless the Director is satisfied the operation can be conducted without damage or threat to the surface improvement. Under these Guidelines, the Director will prohibit use of hydraulic fracturing in a well located within 250 m of a surface improvement, unless the Director is satisfied the hydraulic fracturing operations can be conducted without damage or threat to the surface improvement;
- requiring the operator of a well to be drilled within 5 kilometres of a licensed airport to advise the Regional Director, Airways, Transport Canada and the Director, Air Services, NL Transportation and Works, of the proposed location of the well not later than the date of submitting the application for an authority to drill in respect of that well, and
- prohibiting the drilling of a well that may penetrate a mineral deposit where there are mining operations or where mining operations may be undertaken unless measures satisfactory to the Director are taken to:
 - protect the mineral deposits from damage or loss of value, and
 - prevent interference with the mining operation.

More generally, the Director has authority to approve hydraulic fracturing operations subject to terms and conditions he may attach to that approval.

Environmental Protection Act

Under the *Environmental Protection Act*, the definition of "environment", in addition to "air, land and water, plant and animal life", more specifically includes:

- *human life,*
- *the social, economic, recreational, cultural and aesthetic conditions and factors that influence the life of humans or a community, and*
- *a building, structure, machine or other device or thing made by humans.*

Thus, many considerations relating to surface infrastructure must be addressed within an Environmental Impact Statement. The Minister of Environment and Conservation may require these issues be addressed in an environmental impact statement, and they may be subject to conditions he may attach to the release of the undertaking.

Water Resources Act

The *Water Resources Act* includes a number of provisions to protect water that may affect the location of surface infrastructure:

- Section 30 authorizes the Minister of Environment and Conservation to
 - classify wetlands, flood plains, shorelines, coastal waters and other aquatic systems according to their sensitivity and productivity, and
 - control and determine the use of, or modifications to, wetlands where there may be an impact upon the hydrology of that wetland or its recreational, aesthetic or other natural functions and uses.
- Section 33 authorizes the Minister to designate flood risk areas and regulate land development in the designated flood risk areas, in consultation with municipal authorities and other departments of the government.
- Section 39 authorizes the Minister to
 - designate an area surrounding a present or potential source of public water supply, and
 - regulate resource development and other activities in a designated public water supply area that may impair the quality of water.
- Section 61 authorizes the Minister to
 - define and establish a protection zone around a groundwater well used for non-domestic purposes in order to protect that well from pollution,
 - prohibit the placement or deposit of material in the area which might impair the quality of the groundwater, and
 - prohibit development activity in the area.

Petroleum and Natural Gas Act

Section 10 of the *Petroleum and Natural Gas Act* (not yet proclaimed) provides that a person involved in petroleum exploration, development or production activities:

- must provide satisfactory proof of financial responsibility to the Minister of Finance in an amount prescribed by the regulations, sufficient to meet the costs of clean-up and rehabilitation incurred as a result of the activities, and
- is strictly liable for any loss which may occur as a result of pollution caused and the costs of clean-up and rehabilitation incurred by the province or another person.

Section 10 of the *Act* requires financial responsibility from the operator, and Section 14 of the *Drilling Regulations* authorizes the Minister to require an operator, as a condition of a drilling program approval:

- to provide a performance bond in a form and amount to allow the Minister to terminate the well and leave the drill site in a satisfactory condition if the operator fails to comply with the regulations, and
- to satisfy the Minister he is financially capable of meeting the liability that may be incurred as a result of the drilling of a well.

Note that terminated is defined in the *Drilling Regulations* to mean “in respect of a well or test hole, a well or test hole that has been abandoned, completed or suspended in accordance with these regulations”. Because hydraulic fracturing is performed as part of completing a well, this performance bond is applicable to hydraulic fracturing, as the bond applies to terminating the well as well in addition to the drill site.

2.3 Guidance

2.3.1 Well pads

2.3.1.1 Locations and construction

The Director must approve the location and the design (proposed gradients, dimensions, types of fill materials to be used, etc.) of well sites and well pads to be used for hydraulic fracturing operations prior to well site or well pad construction. Well pads will generally be favoured, and may be required by the Director, especially when multiple horizontal wells are being drilled in proximity.

In approving well sites and well pads, the Director will want to ensure the design and construction of well sites and well pads used for hydraulic fracturing operations:

- include secondary containment, to prevent the migration of potential contaminants from the surface into underlying soil and groundwater during drilling and hydraulic fracturing,
- are located on the most level location obtainable that will accommodate the intended use, and
- use previously disturbed areas whenever possible.

2.3.1.2 Setbacks

Protecting Floodplains, Watercourses and Wetlands

The Director will not approve well sites or well pads to be used for hydraulic fracturing operations in flood prone areas unless he is satisfied:

- the operation can occur without significantly altering flood levels and flow velocities,
- the surface elevation of the well site or well pad is above the flood elevation, and
- the well site or well pad is designed to be accessible during a flood.

Protecting Water Supplies

The Director will require the operator of hydraulic fracturing operations to diligently seek to identify all domestic and public water supplies in the vicinity of proposed well pads, including conducting field investigations, contacting landowners and municipal officials, as well as record searches. The Director will not approve well sites or well pads to be used for hydraulic fracturing operations within:

- 250 metres of a watercourse or a wetland as defined in the *Water Resources Act*,
- 250 metres of the wellhead of any domestic or public water supply well,
- 250 metres of the shoreline of a spring, reservoir, natural lake or impoundment serving as a domestic or public water supply, or
- 250 metres of a surface water intake feeding into a domestic or public water supply.

The Director may

- increase the required setback based on the capacity of the water supply and local hydrogeological characteristics, or
- reduce the setback from a water well, a spring, a reservoir or a water intake if the operator
 - is also the owner of the water supply,
 - obtains written permission from the owner of the water supply, or
 - provides other acceptable mitigative measures (such as berms, dykes, etc.) to reduce the risk of contamination.

Buildings and Cultural Features

The Director will not approve well sites or well pads to be used for hydraulic fracturing operations within:

- 500 metres of a school, hospital or nursing home,
- 250 metres of a dwelling or an outdoor public area such as a playground, fairground, park, campground, protected area or other outdoor public activity area, or
- 100 metres of any other permanent building, pipeline or public road.

2.3.2 Noise

Noise hazards are regulated under Section 68 of the *Occupational Health and Safety Regulations*, which has adopted permissible noise threshold limits developed by the American Conference of Governmental Industrial Hygienists (ACGIH) to establish noise exposure criteria.

2.3.3 Traffic

The operator of a hydraulic fracturing program must provide the Director with an estimate of the expected vehicular traffic to be generated by the program, including the volume, duration and distances of heavy truck movements and maps showing the routes the heavy trucks will travel. The operator will provide this information to municipalities and to the Transportation Branch of the Department of Transportation and Works to assist them in preparing for increased traffic associated with hydraulic fracturing operations.

When requested by the Director, the operator must submit for approval a haul route road use plan before commencement of movement of equipment or vehicles. The plan must address issues specified by the Director, in consultation with municipalities and the Transportation Branch of the Department of Transportation and Works, including:

- assessment of potential impacts of trucking on public safety, existing traffic patterns, the physical condition of roads and related infrastructure, and the environment,
- identifying measures necessary to mitigate the impacts of trucking on the foregoing items, and
- plans for consulting with the Department of Transportation and Works, municipal governments, local school districts and communities located along the proposed haul route(s).

Where applicable, the plan must address the cumulative impacts of trucking planned by two or more hydraulic fracturing operators using the same haul route(s).

The operator may also be required to consult with the Motor Registration Division of Service NL, which is responsible for permitting of oversized/overweight loads, in consultation with Transportation and Works.

The operator of a hydraulic fracturing program must consult with the Department of Transportation and Works and the local municipalities to determine if a road use agreement is required. The road use agreement must be based on a road system integrity study completed by the operator in advance of the program commencement, and designed and conducted in consultation with the Department of Transportation and Works and/or the local municipality. This agreement, if required, will:

- identify areas requiring upgrades and repairs to roads prior to commencement of heavy trucking related to the hydraulic fracturing program, including culverts and bridges that may require reinforcing or upgrading,
- identify damage to roads and related infrastructure (culverts, bridges, etc.) caused by increased traffic generated by the hydraulic fracturing program, and
- assign costs for repairs and upgrades to the responsible operator as appropriate.

2.3.4 Liability and Financial Security

2.3.4.1 Financial Security Requirements

Performance bonds in amounts satisfactory to the Minister are required to meet the costs of clean-up and rehabilitation incurred as a result of terminating the well and conducting activities on the drill site. The financial security is intended to ensure that funds are available if:

- damage or impairment to property takes place within times and distances that can be attributed to the hydraulic fracturing operations, and
- the operator of the foregoing activities does not undertake or satisfactorily complete the required remedial action.

The security must be:

- a deposit of money, or
- an irrevocable documentary credit or letter of credit from an institution acceptable to the Minister and negotiable only by the Minister.

The operator is required to submit an estimate of costs to be incurred for clean-up and rehabilitation as a result of planned activities. This cost estimate comprises two components,

- the cost to properly abandon the wellbore and clean-up and reclaim the surface location where the activity takes place, and
- the cost to properly establish baseline data with respect to offsetting potable groundwater supplies via sampling, appropriately monitoring this water as the activity progresses and re-establishing water supplies if problems arise as a result of activities.

These two component financial security estimates will be reviewed by the Minister, the amount required will be specified and financial security must be in place before an approval can be issued.

The financial security may be used by the Minister if damage or impairment to property is caused by the oil or gas operator that posted the security. For potable water damage due to hydraulic fracturing operations, this will require an owner of a water supply to agree to allow the recording of pre-project information including water well sampling and any other pre-project monitoring or sampling that may be required.

If NL draws on the financial security, the operator must “top up” the security so that the full amount of the required security remains available.

2.3.4.2 Water Supply Replacement or Restoration

To implement the above financial security in regards to damage to water supply, NL will evaluate complaints received from the public regarding water supplies to determine whether a water supply located within 500 metres of the well pad has been diminished in quality¹² after well pad construction and prior to abandonment of the oil or gas well. If the determination is affirmative, the Government of NL will require the operator to cover the costs in re-establishing the water supply. If the operator does not accept liability for these costs, the Government and the operator will work with an independent third party dispute resolution mechanism to determine the cause of the water supply impairment. If the dispute resolution mechanism finds the oil or gas operator is at fault and the operator refuses to pay, the Government will draw on the operator’s financial security to recover the costs incurred in re-establishing the water supply.

¹² See Definitions at the end of these Guidelines.

The operator will not be required to re-establish a water supply, and the Government will not draw on the operator's financial security, if the owner of the water supply refused to allow water sampling or refuses to allow the results of the sampling to be submitted to the independent third party dispute resolution mechanism.

Nothing in these Guidelines is intended to prevent NL from requiring an operator to perform restoration or replacement at a water supply located beyond the above noted distances, if it is determined that the water supply has been diminished in quality as a result of an oil or gas activity.

Activities of contractors or subcontractors are subject to the above provisions respecting water supply replacement or restoration, including potentially drawing on the operator's financial security to recover the costs incurred in re-establishing the water supply.

3. Water Analysis and Monitoring

3.1 Goal

The goal of conducting water analysis and sampling is to safeguard the quality of NL water (groundwater and surface waters) from contamination during nearby hydraulic fracturing operations. Many sections of these Guidelines will contribute to the safeguarding of water – this section will establish means of analyzing and monitoring water quality to safeguard water supplies and to assure the public that water quality is being safeguarded.

3.2 NL Legislation

NL regulations do not currently include an explicit requirement for baseline testing of water wells or regional water sources in the vicinity of hydraulic fracturing operations.

Drilling Regulations

Section 31 of the *Drilling Regulations* addresses surface water quality protection by requiring “*Where a proposed well is to be located within 100 metres of the normal high water mark of a body of water or permanent stream, the operator shall submit evidence that he or she has obtained prior written approval of his or her plan to prevent pollution of the water from those regulatory bodies that have jurisdiction in respect of the drill site*”. These Guidelines will require the plan to prevent pollution of the water to include baseline sampling and monitoring when the planned activity includes hydraulic fracturing. The Guidelines will also require the plan to include baseline sampling and monitoring of water wells accessing groundwater in proximity to the drill site when hydraulic fracturing is being planned.

Petroleum Regulations

Section 33 of the *Petroleum Regulations* requires an application for a development to include, among other things:

- (f) *an environmental impact statement, where required under the Environmental Assessment Act;*
- (g) *a description of the proposed mitigative measures designed to reduce the impact of the proposed development on the environment; and*
- (j) *other information the minister may require.*

Section 35 requires the Minister’s approval of a development plan to take into account whether “*sufficient environmental, social and economic impact studies have been undertaken by the proponent to provide the basis for the establishment of guidelines for production*”. Between the required content in an application and studies to provide a “basis for the establishment of guidelines for production”, the Minister will have ample scope and authority to ensure measures are in place to safeguard water supplies.

Water Resources Act

Section 41 of the *Water Resources Act* authorizes the Minister to “*require and direct the owner, operator or other person responsible for an undertaking to carry out those tests on water emitted from,*

surrounding or connected with that undertaking that the minister considers necessary". This authorizes the Minister of Environment and Conservation to require testing of water from wells "surrounding" a hydraulic fracturing operation, and to have those results reported to the Minister in a manner directed by the Minister. The authority in Section 41 extends to both groundwater and surface water.

Section 62 of the *Water Resources Act* authorizes the Minister to "*order studies, monitoring and investigations for the purpose of collecting data and information on the availability of groundwater, sustainable rates of water withdrawal, spacing of wells, quality of household water supplies, pumping test methods, hydrogeological mapping, groundwater flow systems, groundwater quality and other matters that the minister considers necessary in the interest of the conservation, development, control, improvement and proper utilization of groundwater resources*". This authority specifically relates to groundwater and, in complement with Section 41, authorizes for the Minister of Environment and Conservation to require baseline testing and monitoring water wells.

3.3 Guidance

CAPP's "*Baseline Groundwater Testing Operating Practice*"¹³ states: "*CAPP and its member companies are committed to protecting fresh groundwater sources.*"

CAPP's operating practice requires companies to test domestic water wells within 250 metres of shale gas, tight gas and tight oil development, and to participate in broader and longer term regional groundwater monitoring programs for the purpose of establishing baseline characteristics of the groundwater pre-development, and to analyze possible changes over time.

This practice includes two aspects:

1. domestic water well testing, where companies develop programs to test existing camp wells, domestic wells and natural springs with landowner consent; and
2. regional groundwater monitoring, where industry works with government and regulators to design and implement regional groundwater monitoring programs.

These Guidelines will build upon CAPP's Operating Practice to guide the design, execution and quality assurance aspects of baseline fresh groundwater testing programs associated with hydraulic fracturing in NL. It will include those programs conducted on a domestic water wells by individual operators, and those conducted on a regional basis by the NL government and industry co-operatively, in support of hydraulic fracturing operations.

This section of the Guidelines is largely based on implementing the CAPP Operating Practice, with some modifications to be consistent with standards adopted in nearby jurisdictions.

¹³ <http://www.capp.ca/getdoc.aspx?DocId=218135&DT=NTV>.

3.3.1 Water Testing

3.3.1.1 Water well sampling

Every authority to drill a well granted by the Director will include the following requirements for sampling of groundwater from water wells as terms and conditions:

- The operator must collect and analyze, with landowner consent, water samples for laboratory analysis from all water wells within 500 metres of the well site or well pad where hydraulic fracturing will occur. Initial water well samples must be collected prior to commencement of well site or well pad construction,
- Within a period of 30 to 60 days after completing hydraulic fracturing operations on a well, the operator must arrange for the re-testing of those previously sampled water wells within 500 metres of that well site,
- If hydraulic fracturing operations do not commence within 90 days of drilling, the Director may require additional water well sampling prior to commencement of hydraulic fracturing operations,
- For multi well pads, pre-drilling sampling will be required for each new well if more than 90 days have elapsed since the last post-completion sampling of a previously well drilled on the same pad, and
- The sampling must be conducted by a qualified third party engineering or geosciences firm licensed to practice in NL and hired and paid for by the operator, in accordance with sampling procedures approved by the Minister of Environment and Conservation.

The Director and/or the Minister of Environment and Conservation may require a larger sampling radius and/or additional water quality testing parameters as warranted by local conditions or hydrogeology.

Written permission of the water well owner must be obtained by the operator prior to collecting samples from water wells. The written permission must include consent for the laboratory that conducts the test to release test results to the operator and the Departments of Natural Resources and Environment and Conservation. If requested, the local municipality can be provided with non-identified information on water samples.

If a water well owner does not grant permission to have the water well tested, the operator must obtain written confirmation from the water well owner that testing is not permitted. If the water well owner refuses to provide written confirmation, the operator must document the refusal and deliver a notice to the water well owner verifying that water well samples will not be collected.

3.3.1.2 Regional Water Monitoring

Every authority to drill a well granted by the Director will include the following requirements for surface water monitoring as part of its terms and conditions:

- Surface water monitoring by operators is required for well sites or well pads where hydraulic fracturing will occur that are located within 500 metres of any watercourse or wetland and must include the collection and testing of water samples prior to the commencement of well site or well pad construction, at locations upstream and downstream of the well site or well pad,

- Baseline surface water samples for laboratory analysis must be collected 50 metres upstream, 50 metres downstream, and 100 metres downstream of the location of the hydraulic fracturing operations. Monitoring at these locations must be performed monthly as long as hydraulic fracturing operations continue and until 2 months after completion of operations,
- Conductivity, pH, dissolved oxygen, and temperature must be measured at the time of baseline sampling and on a weekly basis in the field, at the same locations and for the same durations as indicated above, and
- Additional sampling and testing at the same locations and for the same parameters may be required by the Director and/or the Minister of Environment and Conservation during and after well construction and hydraulic fracturing.

3.3.1.3 Sampling and Testing Procedures

Every authority to drill a well granted by the Director will include the following requirements for sampling and testing of water as part of its terms and conditions:

- Baseline water quality testing must be done in a laboratory approved by the Minister of Environment and Conservation and copies of all results must be provided to the Minister of Environment and Conservation and to the Director,
- The analyses must allow comparison with appropriate water quality standards, including as a minimum:
 - inorganic, organic, microbiological and radiological constituents identified in the Guidelines for Canadian Drinking Water Quality, published by Health Canada on behalf of the Federal-Provincial-Territorial Committee on Drinking Water¹⁴.
 - presence or absence of methane in the water, including if appropriate, isotopic fingerprinting analysis, and
- The analysis must test for all specific chemical constituents to be used in the hydraulic fracturing fluids,
- A water deliverability test must be conducted on water wells to establish well yield.

The results of the tests should be sent to the water well owner, the operator, the Director, the Minister of Environment and Conservation, and can be made public subject to written permission from the water well owner.

The third party engineering or geosciences firm is responsible for comparing the results of follow-up testing to pre-activity testing and analysis, identifying any parameters that appear to be significantly changed in their professional opinion and explaining these changes to the water well owner in writing. For samples with constituents exceeding specific water quality guidelines, Health Canada approved fact sheets¹⁵ will be provided by the third party engineering or geosciences firm to assist the water well owner in interpreting their test results. If a test of a sample establishes that the water poses a significant

¹⁴ <http://www.hc-sc.gc.ca/ewh-semt/water-eau/drink-potab/guide/index-eng.php>.

¹⁵ <http://www.hc-sc.gc.ca/ewh-semt/pubs/water-eau/index-eng.php#wtfs>.

human health risk as determined by criteria set by the Health Canada (eg, presence of total coli form and E. Coli), the third party engineering or geosciences firm must notify the water well owner (or the occupant consuming the water) the same day that the results are available and advise them of the risks of consuming the water.

The third party engineering or geosciences firm must prepare and submit to the Director and the Minister of Environment and Conservation a final report detailing the results of the water well sampling and analysis program within 90 days of the completion of the program. This report should provide an overview of the sampling program and a summary of the results of pre and post activity sampling and analysis.

If the owner of a sampled well observes any changes in water quality subsequent to hydraulic fracturing operations in the area he may register a complaint with the Director. The Director may require the operator to arrange and pay for retesting of the water wells. The retesting program must be designed in consultation with Director and the Minister of Environment and Conservation.

4. Water Sourcing and Measurement

4.1 Goal

The goal respecting water sourcing and measurement is to safeguard the quality and quantity of regional and ground water sources by ensuring:

- NL's water resources are not impacted or reduced,
- water used for hydraulic fracturing purposes is measured and recorded, and
- where possible, water used in hydraulic fracturing is reused, recycled and taken from sustainable sources.

CAPP's *Water Sourcing, Measurement and Reuse Operating Practice*¹⁶ strongly encourages its members to follow the practices listed below:

Operational Requirements

Operators are expected to meet or exceed the following requirements when sourcing, measuring or reusing water:

1. Required licences/permits for water that is withdrawn will provide limits and reporting requirements established by the regulator to protect the water resource.
2. Potential sources of water (both temporary and permanent) for hydraulic fracturing to be evaluated to ensure sustainability of the water resource while balancing social and economic considerations will include:
 - a. Flowback
 - b. Wastewater
 - c. Produced water
 - d. Sea water
 - e. Saline groundwater
 - f. Non-saline groundwater
 - g. Surface water
3. The sustainability and safeguarding of surface water and groundwater quantity will be ensured by monitoring appropriate parameters (eg, pressure, volume, water levels, precipitation data) for the following water sources:
 - a. Saline groundwater
 - b. Non-saline groundwater
 - c. Surface water
4. Measurement water use data will be collected for:
 - a. Water sourced
 - b. Water injected and disposed

¹⁶ <http://www.capp.ca/getdoc.aspx?DocId=218142&DT=NTV>.

- c. Produced water/flowback generated
5. Permanent surface water allocations will be based on flow or water level monitoring, as approved by the regulator, with the amount of water withdrawn dependent on the quantity of water actually available.
6. Collaborate and share best practices with other operators regarding water sourcing, measurement and reuse, and reporting of data.

Performance Measures

Conformance with this practice will be confirmed by having:

- A decision-making framework to ensure water source options are assessed and understood, including recycling flowback/produced water for reuse,
- Procedures for the collection of monitoring and measurement data related to water quantity and use, and
- Procedures for the measurement and reporting of key water management metrics as identified in CAPP's Responsible Canadian Energy™ program, or as approved by the regulator.

The Director will require these basic goals and practices be adopted by any operator planning to conduct hydraulic fracturing operations in NL.

4.2 NL Legislation

Water Resources Act

The *Water Resources Act* addresses water sourcing and measurement extensively. Section 12 states that the *Water Resources Act* governs the right to the permanent diversion or the exclusive use of water in NL. Section 14 authorizes the Minister, after considering the potential adverse effects, to issue a licence with or without terms and conditions to divert or use water for a municipal, agricultural, institutional, commercial or industrial purpose, for water and thermal power generation and other purposes the Minister considers necessary.

Section 15 establishes NL's priorities among competing water uses, as follows:

- domestic purposes,
- municipal purposes,
- agricultural purposes,
- commercial, institutional and industrial purposes,
- water and thermal power generation purposes, and
- other purposes prescribed by regulation.

Section 15 also authorizes the Minister, with respect to an application for a water licence, to:

- refuse to grant the licence,
- require additional information with respect to the design, construction, operation or other matters applicable to the proposed licence,

- require a modification or alteration of plans, specifications or other details applicable to the proposed undertaking, or
- grant a licence subject to modifications or alterations and on terms or conditions that the Minister considers necessary.

Regarding measurement, Section 22 provides that *“in the case of a dispute as to the quantity of water used or diverted, or the capacity of works, the minister may order an inspection of the works and that inspection may include flow measurements”*. Section 31 authorizes the Minister to order a licensee to install, operate and maintain stream flow gauging stations, and other gauges in the rivers, streams, lakes, ponds and other bodies of water supplying water to the licensee and to monitor water quality on the locations, at the frequencies and for the parameters that the Minister considers necessary to secure a complete or partial survey of the sources of the water supply. Section 64 authorizes the Lieutenant-Governor in Council to make regulations *“respecting the units of measurement of water and the method or type of method or instrument for measuring water”*.

4.3 Guidance

The Director and the Minister of Environment and Conservation will require operators in NL conducting hydraulic fracturing operations to adopt the practices outlined below respecting water sourcing, measurement and reuse during the well completion and hydraulic fracturing process in NL.

4.3.1 Water Management Plan

The Minister’s approval of a water licence for an operator intending to withdraw water for use in hydraulic fracturing operations will require an approved water management plan prior to commencing hydraulic fracturing as part of the terms and conditions applicable to that water licence. The plan must describe:

- locations of the proposed water sources,
- estimated quantities and types of water (surface/ground, fresh/salt, treated, recycled, etc.) that will be required,
- potential timing of water use during the year,
- planned methods for reusing or treating wastewater,
- reasons why lesser volumes of water are not being proposed, and
- contingency plans for water sourcing should the intended water source become unavailable.

4.3.1.1 Water Conservation and Reuse

Recycling and re-use of flowback water is the preferred water source for other than the first well on the permit. If flowback recycling/re-use is not proposed, the water management plan must demonstrate to the satisfaction of the Director and the Minister of Environment and Conservation that recycling and re-use are not feasible, based on:

- an evaluation of the technologies that could be used to recycle the water,
- the availability of those technologies in NL (at the well pad or elsewhere), and
- the scale of operation necessary to employ the technologies effectively.

4.3.1.2 Priorities of Water Sources

In preparing a water management plan, operators must investigate all potential sources of water. The proposed water source must be selected according to the following priorities:

- 1) recycling/re-use of flowback and produced water from oil or gas wells, as well as treated/recycled wastewater from municipal or industrial sources,
- 2) ocean water,
- 3) non-potable groundwater water (eg, from deep, saline aquifers),
- 4) dugouts, catchments or other man-made features that capture run-off or rainwater, or
- 5) lakes or watercourses (except where municipal water supplies are drawn from lakes, watercourses or impoundments).

Evaluation of proposals to utilize a water source other than recycling/re-use of flowback water will consider factors such as:

- the scale, stage and duration of the proposed work,
- potential for road damage (due to trucking), and
- implications of the use of salt water and wastewater for the management of flowback water.

4.3.1.3 Assessment of Proposed Water Sources

The operator's water management plan must demonstrate that the rate of water withdrawals will not exceed sustainable limits and will not cause:

- depletion of non-saline groundwater,
- a progressive lowering of groundwater levels,
- water quality degradation, or
- reduction in the quantity of surface water to an extent that adversely affects wetlands, aquatic habitat, aquatic ecosystems or other water users.

For proposed water licences to withdraw groundwater, the water supply source assessment by the operator must include:

- long term drawdown projections,
- aquifer testing to evaluate whether the proposed water wells can provide and sustain the drawdown projections, and
- an assessment of impacts on other water users.

For proposed water licences to withdraw surface water from rivers, lakes and streams, the water management plan and water supply source assessment must demonstrate that the in-stream flow will be maintained, calculated on seasonal, site-specific basis, at a level that avoids significant adverse environmental impacts including:

- reduced stream flow,
- impacts on wetlands,
- aquatic habitat and ecosystems, and
- impacts on other water users.

Where the same watercourse or aquifer will be used by more than one operator or by a single operator with more than one water supply requirement, the above assessments must be based on cumulative water use.

4.3.2 Water Use Monitoring and Recording

The water management plan must include the monitoring and recording of water withdrawals (eg, via a continuous-recording device or a flow meter or other acceptable method) and monitoring of in-stream flows at surface water withdrawal locations. Operators must report the amount and source of water used for hydraulic fracturing in a format and at a frequency determined by the Director and the Minister of Environment and Conservation.

5. Managing Seismicity and Geologic Containment

5.1 Goal

The goal of managing seismicity and geologic containment is to minimize the risk of seismic events that might be triggered by hydraulic fracturing and to avoid geologic conditions that would adversely affect the hydraulic fracturing process.

5.2 NL Legislation

Drilling Regulations

Section 30 of the *Drilling Regulations* requires an application for an authority to drill a well to include a highly detailed and technical well prognosis, which must include the information:

- (a) the manner in which the program for the drilling of the well has been designed to overcome the meteorological conditions referred to in the application for drilling program approval;*
- (b) the prevailing environmental conditions in the area of the drill site;*
- (d) the equipment, procedures and resources to be employed to protect the natural environment in the vicinity of the proposed well;*
- (e) the detailed geological prognosis including
 - (i) a diagrammatic presentation of the stratigraphic section and the interval velocities used to produce the section,*
 - (ii) the depth, thickness and lithology of formations,*
 - (iii) the depth of geological and seismic markers,*
 - (iv) the prospective horizons,*
 - (v) a series of time structure or depth structure contour maps illustrating the areal configuration of the major horizons, and*
 - (vi) if seismic data has been acquired, at least 2 fully processed seismic sections, crossing the proposed well site or projected across the proposed well site which preferably should be orthogonal;**
- (f) the details of the well evaluation program;*
- (g) the subsurface conditions anticipated at the proposed drill site that may affect the safety and efficiency of the drilling operations including the depth and nature of formations where problems such as lost circulation, swelling shale and abnormal pressure zones are anticipated;*
- (n) other information that the director may require.*

Section 32 authorizes the Director to approve an application for an authority to drill a well on condition the drilling of the well is in accordance with the technical details included in the application, unless alternative conditions are specified by the Director. The authority to specify alternative conditions gives the Director ample authority to specify terms and conditions on the drilling of the well.

5.3 Guidance

5.3.1 Seismicity

CAPP's Hydraulic Fracturing Operating Practices include "*The Anomalous Induced Seismicity: Assessment, Monitoring, Response and Mitigation Operating Practice*"¹⁷ which outlines the steps to be taken to assess, evaluate, monitor and mitigate seismic events that might occur during hydraulic fracturing operations.

For the purpose of these Guidelines, the following definitions from CAPP's operating practice will be used:

- Seismicity - The frequency and magnitude of earthquake activity in a given area,
- Anomalous seismicity - Seismicity that would not normally occur when performing hydraulic fracture completions (such as seismicity from fault movement), and
- Induced seismicity - Seismic events that can be attributed to human activity. Seismicity can be induced by geothermal energy extraction, mining, dam building and hydraulic fracturing.

The steps the Director will require operators in NL to take to avoid anomalous induced seismicity, based on this CAPP operating practice, are outlined below.

5.3.1.1 Assessing the Potential for Anomalous or Induced Seismicity

The Director will require operators to assess the potential for anomalous or induced seismicity for each hydraulic fracturing program by:

- as part of the geological prognosis for the well, using available engineering, geologic and geophysical data to understand and describe the geological setting, including pre-existing faults and lineaments and historical seismicity in the area,
- communicating with area operators and the Department of Natural Resources to determine if seismicity has previously been experienced and, if so, at what intensities,
- understanding the local context by considering:
 - population and communities
 - buildings and structures
 - infrastructure
 - environment.

Where this assessment indicates potential for anomalous or induced seismicity to exist, the Director will require operators to implement the following practices for each hydraulic fracturing program or location:

1. *Wellbore placement and drilling design* - evaluate wellbore placement and drilling design to account for local surface and geological conditions, including pre-existing faults and lineaments.
2. *Personnel preparedness and monitoring procedures*

¹⁷ <http://www.capp.ca/getdoc.aspx?DocId=217532&DT=NTV>.

- communicate with onsite personnel to recognize and be prepared for possible seismicity detectable to people on the surface,
 - suspend operations if unusual conditions are experienced or suspected, and
 - establish appropriate monitoring procedures based on the assessment of the potential for seismicity, including:
 - use of data from Natural Resources Canada’s Yellowknife Seismic Array and other components of the IMS Seismic Network
 - observations by onsite personnel
 - use of surface monitoring.
3. *Mitigation and response procedures to anomalous or induced seismicity* - if seismicity is detected by available monitoring equipment – including the Natural Resources Canada monitoring system – or by onsite personnel, an operator’s mitigation procedures will be activated, including:
- increasing monitoring activities,
 - evaluating operating conditions,
 - temporarily suspending operations or proceeding with caution,
 - engaging engineers, geological and geophysical staff and/or third-party experts to review available subsurface data and, if deemed necessary, design and conduct engineered trials to adjust operating procedures as appropriate with respect to injection volumes, rates, locations, etc.,
 - reporting and discussing occurrence with the Director, and
 - share learnings with other area operators.

5.3.2 Geologic Containment

The Director will require the operator to eliminate or reduce to as low as reasonably practicable the potential for substances such as fracturing fluids, drilling fluids, and hydrocarbons to reach water wells or the surface via underground fractures, faults, abandoned oil or gas wells or an inadequate bedrock layer. This will be addressed through well integrity, which is discussed in Section 6, immediately below.

6. Well Construction, Operation and Integrity

6.1 Goal

The wellbore integrity goal for wells used for hydraulic fracturing operations in NL is to:

- ensure containment of all operational fluids and pressures within the wellbore,
- protect groundwater aquifers by preventing any migration of fluids from the wellbore into overlying porous formations,
- reduce the risk of inter-wellbore communication between the hydraulically fractured well and a nearby well,
- manage well control at a nearby well in the event of inter-wellbore communication with the hydraulically fractured well, and
- prevent surface water impacts.

6.2 NL Legislation

Drilling Regulations

Section 11 of the *Drilling Regulations* requires an operator to formulate contingency plans and have equipment available to cope with a foreseeable emergency situation during a drilling program, including:

- the loss of well control,
- arrangements for the drilling of a relief well should it become necessary, and
- hazards unique to the site of the drilling operations and spills of oil or other pollutants.

It also requires the operator to have a copy of the contingency plan accessible at each drilling rig.

Section 17 requires an operator to ensure:

- the drilling of a well is conducted in a manner that maintains full control of the well at all times, and
- plans exist and equipment is available to deal with all abnormal situations that may reasonably be anticipated.

Section 29 requires an application for authority to drill a well to include the casing program and estimate of the volume of cement to be used. It also requires a well prognosis, which must include:

- the equipment, procedures and resources to be employed to protect the natural environment in the vicinity of the proposed well,
- a detailed geological prognosis including
 - a diagrammatic presentation of the stratigraphic section and the interval velocities used to produce the section,
 - the depth, thickness and lithology of formations,
 - the depth of geological and seismic markers,
 - the prospective horizons,
 - a series of time structure or depth structure contour maps illustrating the areal configuration of the major horizons,

- details of the well evaluation program,
- subsurface conditions anticipated at the proposed drill site that may affect the safety and efficiency of the drilling operations including the depth and nature of formations where problems such as lost circulation, swelling shale and abnormal pressure zones are anticipated,
- details of the casing program including
 - calculations of the design safety factors, and
 - the anticipated fracture gradient curves and pore pressure profiles,
- details of the cementing program for each casing string,
- the blowout preventer system,
- details of the sequence of drilling operations and procedures to be used for each phase of the hole
- the basic type of fluid system and a summary of expected properties to be maintained for each phase of the hole,
- a summary or description of the offset well data used in the planning and engineering of the well, and
- other information the Director may require.

Section 32 provides that the approval of an authority to drill a well is on condition the well is drilled in accordance with the particulars required to be included in the application submitted by the operator, unless otherwise authorized by the Director.

Part III deals extensively with casing and cementing requirements, including provisions addressing:

- design of casing,
- burst pressure assumptions,
- collapse loading assumptions,
- tensile loading assumptions,
- alternative casing design,
- casing setting depths,
- casing program,
- cementation of casing,
- proper cementation,
- cement mixture and process,
- cementing intervals,
- liner cementing intervals, and
- waiting on cement time.

Some particularly relevant provisions in Part III that authorize the Director to require or approve operational components that may relate to hydraulic fracturing operations include the following.

- Alternative casing design – Subsection 41(2) authorizes the Director to approve alternative casing design criteria submitted by the operator if the operator demonstrates the safety is equivalent or superior to the safety of the casing designed in accordance with the regulations.

- Casing setting depths – Subsection 43(2) authorizes the Director
 - where abnormal pressure conditions are known to exist or are anticipated, to require the operator to install casing in addition to the casing required by the regulations; and
 - where the operator demonstrates that an equivalent degree of safety to that required is provided with different casing setting depths, approve casing setting depths other than those required by those subsections.
- Cementation of casing – Subsection 44(2) authorizes the Director to approve an alternative program for the cementation of casing and casing liners where the operator demonstrates that other measures will provide an equivalent or greater degree of well control.

Petroleum Regulations

Subsection 33(1) requires an application for a development plan to include, among other things:

- (d) a detailed description of the proposed method for petroleum recovery and the estimated recovery factor;*
- (f) an environmental impact statement, where required under the Environmental Assessment Act;*
- (g) a description of the proposed mitigative measures designed to reduce the impact of the proposed development on the environment; and*
- (j) other information the minister may require.*

The information required in the application would address hydraulic fracturing, if it is to occur.

Subsection 35(1) authorizes the Minister to:

- (a) approve the development plan subject to the terms or conditions that the minister considers appropriate; or*
- (b) reject the development plan.*

Subsection 35(2) requires the decision by the Minister under Subsection 35(1) to take into account, among other things, whether:

- (a) the proposed technology for petroleum production allows for safe production in the lease area, or proposed lease area or whether more appropriate production alternatives exist; and*
- (b) sufficient environmental, social and economic impact studies have been undertaken by the proponent to provide the basis for the establishment of guidelines for production.*

Because the Minister must consider safety and environmental impacts in approving a development plan, and is authorized to make his approval subject to terms and conditions, he clearly has authority to ensure hydraulic fracturing operations are conducted in manner that ensure wellbore integrity.

6.3 Guidance

6.3.1 Well Integrity

During hydraulic fracturing operations, subject wells can incur significant stresses, which may lead to a loss of well integrity. Well integrity loss may result in subsurface impacts or in a release of fluids to the surface, placing the public and the environment at risk. To ensure well integrity, the Director will require operators of wells to be used for hydraulic fracturing operations in NL adhere to the requirements set out in *AER Directive 83: Hydraulic Fracturing – Subsurface Integrity*¹⁸, and other AER Directives as outlined below. The Director may vary any component of AER Directive 83, or other AER Directives referenced below, in his approval based on his assessment of site-specific conditions.

6.3.1.1 General

Operators must:

- design and construct the well to provide well integrity during hydraulic fracturing operations,
- design the casing and cementing programs in conformance with a well-specific, engineered design and installed by independent, competent specialist contractors in co-ordination with the operator,
- evaluate the integrity of the casing and cement system through field inspection and cement evaluation logs to confirm that the cement has formed a competent seal between the casing and the surrounding rock to prevent the flow of fluids behind the casing,
- obtain approval of the Director if a barrier system other than a single- or dual-barrier system is used, and
- manage well integrity throughout the life of the well, from construction to post abandonment.

Surface casing in NL must be set in accordance with *AER Directive 008: Surface Casing Depth Requirements*¹⁹ and cementing in NL must be performed in accordance with *AER Directive 009: Casing Cementing Minimum Requirements*²⁰.

6.3.1.2 Barrier Systems

For hydraulic fracturing operations, a barrier system is used to maintain hydraulic isolation between the formation undergoing the hydraulic fracture and the overlying porous interval. A dual-barrier system (see Figure 2) maintains hydraulic isolation by using two barriers to contain pressure/fracturing fluids in the wellbore, consisting of:

- a primary barrier system capable of containing and isolating the fracture fluids,
- a secondary barrier system capable of providing well control in the event of a failure of the primary barrier, and
- a monitoring system to detect and allow for a response to a primary barrier failure.

The Director will require:

¹⁸ <http://www.aer.ca/documents/directives/Directive083.pdf>.

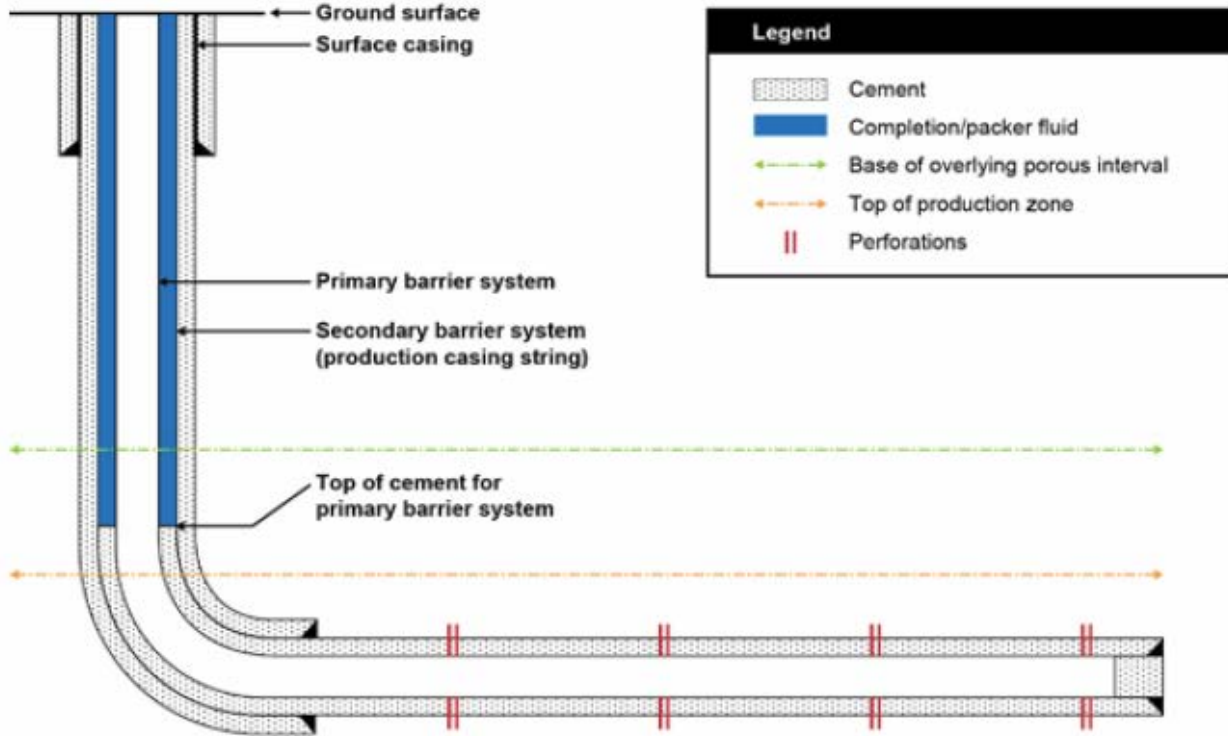
¹⁹ <http://www.aer.ca/documents/directives/Directive008.pdf>.

²⁰ <http://www.aer.ca/documents/directives/Directive009.pdf>.

- pressures in the annular area between the primary barrier and the secondary barrier be monitored from the surface to below the base of the overlying porosity interval to detect a primary barrier failure, and
- if a failure occurs on the primary barrier, that measures be in place to prevent a failure of the secondary barrier.

To be classified as a dual-barrier system, the cement of the primary barrier system must not extend above the base of the overlying porous interval.

Figure 2: Example of a Simplified Dual-Barrier System



Source: AER Directive 83

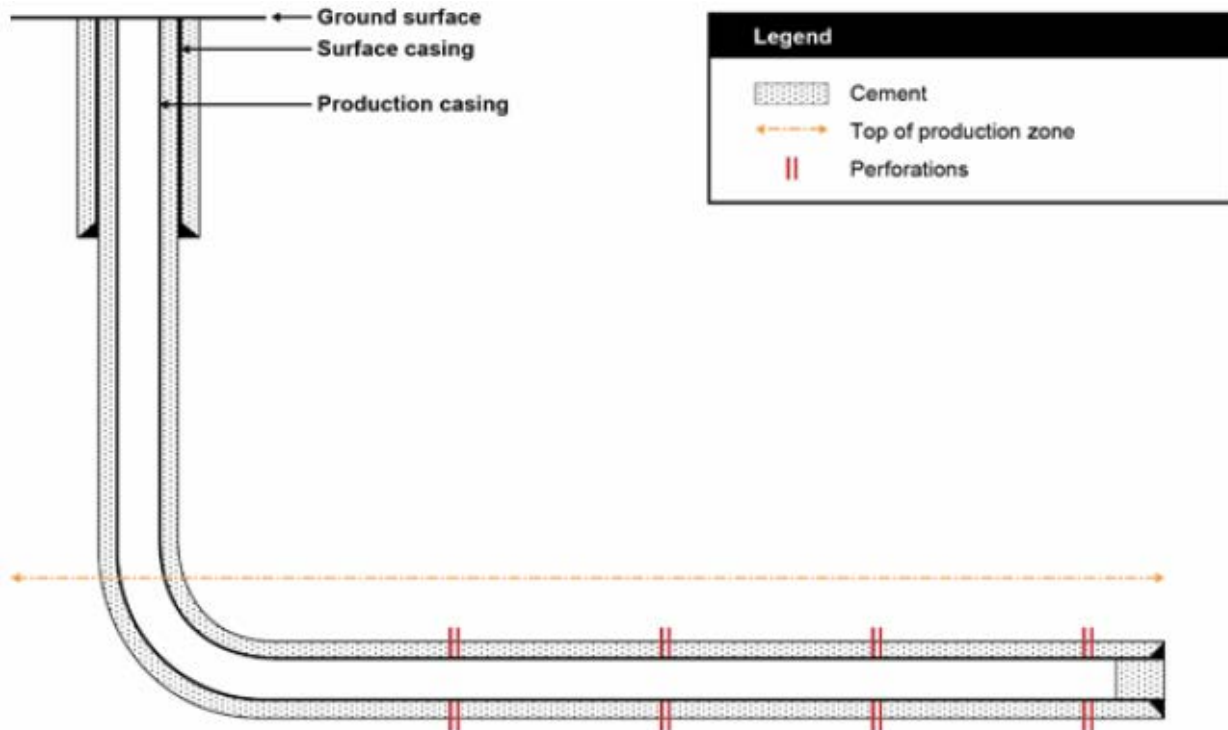
If a single-barrier system is used (see Figure 3), the Director expects increased diligence in designing the barrier system, and will require operators to:

- document the load capacity and safety factors used in the casing design relative to the loads and the well environment that the casing will be exposed to,
- document the adjusted maximum pressure,
- adopt an operating practice, such as Enform’s IRP #25 *Primary and Remedial Cementing Guidelines* (Drilling and Completions Committee)²¹ or a technically equivalent standard, when planning and executing its cementing program,
- be able to demonstrate integrity of
 - both casing and cement prior to initial fracture operations,

²¹ http://enform.ca/safety_resources/publications/PublicationDetails.aspx?a=61&type=irp.

- casing during fracture operations,
- casing with final completion operations or within 90 days of the fracture operation,
- conduct a surface casing vent flow / gas migration test (as per AER *Interim Directive 2003-01: Isolation Packer Testing, Reporting, and Repair Requirements; Surface Casing Vent Flow/Gas Migration Testing, Reporting, and Repair Requirements; Casing Failure Reporting and Repair Requirements*²²) or a surface casing annulus flow test (as per the attachment to AER *Bulletin 2011-35: Surface Casing Vent Requirements for Wells*²³) prior to initial fracturing operations and between 60 and 90 days after completing fracturing operations,
- set surface casing in accordance with AER *Directive 008: Surface Casing Depth Requirements*²⁴, and
- if surface casing is not set to the BGWP,
 - not use hydraulic fracturing fluids that may adversely affect ground water, and
 - cement the next casing string to surface.

Figure 3: Example of a Simplified Single-Barrier System



Source: AER Directive 083

6.3.2 Inter-wellbore Communication

Inter-wellbore communication occurs when a communication pathway has been established between the hydraulically fractured well and an adjacent producing, shut-in, or abandoned oil or gas well. A

²² <http://www.aer.ca/documents/ids/pdf/id2003-01.pdf>.

²³ <http://www.aer.ca/rules-and-regulations/bulletins/bulletin-2011-35.htm>.

²⁴ <http://www.aer.ca/documents/directives/Directive008.pdf>.

communication pathway may cause a well control event at the adjacent well, resulting in subsurface impacts or a release of fluids to the surface, placing the public and the environment at risk.

6.3.2.1 General

The Director will require operators of wells used for hydraulic fracturing operations to manage the risks of inter-wellbore communication between the hydraulically fractured well and an offset well depending on the proximity, type and quantities of other wells in the area. For the purposes of these Guidelines:

- A subject well is a well at which an operator proposes to conduct hydraulic fracturing operations,
- A fracture planning zone (FPZ) is the area that may be impacted by hydraulic fracturing operations, extending the distance of twice the half-length²⁵ of the planned fracture over the entire wellbore, and
- An offset well is any producing, shut-in or abandoned oil or gas well within the FPZ of a subject well, excluding water wells.

6.3.2.2 Hydraulic Fracturing Risk Planning

Prior to initiating a hydraulic fracturing program, the Director will require an operator to assess the potential for inter-wellbore communication between the stimulated well and any well within the FPZ. The assessment must consider all relevant geological and geophysical information available to the operator and must be conducted in accordance with the Drilling and Completions Committee's IRP 24²⁶.

The fracturing assessment will include the following elements:

- determination of a FPZ,
- identification of all offset wells within the FPZ,
- assessment of well integrity for each offset well,
- risk assessment for each offset well, using a methodology such as described in *Interim Enform IRP 24: Fracture Stimulation: Inter-wellbore Communication* (Drilling and Completions Committee)²⁷,
- determination of at-risk offset wells within the FPZ,
- identification and assessment of special-consideration wells for possible inclusion in the well control plan,
- identification of energizing gas(es) used in fracture fluids, and
- identification of any subsurface features such as those described in *Enform IRP 24 Hazard Register*²⁸.

The operator must maintain a copy of its fracturing assessment at the subject well site for the duration of the operation.

²⁵ "Fracture half-length" means the radial distance initiated from the subject wellbore to the outer tip of a fracture propagated by fracturing. Twice the fracture half-length is referred to by Enform as the Fracture Planning Zone.

²⁶ http://www.enform.ca/safety_resources/publications/PublicationDetails.aspx?a=29&type=irp.

²⁷ http://www.enform.ca/safety_resources/publications/PublicationDetails.aspx?a=29&type=irp.

²⁸ *ibid.*

The fracturing assessment must be conducted by and signed by a qualified professional, and the operator must provide the results to the Director prior to the commencement of the hydraulic fracturing program. If the assessment indicates that induced fractures may extend to an offset well within the FPZ, the Director will not permit hydraulic fracturing to occur unless the proposed hydraulic fracturing program is modified to eliminate or acceptably reduce the risk of inter-wellbore communication.

The use of high vapour pressure hydrocarbons in hydraulic fracturing operations requires prior approval by the Director.

6.3.2.3 At-risk Offset Well Control Plans

Depending on the presence, proximity, type and number of other wells in the area, the Director will require operators to have a well control plan for each at-risk offset well that includes:

- the method(s) of detection of inter-wellbore communication,
- how information will be relayed from an at-risk offset well back to the hydraulic fracturing operations should an inter-wellbore communication event occur,
- the adjusted maximum pressure for each at-risk offset well, and
- how the operator will ensure well control at each at-risk offset well.

The operator must maintain a copy of its at-risk offset well control plan at the subject well site and each at-risk offset well for the duration of the hydraulic fracturing operation.

6.3.2.4 Hydraulically Fractured Well / At-risk Offset Well Owner Engagement

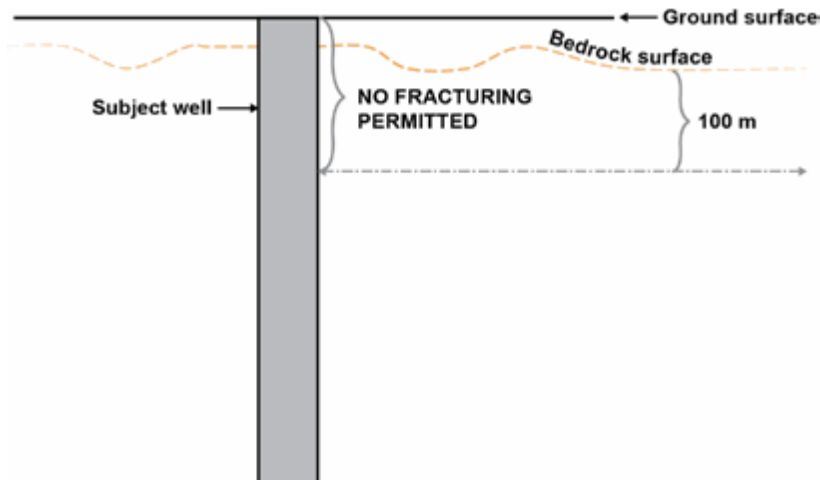
The Director will require:

- the operator to notify owners of at-risk offset wells of its planned hydraulic fracturing program,
- upon notification of a planned hydraulic fracturing program, operators of at-risk wells to engage and work cooperatively with operators of subject wells in the development of well control plans,
- the subject well operator to engage owners of at-risk offset wells and make all reasonable efforts to develop mutually acceptable plans for monitoring or hydraulic fracturing operations and maintaining well control,
- operators of both offset and subject wells to be responsible for maintaining control of their wells at all times, and
- the operator, upon becoming aware of any communication event with an offset well, to immediately notify the owner of the offset well.

6.3.2.5 Shallow Hydraulic Fracturing Restrictions

To prevent fracture propagation during hydraulic fracturing operations that may result in a release of fluids to the surface, placing the public and the environment at risk, the Director will not permit hydraulic fracturing within 100 vertical m of the top of the bedrock surface (see figure 4), where bedrock is defined as the consolidated rock underlying unconsolidated glacial or drift material.

Figure 4: Hydraulic fracturing near top of bedrock



Source: AER Directive 83

6.3.3 Groundwater Protection

Communication between a hydraulically fractured well and groundwater as a result of hydraulic fracturing operations must be prevented by conducting the following assessments and operating in accordance with these Guidelines.

6.3.3.1 Geologic Containment Assessment

Prior to initiating the first hydraulic fracturing program in a geologic basin, geologic formation or geographic region as identified by NL, the Director will require the operator to prepare an assessment of the ability of the intervening zone (between the oil or gas-bearing strata and the base of a non-saline groundwater aquifer) to act as a confining layer to contain the hydraulic fracturing treatment and prevent the vertical migration of fracturing fluid, formation water, hydrocarbons or other potential contaminants, to strata that contain non-saline groundwater.

This geological containment assessment must:

- consider all relevant information available to the operator including hydraulic gradient, seepage velocity, required travel time, pore storage volume, and geochemistry (solubility, adsorption, etc.),
- analyze the mobility of fracturing fluid in the strata between the perforated well casing and strata containing non-saline groundwater,
- analyze the location and extent of geological faults (horizontal and vertical) and natural fracture zones, and
- extend to a distance that is twice the planned fracture half-length over the entire wellbore.

The operator must consider the results of the geological containment assessment in designing the hydraulic fracturing program to ensure that fracturing fluids, formation water or hydrocarbons will not migrate vertically within a geological formation and thereby come into contact with any strata containing non-saline groundwater.

The operator must provide the results of the geological containment assessment, signed by a qualified professional, to the Director prior to the commencement of the hydraulic fracturing program.

6.3.3.2 Groundwater Risk Assessment

The Director will require an operator proposing to conduct hydraulic fracturing operations to include the following in his geologic containment assessment:

- an evaluation of the potential for direct fracture communication from the subject well to groundwater,
- the true vertical depth (TVD) of the top and base of any groundwater above the BGWP,
- the TVD of the fracture interval(s) within the wellbore,
- the minimum distance between vertical fracture propagation and the adjacent groundwater along the entire fracture interval,
- documentation of the procedure used to determine whether fracture fluid components may cause an adverse effect on groundwater,
- any geological feature or other pathways that may allow or facilitate communication to groundwater, and
- mitigation measures to minimize the risk of adverse effects on groundwater.

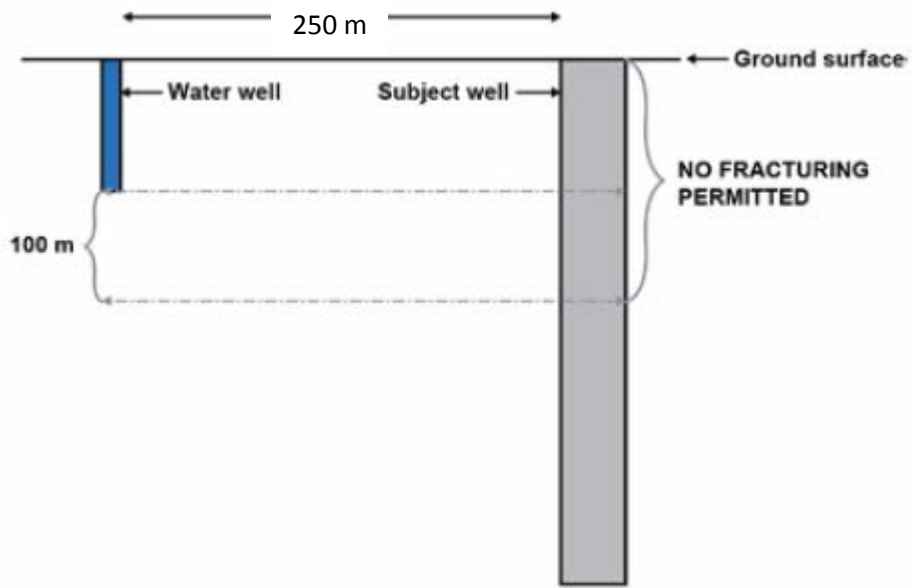
The Director will not approve hydraulic fracturing operations within 100 m of the BGWP or where the FPZ may extend within 100 m of the BGWP.

6.3.4 Hydraulic Fracturing Near Water Wells

Hydraulic fracturing operations must not have an adverse effect on the water well's water quality or quantity.

The Director will not approve hydraulic fracturing operations within a zone that extends 250 m horizontally from the surface location of a water well (see section 2.3.1.2 – Set Backs) and 100 m vertically from the total depth of the water well (see figure 5).

Figure 5: Hydraulic Fracturing Near Water Wells



Source: AER Directive 83, as modified.

7. Chemical Use and Disclosure

7.1 Goal

The goal respecting chemical use and disclosure is to provide public assurance of the safety of hydraulic fracturing operations. These Guidelines will:

- require public disclosure of fracturing fluid additives used in hydraulic fracturing operations, as approved for use by the Director,
- describe minimum requirements for the timing, data inclusion and public disclosure of fracturing fluid additives used during the hydraulic fracturing of wells in NL, and
- encourage use of more green chemicals in hydraulic fracturing fluids and reduced use of fracturing fluid additives.

The goal of CAPP's *Fracturing Fluid Additive Disclosure Operating Practice*²⁹ is "To reassure Canadians about the safe application of hydraulic fracturing technology, this practice outlines the requirements for companies to disclose fluid additives and the chemical ingredients in those additives that are identified on the Material Safety Data Sheet (MSDS)".

Ingredients which must be listed on the MSDS are identified by federal law. The well-by-well disclosure of fracturing fluid additives must include:

- The trade name of each additive and its general purpose in the fracturing process,
- The name and the Chemical Abstracts Service number of each chemical ingredient listed on the MSDS for each additive, and
- The concentration of each reportable chemical ingredient.

7.2 NL Legislation

Drilling Regulations

Section 29 of the *Drilling Regulations* requires an application for an authority to drill a well to include "other information that the director may require". For wells where hydraulic fracturing operations are intended, this provision allows the Director to require information on intended hydraulic fracturing fluid additives. Requiring inclusion of this information in the application makes the use of these fracturing fluid additives subject to the approval of the Director.

Section 32 authorizes the Director to approve an application for an authority to drill a well. The drilling of the well must be in accordance with the detailed information that is required in the application (sections 29 and 30) submitted by the operator unless otherwise authorized by the Director. This latter proviso allows the Director to add additional terms and conditions to his authority to drill a well, and these conditions could include a requirement to publicly release information on fracturing fluids additives and chemical ingredients.

²⁹ <http://www.capp.ca/getdoc.aspx?DocId=218130&DT=NTV>.

Section 151 requires a final well report, including “*a summary of the completion operations*” and the approval to drill the well could include a condition requiring the inclusion of information on fracturing fluids additives and chemical ingredients in that report, and requiring the operator to post that information publicly on www.fracfocus.ca.

Petroleum Regulations

Subsection 33(1) requires an application for a development plan to include, among other things:

- (d) a detailed description of the proposed method for petroleum recovery and the estimated recovery factor;*
- (f) an environmental impact statement, where required under the Environmental Assessment Act;*
- (g) a description of the proposed mitigative measures designed to reduce the impact of the proposed development on the environment; and*
- (j) other information the minister may require.*

The information required in the application would address hydraulic fracturing, if it is to occur, including fracturing fluids.

Subsection 35(1) authorizes the Minister to:

- (a) approve the development plan subject to the terms or conditions that the minister considers appropriate; or*
- (b) reject the development plan.*

Subsection 35(2) requires the decision by the Minister under Subsection 35(1) to take into account, among other things, whether:

- (a) the proposed technology for petroleum production allows for safe production in the lease area, or proposed lease area or whether more appropriate production alternatives exist; and*
- (b) sufficient environmental, social and economic impact studies have been undertaken by the proponent to provide the basis for the establishment of guidelines for production.*

Because the Minister must consider safety and environmental impacts in approving a development plan, and is authorized to make his approval subject to terms and conditions, he clearly has authority to require hydraulic fracturing operators to report the composition of fracturing fluids on a site such as www.fracfocus.ca.

Environmental Protection Act

Section 67 of the *Environmental Protection Act* authorizes the Lieutenant Governor in Council to release an undertaking for which an environmental impact statement has been completed subject to any terms and conditions that it may specify. The disclosure of information on fracturing fluids additives and chemical ingredients could be specified as a condition of the release.

7.3 Guidance

7.3.1 Disclosure

These disclosure guidelines apply to each oil or gas well where hydraulic fracturing takes place.

7.3.1.1 Pre-Hydraulic Fracturing Disclosure

At the time hydraulic fracturing is proposed, the proponent must provide as much information as available at the time in the environmental impact assessment conducted under the *Environmental Protection Act*.

At least 30 days prior to commencing a hydraulic fracturing program, the operator must provide the Director and the Minister of Environment and Conservation with a list of fracturing fluids additives and chemical ingredients to be used in the operation, including the following information:

- the type of base fluid and the total volume of hydraulic fracture fluid to be employed during the hydraulic fracturing program;
- all additives including but not limited to biocide, breaker, brine, corrosion inhibitor, cross-linker, demulsifier, friction reducer, gel, iron control, oxygen scavenger, pH adjusting agent, proppant, scale inhibitor, surfactant, etc.;
- the trade name, supplier, chemical ingredient name, Chemical Abstracts Service (CAS) registry number, Materials Safety Data Sheets (MSDS) and purpose of each ingredient
- the maximum concentration of each chemical within each additive and of each additive within the fracture fluid (expressed as a percent);
- a statement indicating whether
 - an MSDS is not available for any chemical ingredients to be used,
 - an exemption from disclosure of a chemical name and/or concentration has been received in accordance with the Canadian *Hazardous Materials Information Review Act*, Section 11, or
 - an exception from public disclosure of a chemical name and/or concentration is claimed pursuant to the *Access to Information and Protection of Privacy Act*.

The operator must provide the results of a Risk Assessment to the Director that assesses the potential health and environmental risks of each additive to be used, and outlines the operational controls and measures to be used to manage the identified risks. Operators who are members of CAPP or SEPAC can use the risk assessment tool developed for CAPP to classify fracturing fluid additives according to health potential and environmental risks.

7.3.1.2 Post-Hydraulic Fracturing Disclosure

Within 30 days of completing a hydraulic fracturing program, the Director will require the operator to:

- provide a post-hydraulic fracturing report that includes the information listed below respecting the fracturing fluid additives, and

- make the report available on the publicly accessible internet website at www.fracfocus.ca³⁰, and also make this information available to the public by hard copy on request.

The operator will provide the following information on an adapted version of BC's OGC disclosure form (obtained from CAPP in the following link <http://www.capp.ca/getdoc.aspx?DocId=202438&DT=NTV>):

- a brief description of the intended function of each additive used in the fracturing fluid,
- the type and volume of base fluid(s) used in the hydraulic fracturing treatment, expressed in cubic metres,
- the trade name of each additive and its general purpose in the fracturing process,
- the name of each chemical ingredient listed on the Material Safety Data Sheet (MSDS) for each additive, and the Chemical Abstracts Service registry number (CAS number) for each chemical ingredient,
- where the specific identity of a chemical ingredient is considered a trade secret, a more general identification may be used consistent with the MSDS,
- disclosure of any compound incidental to the chemical manufacturing process is not required unless the compound is listed on the MSDS for the additive,
- the concentration of each chemical ingredient within the additive, expressed as a % of the total mass of the additive, and
- the concentration of each chemical ingredient, expressed as a % of the total mass of the fracturing fluid including base fluid and additives.

7.3.2 Use of "Green" Fracturing Chemicals

The Director will encourage the operator to use chemicals formulated with non-toxic substances or designed to break down into non-toxic substances in the environment after they have performed their intended task. Green chemicals can reduce hazards associated with surface spills and in the subsurface and the Director will encourage their use whenever possible.

7.3.3 Reduction of Chemical Usage

In order to reduce the overall risk of chemical usage, the Director will encourage the operator to review the effectiveness and necessity of each chemical additive to determine whether and how much to use.

³⁰ This website (www.fracfocus.ca) was launched by the government of British Columbia in January of 2012. Alberta and BC are members of this website and both now require all fracturing fluid chemicals used in their respective provinces be disclosed publicly on the website.

8. Air Quality Management

8.1 Goal

To limit emissions, minimize greenhouse gas (GHG) emissions and conserve petroleum during the completion and testing of hydraulically fractured wells, these Guidelines will require the operator to:

- set emission limits,
- create inventories of emission sources,
- model and monitor emissions, and
- reduce emissions using “green” completion techniques.

*AER Draft Directive 60: Upstream Petroleum Industry Flaring, Incinerating, and Venting*³¹ provides requirements for flaring, incinerating, and venting activities conducted in Alberta at all upstream petroleum industry wells and facilities. These requirements were developed to eliminate or reduce the potential impacts associated with these activities and to ensure that public safety concerns and environmental impacts were addressed prior to commencing flaring, incinerating, and venting activities.

Directive 60 requires operators to address and evaluate the following three questions, in this sequence:

- Can flaring, incinerating, and venting be eliminated?
- If it cannot be eliminated, can flaring, incinerating, and venting be reduced?
- If it cannot be reduced, will flaring, incinerating, and venting meet performance standards?

The Director will require operators planning to conduct hydraulic fracturing operations in NL to address these questions and adopt acceptable goals and standards respecting flaring, incinerating and venting arising from hydraulic fracturing operations in NL. If the flaring and venting arises from hydraulic fracturing for crude oil production, NL is signature to the World Bank Standard for Global Gas Flaring and Venting Reduction. This is a voluntary standard that provides guidance on reducing flaring and venting of gas associated with crude oil production and, ultimately, in minimizing the continuous and non-continuous production flaring and venting of associated gas.

8.2 NL Legislation

Drilling Regulations

Section 32 of the *Drilling Regulations* authorizes the Director to approve an application for an authority to drill a well. The well must be drilled in accordance with the detailed description required in the application (sections 29 and 30) as submitted by the operator unless otherwise authorized by the Director. This latter proviso allows the Director to add additional terms and conditions to his approval to drill well, and these conditions could include requirements regarding release of emissions to the atmosphere from hydraulic fracturing operations.

Petroleum Regulations

Subsection 33(1) requires an application for a development plan to include, among other things:

³¹ <http://www.aer.ca/documents/directives/DraftDirective060.pdf>.

- (f) an environmental impact statement, where required under the Environmental Assessment Act;*
- (g) a description of the proposed mitigative measures designed to reduce the impact of the proposed development on the environment; and*
- (j) other information the minister may require.*

The information required in the application would address hydraulic fracturing, if it is to occur.

Subsection 35(1) authorizes the Minister to:

- (a) approve the development plan subject to the terms or conditions that the minister considers appropriate; or*
- (b) reject the development plan.*

Subsection 35(2) requires the decision by the Minister under Subsection 35(1) to take into account, among other things, whether:

- (a) the proposed technology for petroleum production allows for safe production in the lease area, or proposed lease area or whether more appropriate production alternatives exist; and*
- (b) sufficient environmental, social and economic impact studies have been undertaken by the proponent to provide the basis for the establishment of guidelines for production.*

Because the Minister must consider safety and environmental impacts in approving a development plan, and is authorized to make his approval subject to terms and conditions, he clearly has authority to ensure hydraulic fracturing operations are conducted in manner that protects air quality.

Air Pollution Control Regulations

All hydraulic fracturing operators must comply with the *Air Pollution Control Regulations*. Section 4 of these Regulations prohibits air contaminants from hydraulic fracturing operations from exceeding the ambient air quality standards prescribed in Schedule A of the Regulations.

8.3 Guidance

As with other industrial sources of air emissions, emissions from oil and gas activities will be assessed using a range of tools including:

- inventories of emission sources (locations and estimated emission rates),
- air quality monitoring at emission sources to measure emission rates,
- emission dispersion modeling to predict off-site concentrations of emissions, and
- ambient air quality monitoring off-site to verify predicted concentrations including concentrations from multiple sources.

8.3.1 Emission Inventory

The Director will require operators planning to conduct hydraulic fracturing operations in NL to submit an emissions inventory that describes predicted emission rates for all emission sources, including flares and incinerators, vents, storage tanks, and transportation (trucking, etc.).

Emission categories such as those used by the US EPA may be used for this purpose. The emissions of principal interest are:

- criteria air contaminants³²,
- toxic air pollutants³³,
- CO₂, and
- H₂S.

The inventory should also describe the general locations of stationary emission sources (eg, stack locations and heights).

8.3.2 Emission Dispersion Modeling

Using information contained in the emission inventory, the Director will require operators to conduct screening level emission dispersion modeling using basic models such as those available from the US EPA Support Center for Regulatory Atmospheric Modeling website³⁴ and to submit modeling results to the Director.

If warranted by the results of the emission monitoring and dispersion modeling, operators of more complex and extensive emission sources such as multiple wells and associated infrastructure will be required to apply more sophisticated air quality dispersion modeling capable of addressing the full complexity and extent of the emission sources.

8.3.3 Air Quality Monitoring At Source

Operators may be required to provide baseline air quality studies and to conduct periodic, site-specific air quality monitoring at their facilities as determined by the Director in consultation with the Department of Environment and Conservation. The decision to require this will be based on the Director's review of the air emissions inventory and emission dispersion modeling results. Complaints related to air quality may also lead to a requirement for site-specific monitoring.

8.3.4 Ambient Air Quality Monitoring

If predicted emission concentrations in sensitive locations (such as residential areas) or maximum ground level concentrations exceed NL's Ambient Air Quality Standards³⁵, ambient monitoring may be required in order to determine actual emission concentrations and to aid in the preparation of an emission reduction plan. Ambient air quality monitoring may also be required when necessary to determine the cumulative effects of air emissions.

³²Criteria air contaminants refer to a group of pollutants defined by Environment Canada that include: sulphur oxides (SO_x); nitrogen oxides (NO_x); particulate matter (TPM, PM₁₀ and PM_{2.5}); volatile organic compounds (VOC); carbon monoxide (CO); and ammonia (NH₃).

³³Toxic air pollutants are defined in Schedule 1 of the Canadian *Environmental Protection Act* (1999), <http://laws-lois.justice.gc.ca/eng/acts/c-15.31/page-124.html#h-115>.

³⁴<http://www.epa.gov/scram001/>.

³⁵<http://www.assembly.nl.ca/Legislation/sr/Regulations/rc040039.htm#SchedA>.

Ambient air quality monitoring stations will generally not be required at each individual well pad location. Instead they would be located where clusters of oil and gas activities occur. The scope of an ambient air quality monitoring program will depend on potential cumulative air quality impacts including the intensities and types of existing and proposed activities in a given area (eg, trucking, the presence of other oil or natural gas operators, and the presence of other industrial activities).

The monitoring program may be required to include any of the following components:

- baseline air quality studies,
- compiling emissions showing total pollutants in an area,
- ground level impact modeling to show the potential impact on ambient air quality including potential levels of smog-forming chemicals such as ozone,
- installing real-time multi-parameter ambient monitoring stations,
- collecting grab samples,
- odour monitoring, and
- upset or occurrence monitoring when odours or other unusual events occur.

8.3.5 Fugitive Emissions Management and Green House Gas Reduction Plan

8.3.5.1 Venting Prohibition

In approving well completion programs and production plans, the Director will follow the principle that venting of gas is not an acceptable alternative to conservation or flaring of that gas. The operator must burn non-conserved volumes of gas if volumes and flow rates are sufficient to support stable combustion and must provide justification for volumes not combusted. Vented volumes include tank venting and surface casing vents but do not include venting from pneumatic instruments.

The Director may allow temporary, short-term venting at wells with the following conditions:

- gas is sweet,
- gas does not contain any free hydrocarbon liquid; if free hydrocarbon liquids are present in the produced gas, a flare (or other gas combustion device) and liquid separation must be used,
- total gas volume does not exceed $2 \times 10^3 \text{ m}^3$, and the duration does not exceed 24 hours,
- venting is not within 500 m of a residence, unless the residents consent, and
- vented gas does not constitute an unacceptable fire or explosion hazard;

Inert gases such as nitrogen and carbon dioxide released from upstream operations or produced from wells may not have sufficient heating value to support combustion. These gases may be vented to the atmosphere provided that non-combustible gas mixtures containing odorous compounds including H_2S are not be vented if off-lease odours may result. Alternatives to venting must be used, such as flaring or incinerating with sufficient fuel gas to ensure destruction of odorous compounds.

8.3.5.2 Fugitive Emissions

Operators must prepare, adopt and follow a fugitive emissions management and greenhouse gas emission reduction plan for the construction, completion and operation of well drilling, well completion and the production gathering and initial processing of oil and gas.

The Director will require each operator to develop and implement a program to detect and repair leaks that meets or exceeds the Canadian Association of Petroleum Producers' *Best Management Practice for Fugitive Emissions Management*³⁶.

8.3.5.3 Greenhouse Gases – Reporting Emissions

The Director will require operators of oil and gas wells to report their annual greenhouse gas emissions emitted during hydraulic fracturing in a manner determined by the Director.

³⁶ <http://www.capp.ca/library/publications/policyRegulatory/pages/pubInfo.aspx?DocId=116116>.

9. Fluid Handling, Storage, Transportation and Disposal

9.1 Goal

The goal respecting handling, storage transportation and disposal of fluids is to ensure that all operators conducting hydraulic fracturing operations in NL adopt practices to reduce the risk of potential spills of fracturing fluids, produced water, flowback water and fracturing fluid wastes associated with the hydraulic fracturing operations. This section outlines requirements for operators to safely and environmentally responsibly transport, handle, store and dispose of all fluids associated with hydraulic fracturing.

CAPP's *Fluid Transport, Handling, Storage and Disposal*³⁷ operating practice outlines a series of "practices and procedures to identify, evaluate and mitigate potential risks related to fluid transport, handling, storage and disposal, and respond quickly and effectively to an accidental spill of fluids (including remediation of the spill site)". The operating practice addresses:

- ensuring maintenance and safety protocols are in place to address the risks associated with fluid transport by road, rail or pipeline,
- reducing fluid transport by road in large-scale projects, where possible,
- constructing and operating pipelines that transport fluids, where possible,
- removing natural gas from flowback prior to storage,
- restricting wildlife access to fluid storage sites, and
- safely disposing of fluids no longer needed at approved waste management facilities, including disposal wells.

9.2 NL Legislation

Drilling Regulations

Section 83 of the *Drilling Regulations* directs an operator to ensure:

- any oil or gas produced during formation flow tests is stored in suitable tanks or flared in a manner approved by the Director, and
- any stored waste oil or oily material, not burned at the drill site, is transported in a suitable container for disposal at an approved disposal site.

Section 84 requires an operator to ensure spent acid or excess acid is disposed of in a manner approved by the Director during all aspects of a drilling program.

9.3 Guidance

9.3.1 Waste Management Plan

The Director will require operators submit a waste management plan for review and approval prior to commencing hydraulic fracturing operations. The plan must:

³⁷ <http://www.capp.ca/getdoc.aspx?DocId=218146&DT=NTV>.

- demonstrate waste minimization through recycling and re-use,
- describe the wastes that will be generated,
- describe how those wastes will be handled and stored,
- describe the proposed method(s) and location(s) of waste treatment, re-use, or disposal, and
- demonstrate compliance with the waste management requirements established by NL and with requirements contained in any conditions attached to permits, approvals or licences issued by NL that address waste management.

9.3.2 Emergency Containment of Hydraulically Fractured Fluid

The Director will require installation of a relief valve and diversion line to contain fluids in the event of hydraulic fracturing string failure by diverting them from the casing to a covered, watertight tank. The relief valve must limit the pressure inside the casing to a maximum of 95% of the lowest internal yield pressure rating of the casing.

The Director will also require the operator to have a vacuum truck available within a maximum response time of one hour to the well site during the pumping of hydraulic fracturing fluid into the wellbore and during the initial flowback phase.

If the operator's hydraulic fracturing technology uses a fluid that is not liquid at atmospheric temperatures and pressures, the Director may require alternative emergency containment features and procedures.

9.3.3 Flowback Water and Produced Water

The Director will not permit the use of pits for the storage of flowback water or produced water. All flowback and produced water must be transported by pipe to covered, water-tight tanks equipped with secondary containment. Tanks and piping used to store and transport flowback and produced water must be constructed of heat and corrosion-resistant materials compatible with operational pressures and known or anticipated chemical and physical properties of the water.

Recycling is the preferred method of managing flowback water and produced water, unless the operator can demonstrate to the Director that recycling is not feasible.

The Director will also require flowback and produced water be:

- treated in accordance with the approved waste management plan and placed in appropriate tankage for short term storage prior to re-use, or
- transported to an appropriate waste water treatment facility for treatment and disposal or alternative uses, if the use of the receiving facility has been specifically approved by NL and subject to the terms and conditions of that approval.

9.3.4 Naturally Occurring Radioactive Materials

The Director will require wastes recovered from or produced by the first well drilled in a geologic formation or basin, or on a well pad, be tested for naturally occurring radioactive materials (NORMs) prior to their removal from the well site. The wastes to be tested include:

- flowback recovered from a well after hydraulic fracturing,
- fluids recovered during the production phase of a well (ie, produced water),
- drill cuttings, and
- used drill fluids.

The Director will also require piping and equipment that was in contact with the above wastes be tested for NORMs prior to its disposal or recycling.

A report outlining the findings of the testing must be submitted to the Director:

- stating whether NORMs were found in excess of criteria established by the Minister of Environment and Conservation,
- describing the NORM concentrations; and
- proposing how NORM affected materials will be managed.

The report must be approved by the Director before any NORM-affected materials leave the site.

Section 443(3)(d) of the *Occupational Health and Safety Regulations* requires an employer that has radioactive materials in quantities which may endanger fire-fighters at a workplace to ensure that the local fire department is notified of the nature and location of the hazardous materials or substances and methods to be used in their safe handling.

9.3.5 Use of Waste Water Treatment Plants

The Director will not permit disposal of wastes (eg, flowback or produced water) at a waste water treatment facility in NL unless he is satisfied the facility is capable of effectively treating the wastes. The waste water facility operator, in consultation with the operator and the Director, must

- characterize the nature and concentrations of contaminants in the waste fluid, and
- design and install any necessary treatment processes

to ensure the waste water treatment facility has sufficient capacity and capability to treat the contaminants found in the waste fluid, without impacting the viability of the waste water treatment system and without causing other negative impacts, including adverse impacts on the quality of the receiving water.

Downstream water quality monitoring by the owner of the waste water treatment facility will be required by NL as a condition of approving use of a wastewater treatment facility that discharges to surface water.

9.3.6 Chemical Management – Chemical Inventory

The Director will require operators to maintain an inventory of chemicals used or stored at each well site or well pad, including fuel and other products used during drilling, completion, workover operations and hydraulic fracturing. These inventories must be kept current throughout the life of a well and must be in a readily retrievable format at the operator’s local field office.

9.3.7 Access Control

The Director will require an unattended well pad to:

- remove all chemicals including chemical additives used for well stimulation and hydraulic fracturing from the site or secure them from public access, and
- lock all plugs, valves or other release mechanisms associated with storage tanks and containers, (excluding fresh water, fire prevention materials and spill response materials).

The Director will require the wellhead and all associated equipment for any well where hydraulic fracturing is to occur to be secured to prevent any tampering with wellhead equipment and supplies.

9.3.8 Storage Tanks, Vessels and Containers

9.3.8.1 Primary Containment Tanks, Containers and Vessels

The Director will require use of tanks, containers and vessels designed in accordance with Underwriters Laboratories (UL), American Petroleum Institute (API) or other standards as applicable. Tanks and piping used to store and transport flowback or produced water must be constructed of heat and corrosion-resistant materials compatible with known or anticipated chemical and physical properties of the water and operational pressures. The Director will require, as a condition of an authority to drill a well granted to an operator, that all tanks, containers and vessels be inspected by a Professional Engineer licensed to practise in NL to verify they are fit for the intended use. A copy of the engineer's signed and stamped tankage inspection and installation report must be provided to the Director and a copy kept at the facility location.

Where practicable, closed top tanks containing odorous or volatile compounds should vented to an appropriate filter, scrubber system, etc., rather than to the atmosphere. Unless otherwise approved by the Director, open topped metal tanks must:

- be used only for clean water or non-odorous water-based waste materials,
- be of durable design and material,
- maintain at least one metre of freeboard at all times,
- have primary containment provided by an impermeable 60 millimetre HDPE synthetic liner (ie, corrugated steel ring with a synthetic liner), with the design and installation certified by a Professional Engineer licensed to practise in NL.

9.3.8.2 Secondary Containment

The Director will require all storage tanks, vessels or containers at a well site or well pad (including tanks, vessels or containers for liquids and liquid wastes used, stored or produced during drilling, completion, operation, servicing, or plugging of a well, and including liquid mixing, storage and staging areas) be equipped with secondary containment to ensure that liquids will not migrate off the site or pad in the event of a spill or leak and will be captured at source for clean-up or treatment.

The secondary containment for tanks must be able to contain 110% of the capacity of the largest single tank or of all the connected tanks (whichever is greater) within the containment area. The secondary containment must be constructed:

- using a suitable surface layer of soil or gravel,

- underlain by a protection layer of sand or an appropriate geotextile,
- underlain by:
 - a composite liner of a minimum sixty (60) millimetre impervious HDPE synthetic liner, or
 - a three hundred (300) millimetre of low permeability soil with a maximum hydraulic conductivity in the field of 1×10^{-7} centimetre per second, or
 - an equivalent liner system approved by the Director.

Secondary containment is not required for:

- tanks, vessels or containers used to store freshwater,
- water-tight containers, or
- tanks that contain only drill cuttings with no free flowing liquids.

The Director may identify additional secondary containment requirements for hydraulic fracturing if the risk at the proposed location or type of operation of liquid chemical releases is not satisfactorily addressed by the above standard requirements.

9.3.8.3 Underground Storage Tanks

The Director will not permit use of underground storage tanks at well sites or well pads.

Appendix 1: Acronyms and Definitions

Acronyms

AER – Alberta Energy Regulator

ALARP – as low as reasonably practicable

API – American Petroleum Institute

CAPP -- Canadian Association of Petroleum Producers

CAS – Chemical Abstracts Service

C-NLOPB – Canada-Newfoundland & Labrador Offshore Petroleum Board

COGOA – *Canada Oil and Gas Operations Act*

BC OGC – British Columbia Oil and Gas Commission

BGWP – base of groundwater protection

Department – Newfoundland & Labrador Department of Natural Resources

Director – the officer responsible for the administration of the *Drilling Regulations*, as designated by the Minister, and normally the Assistant Deputy Minister, Petroleum Development, NL Department of Natural Resources

EA – an environmental assessment, specifically for an authorization under COGOA

EPA – US Environmental Protection Agency

Enform – The safety association for the upstream oil and gas industry in British Columbia, Alberta and Saskatchewan

ERP – emergency response plan

FPZ – fracture planning zone

GHG – greenhouse gases

HDPE – high density polyethylene

IRP – industry recommended practice

mg/L – milligrams per litre

MSDS – Material Safety Data Sheet

NEB – National Energy Board

NL – Newfoundland & Labrador

NORM – naturally occurring radioactive materials

OA – operations authorization, under COGOA

TDS – total dissolved solids

TVD – total vertical depth

UL – Underwriters' Laboratory

Definitions³⁸

Additive: Any substance or combination of substances comprised of chemical ingredients found in a hydraulic fracturing fluid, including a propping agent, which is added to a base fluid in the context of a hydraulic fracturing treatment. Each additive performs a certain function and is selected depending on the properties required.

Annulus: The space between the wellbore and casing, or between casing and tubing, where fluid can flow.

Anomalous seismicity: Seismicity that would not normally occur when performing hydraulic fracture completions (such as seismicity from fault movement).

At-risk offset well: An offset well that may be adversely affected by a hydraulic fracturing operation.

Barrier: Individual components that collectively make up a barrier system.

Base of groundwater protection (BGWP): A modelled depth at which saline groundwater is likely to occur. It is calculated as the base of the deepest protected (non-saline groundwater-bearing) formation plus a 15 m buffer.

Bedrock: Consolidated rock underlying unconsolidated glacial or drift material.

Base fluid: The base fluid type, such as water or nitrogen foam, used in a particular hydraulic fracturing treatment. Water includes fresh water, brackish or saline water, recycled water or produced water.

Casing string: An assembled length of steel pipe configured to suit a specific wellbore. The sections of pipe are connected and lowered into a wellbore, then cemented in place.

Cement evaluation log: A representation of the integrity of the cement job, especially whether the cement is adhering solidly to the outside of the casing.

Cement job: The application of a liquid slurry of cement and water to various points inside or outside the casing.

Chemical Abstracts Service (CAS): The chemical registry that is the authoritative collection of disclosed chemical substance information.

Chemical Abstracts Service registry number (CAS number): The unique identification number assigned by the Chemical Abstracts Service to a chemical constituent.

³⁸ Based on CAPP's Hydraulic Fracturing Recommended Operating Practices – Definitions Sections.

Chemical ingredient: A discrete chemical constituent with its own specific name or identity, such as a CAS number, that is contained in an additive.

Domestic water well: An opening in the ground, whether drilled or altered from its natural state, for the production of groundwater used for drinking, cooking, washing, yard or livestock use.

Dual-barrier system: A well system designed for hydraulic fracturing operations made up of both primary and secondary barrier systems.

Energizing gas: A gas used to improve the effectiveness of the hydraulic fracture.

Flowback: The flow of fracturing fluid back to the wellbore after treatment is completed.

Fracturing fluid: The fluid used to perform a particular hydraulic fracturing treatment and includes the applicable base fluid and all additives.

Fracture Fluid System: The fluid delivered down-hole that consists of one or more additives plus the base fluid and proppant.

Fracturing fluid waste: An unwanted substance or mixture of substances that results from the hydraulic fracturing operation, not including flowback.

Fracture planning zone (FPZ): An area that may be impacted by hydraulic fracturing operations.

High vapour pressure hydrocarbon: Any hydrocarbon and stabilized hydrocarbon mixture with a Reid vapour pressure greater than 14 kilopascals.

Free natural gas: Free gas is defined as gas that readily comes out of solution at atmospheric pressure and ambient temperature.

Fresh (non-saline) groundwater: Groundwater that has a total dissolved solids (TDS) content less than or equal to 4,000 mg/L or as defined by the jurisdiction.

Hydraulic Fracturing: A controlled operation that pumps a fracturing fluid and a propping agent through the wellbore to the target geological formation at high pressure in multiple intervals or stages, in order to create fractures in the formation and facilitate production of hydrocarbons.

Hydraulic Fracturing Program: A program comprised of one or more fracturing stages within the same wellbore.

Gas migration: A flow of gas that is detectable at surface outside of the outermost casing string. It refers to all possible routes for annular gas entry and propagation through and around the cement sheath.

Induced seismicity: Seismic events that can be attributed to human activity. Seismicity can be induced by geothermal energy extraction, mining, dam building and hydraulic fracturing.

Ingredient: The individual chemical constituents of an additive.

Material Safety Data Sheet (MSDS): A document, as required by the *Controlled Products Regulations* under the federal *Hazardous Products Act*, that contains information on the potential hazards (health, fire, reactivity and environmental) of an additive and its components.

Non-saline aquifer: An aquifer above the BGWP that contains water with a total dissolved solids content of less than or equal to 4000 milligrams per litre.

Primary barrier system: A well system designed to contain and isolate fracture fluids within the well.

Produced water: Water naturally present in the reservoir or injected into the reservoir to enhance production, produced as a co-product when gas or oil is produced.

Propping agent (Proppant): Typically non-compressible material, most commonly sand, added to the fracturing fluid and pumped into the open fractures to keep them propped them open once the fracturing pressures are removed.

Offset well: Any well that is within the FPZ of a subject well, excluding water wells.

Operator: An Operator as defined in the *Drilling Regulations*, meaning an individual or company that seeks or has been granted approval to conduct a drilling program.

Recycle: The process of treating flowback or produced water to allow it to be reused either for hydraulic fracturing or for another purpose.

Reuse: The process of using water multiple times for similar purposes.

Risk: the probability that a hazard may occur.

Risk Assessment: An assessment that:

- considers the physical, chemical and toxicological properties of the ingredients of a fracture fluid system;
- categorizes the additives (based on their ingredients) in terms of their potential health and environmental impacts;
- identifies those additives for which special controls or practices are required in order to reduce risk to human health and the environment; and
- identifies the measures proposed above.

Saline groundwater: Groundwater that has a total dissolved solids (TDS) content more than 4,000 mg/L [or as defined by the jurisdiction].

Secondary barrier system: The backup well system that provides well control in the event of a failure of the primary barrier system.

Seismicity: The frequency and magnitude of earthquake activity in a given area.

Single-barrier system: A well system designed for hydraulic fracturing operations comprised of a primary barrier system only.

Shale gas, tight gas and tight oil: For the purposes of these Guidelines, shale gas, tight gas and tight oil refers to unconventional resources from low permeability reservoirs being developed using horizontal wells with multi-stage hydraulic fracturing.

Surface casing vent flow: The flow of gas and/or liquid or any combination out of the surface casing/casing annulus.

Surface water: Water collecting on the ground or in a stream, river, lake, sea or ocean, as opposed to groundwater.

Trade name: The name under which an additive is sold or marketed.

Trade secret: Any confidential formula, pattern, process, device, information, or compilation of information entitled to protection as a trade secret under the applicable law which is used in a business and which gives the business an opportunity to obtain an advantage over competitors that do not know or use it.

Wastewater: Spent or used water with dissolved or suspended solids, discharged from homes, commercial establishments, farms and industries.

Water deliverability test: A field test to estimate the flow capacity of the water well under existing conditions (eg, using the well owner's pump). Water is withdrawn from the well for a fixed duration (usually 1 hour) before the pump is turned off and the water level is allowed to recover.

Water well: A well with the primary purpose of non-saline groundwater production.

Well control event: A flow of wellbore fluids in the subsurface from one formation to another formation, a flow of wellbore fluids at surface that can be controlled by existing wellhead or blowout prevention equipment, or a blowout.

Well integrity Prevention of the escape of fluids (ie, liquids or gases) to subsurface formations or surface.

Wellbore: For the purposes of this practice, a wellbore is defined as the open hole that is drilled prior to the installation of casing and cement.

Appendix 2: Legislative Authority

Oil and gas activities cannot proceed without approvals under the P&NGA and its regulations. The granting of these approvals is based on the content of the detailed description of the activity as provided in the application for approval, and may also be based on the authority to prescribe terms and conditions necessary to ensure the protection of the public interest. The requirements outlined in these Guidelines for the most part will be implemented as requirements in the applications for or as terms and conditions to:

- approval of a development plan under the *Petroleum Regulations*, a drilling program or an authority to drill a well under the *Drilling Regulations* or any other approval granted under the P&NGA³⁹,
- a release of an undertaking granted under Part X of the *Environmental Protection Act*, or
- a licence for water use or water rights granted under the *Water Resources Act*.

Subsection 73(1) of the *Petroleum Regulations* authorizes the Minister to “*issue guidelines in respect of these regulations*”, and Subsection 35(1) of the *Drilling Regulations* authorizes the Director to “*issue and publish, in the manner the director considers appropriate, guidelines and interpretation notes with respect to the application and administration of the regulations*”. These Guidelines are not subordinate legislation, and the relevant NL legislation will always prevail over the Guidelines. The Guidelines are intended to assist operators in complying with the regulations by providing greater clarity on:

- the expectations of the Minister and the Director in terms of the detailed content of applications for petroleum activities, and
- the manner in which the regulations will be administered and applied.

Neither the regulations nor these Guidelines exhaustively list the requirements to be met in conducting hydraulic fracturing operations in onshore NL. Operators undertaking hydraulic fracturing operations in NL are responsible for meeting all applicable requirements under all relevant legislation and for identifying and addressing all potential safety, environmental and resource conservation risks of conducting hydraulic fracturing operations.

These Guidelines may contain specific “*methods, measures or standards*” that operators may be required to meet. However, the operator may propose alternative methods, measures and standards, and the Minister or Director may approve these alternatives if they are consistent with the regulations and he is satisfied they will achieve equivalent or greater results in terms of safety, environmental protection and resource conservation.

Some areas of the regulations where guidance respecting hydraulic fracturing may be particularly useful and appropriate are outlined below.

³⁹ For an onshore to offshore well, this could also be implemented as a term or condition under an authorization granted by the C-NLOPB under the *Canada-Newfoundland and Labrador Atlantic Accord Implementation Newfoundland and Labrador Act*.

Petroleum Regulations

The *Petroleum Regulations* (PR) deal principally with the granting of exploration licences, exploration permits and leases. An exploration permit allows a well to be drilled and tested and allows all or a portion of the permit area to be converted to a lease where a development plan has been approved by the Minister (Section 24).

A lease provides the right to develop a petroleum pool in the lease area in accordance with an approved development plan, to produce petroleum from the lease area and to use and market petroleum from the lease area. Because hydraulic fracturing is conducted as part of completing a well, or preparing that well for production, that well must have an approved development plan, as production in onshore NL can only occur from a lease with an approved development plan. The information that must be submitted to the Minister with an application for a development plan is listed in Subsection 33(1), and must include, among other things:

- (d) a detailed description of the proposed method for petroleum recovery and the estimated recovery factor;*
- (f) an environmental impact statement, where required under the Environmental Assessment Act;*
- (g) a description of the proposed mitigative measures designed to reduce the impact of the proposed development on the environment; and*
- (j) other information the minister may require.*

The required information listed above would have to address hydraulic fracturing, if it is to occur. These Guidelines will address some key elements of the information the Minister may require regarding proposed hydraulic fracturing operations. The generic and open-ended nature of paragraph (j) gives the Minister broad scope to require submission of further detailed information respecting proposed hydraulic fracturing operations. The requirement for an environmental impact statement entails communication and cooperation with the Minister and Ministry of Environment and Conservation, which is especially important in the conduct of hydraulic fracturing operations.

Following receipt of a development plan application, Section 34 requires the Minister to publish, within 30 days, that the application has been received, and Subsection 35(1) requires the Minister, within 120 days of that publication, to:

- (a) approve the development plan subject to the terms or conditions that the minister considers appropriate; or*
- (b) reject the development plan.*

Subsection 35(2) requires the decision by the Minister under Subsection 35(1) to take into account, among other things, whether:

- (a) the proposed technology for petroleum production allows for safe production in the lease area, or proposed lease area or whether more appropriate production alternatives exist;*

- (b) sufficient environmental, social and economic impact studies have been undertaken by the proponent to provide the basis for the establishment of guidelines for production; and*
- (c) the proponent's proposed development plan would result in sufficient employment and industrial benefits to the province and make sufficient use of goods and services competitively produced or provided from within the province.*

Because hydraulic fracturing may have implications in any of the above areas, the Minister is clearly required to understand the nature of the proposed activities and plans, so he can properly assess the safety, environmental, social and economic aspects of the proposed development. These Guidelines are intended to ensure the Minister has adequate information respecting any proposed development that includes hydraulic fracturing so he can approve or reject that proposed development plan. The Minister is clearly authorized to attach terms and conditions to any approval given, and these terms and conditions can relate to the manner in which hydraulic fracturing operations are conducted.

Drilling Regulations

The *Drilling Regulations* (DR) deal principally with the drilling of wells, which is integral to almost all oil and gas exploration and production activities. The DR require an operator drilling an onshore well to obtain a drilling program approval in accordance with Section 12 and an authority to drill a well approved by the Director in accordance with Section 32. Section 6 authorizes the Director to make modifications to approvals, if there are problems that arise with respect to any equipment, procedure, course or program that are being used in an approved program. The Director may require an operator to modify or acquire the equipment, procedure, course or program to meet the standards specified by the Director. These Guidelines will assist in avoiding modifications of this nature, which can be costly and create uncertainty.

Drilling Program Approval

An application for a drilling program must be in the form prescribed the Director (Section 7) and must contain the following (Section 8):

- (a) the purpose, area, timing, nature and logistics of the program;*
- (b) a description and the specifications of a drilling rig to be used in the program;*
- (c) particulars of special conditions or circumstances that may affect the safety of the drilling operations;*
- (d) on request of the director, the particulars and specifications in respect of the make, model, type and rated capacity of drilling equipment, including the derrick or mast and the draw works, blocks, hook and swivel;*
- (e) a description of the natural environment in the area of the program including environmental conditions that may affect the operations of the drilling program;*

- (f) *general dimensional arrangement drawings of the drilling rig, drill site, drilling base and administrative area used or intended to be used during drilling operations; and*
- (g) *on the request of the director, in the case of every drilling rig used or intended to be used by an applicant during the program*
 - (i) *the data and particulars on which the applicant relies to show that the drilling rig has adequate stability to safely conduct the proposed program,*
 - (ii) *a description of the relationship between the performance characteristics of each drilling rig and the prevailing environmental conditions in the area of the program, and*
 - (iii) *general arrangement drawings that show the arrangement of all drilling equipment on the rig, bulk transfer systems, drilling fluid systems, well control systems including blowout preventers, choke manifolds, testing and flowing apparatus, cranes, and firefighting appliances and communication and alarm systems.*

In addition, the operator may be required to provide the Director with “*a description of the anticipated effect that a proposed drilling program will have on the natural environment of the area described in the application for drilling program approval*” (Section 9) and “*a description of the qualifications of each person involved in the drilling program who is employed by that operator in a supervisory capacity*” (Section 10). Section 11 requires the application for approval include a contingency plan which demonstrates that “*plans have been formulated and that equipment is available to cope with a foreseeable emergency situation during a drilling program, including*

- (a) *a serious injury to or the death of a person;*
- (b) *a major fire;*
- (c) *the loss or disablement of a drilling rig;*
- (d) *the loss of well control;*
- (e) *arrangements for the drilling of a relief well should it become necessary;*
- (f) *hazards unique to the site of the drilling operations; and*
- (g) *spills of oil or other pollutants.”*

Because hydraulic fracturing occurs at the completion stage of a drilling program, much of the information required in this application may relate to the hydraulic fracturing operations, and the Guidelines will assist in ensuring the Director has sufficient and appropriate information to approve this activity.

Section 17 sets out some Operator’s Duties, which include ensuring that:

- (a) *the drilling of a well is conducted in a manner that maintains full control of the well at all times;*

- (b) plans have been made and equipment is available to deal with all abnormal situations that may reasonably be anticipated;*
- (d) the drilling of the well is conducted in accordance with the procedures and equipment authorized under these regulations or as otherwise prescribed by the minister.*

Note that paragraph (d) above allows the well to be drilled in accordance with procedures and equipment as “prescribed by the Minister”, which provides authority for the Minister to set out alternative procedures and equipment that may be applicable to hydraulic fracturing, including those as may be outlined in these Guidelines.

Authority to Drill a Well

Subsection 29(2) requires an application for authority to drill a well be in a form satisfactory to the Director and to include, among other things:

- (f) the proposed evaluation program including a program for the taking of conventional cores, wireline logs or formation flow tests;*
- (g) the casing program and the volume of cement estimated to be used;*
- (i) other information that the director may require.*

More importantly to a hydraulic fracturing operations, perhaps, the application must also include a well prognosis (Section 30) which includes:

- (a) the manner in which the program for the drilling of the well has been designed to overcome the meteorological conditions referred to in the application for drilling program approval;*
- (b) the prevailing environmental conditions in the area of the drill site;*
- (c) the expected rig discharges at the drill site;*
- (d) the equipment, procedures and resources to be employed to protect the natural environment in the vicinity of the proposed well;*
- (e) the detailed geological prognosis including*
 - (i) a diagrammatic presentation of the stratigraphic section and the interval velocities used to produce the section,*
 - (ii) the depth, thickness and lithology of formations,*
 - (iii) the depth of geological and seismic markers,*
 - (iv) the prospective horizons,*
 - (v) a series of time structure or depth structure contour maps illustrating the areal configuration of the major horizons, and*

- (vi) *if seismic data has been acquired, at least 2 fully processed seismic sections, crossing the proposed well site or projected across the proposed well site which preferably should be orthogonal;*
- (f) *the details of the well evaluation program;*
- (g) *the subsurface conditions anticipated at the proposed drill site that may affect the safety and efficiency of the drilling operations including the depth and nature of formations where problems such as lost circulation, swelling shale and abnormal pressure zones are anticipated;*
- (h) *the details of the casing program including*
 - (i) *calculations of the design safety factors, and*
 - (ii) *the anticipated fracture gradient curves and pore pressure profiles;*
- (i) *the details of the cementing program for each casing string;*
- (j) *the blowout preventer system and variations in the blowout preventer system from those described in the application for drilling program approval;*
- (k) *the details of the sequence of drilling operations and procedures to be used for each phase of the hole;*
- (l) *the basic type of fluid system and a summary of expected properties to be maintained for each phase of the hole;*
- (m) *a summary or description of the offset well data used in the planning and engineering of the well; and*
- (n) *other information that the director may require.*

Section 32 states that a well with an approved authority to drill a well shall be drilled in accordance with the particulars included in the application submitted by the operator unless otherwise authorized by the Director, again giving the Director authority respecting the conduct of that drilling operation. The details of the application remain extremely important, and these Guidelines will assist in ensuring that adequate and appropriate information is submitted in the application.

Section 33 also authorizes the Director to withdraw an authority to drill a well “*where the safety of operations becomes uncertain owing to:*

- (a) *the level of performance of the drilling rig being demonstrably less than the level of performance indicated in the application for a drilling program approval submitted by the operator; or*
- (b) *the environmental conditions encountered in the area of the drilling program for which the application for the authority to drill a well was approved under subsection 32(1), being more severe than those predicted by the operator when the drilling program approval was approved under section 12.”*

Withdrawal of an authority to drill may be necessary in some circumstances, but obviously not a preferred outcome, and these Guidelines may be helpful in preventing this from occurring.

Terminating or Completing a Well

Note that terminated is defined in the DR to mean “*in respect of a well or test hole, a well or test hole that has been abandoned, completed or suspended in accordance with these regulations*”. Terminated includes “completed” which the DR defines to mean “*in respect of a well or test hole, a well or test hole that has been prepared to permit the*

- (i) production of fluids from the well,*
- (ii) observation of the performance of a reservoir,*
- (iii) injection of fluids into the well, or*
- (iv) disposal of fluids into the well.”*

While much of DR Part VIII WELL TERMINATION appears to be directed towards abandonment, because hydraulic fracturing is preparing the well for production and is a process applied in completing a well, the provisions of the DR relating to terminating and completing wells would also apply to hydraulic fracturing. DR s.120 states:

- (1) Where an operator intends to terminate a well, he or she shall submit the details of the proposed program for the termination to the director for approval.*
- (2) Where the program referred to in subsection (1) has been approved, the operator shall, subject to subsection 90(3) ensure that the well is terminated in accordance with that program.*

DR ss.134(1) sets out well completion requirements, requiring an operator to ensure that a well termination program submitted for approval under s.120 includes, among other things:

- (a) the isolation of each completed reservoir interval from another porous or permeable interval penetrated by the well;*
- (b) the safe and efficient testing and production of a completed reservoir interval; and*
- (f) the stimulation of productive formations in a manner that is safe and that permits evaluation of production characteristics.*

Approval by the Director of a program to provide for p.134(1)(f) provides ample scope for applying components of these Guidelines as part of completion program to be approved by the Director.

Environmental Protection Act

Section 48 of the *Environmental Protection Act* (EPA) prohibits an undertaking from proceeding unless it has been exempted or “released” under this Act. Section 32 of the *Environmental Assessment Regulations* explicitly states that “*An undertaking that will be engaged in crude oil, natural gas or petroleum production facilities shall be registered*”. The Minister of Environment and Conservation (Minister of EC) will determine whether the undertaking is subject to an environmental preview report (EPR) or an environmental impact statement (EIS) before being released. If an EPR or an EIS is required, the Minister of EC shall appoint an assessment committee to prepare guidelines for the required EPR or EIS, which shall be approved by the Minister of EC and be provided to the proponent, who shall prepare

the required EPR or EIS in accordance with the guidelines and submit it to the Minister of EC. These guidelines will depend on the nature of the undertaking, and could be tailored to be specifically applicable to an undertaking that includes hydraulic fracturing operations.

Section 57 of the EPA requires an EIS to be prepared in accordance with the guidelines, and to include, among other things:

- (d) a description of the
 - (i) present environment that will be affected or that might reasonably be expected to be affected, directly or indirectly, by the undertaking, and*
 - (ii) predicted future condition of the environment that might reasonably be expected to occur within the expected life span of the undertaking, if the undertaking was not approved;**
- (e) a description of
 - (i) the effects that would be caused, or that might reasonably be expected to be caused, to the environment by the undertaking with respect to the descriptions provided under paragraph (d), and*
 - (ii) the actions necessary, or that may reasonably be expected to be necessary, to prevent, change, mitigate or remedy the effects upon or the effects that might reasonably be expected upon the environment by the undertaking;**
- (f) an evaluation of the advantages and disadvantages to the environment of the undertaking, the alternative methods of carrying out the undertaking and the alternatives to the undertaking;*
- (g) a proposed set of control or remedial measures designed to minimize any or all significant harmful effects identified under paragraph (e); and*
- (h) a proposed program of study designed to monitor all substances and harmful effects that would be produced by the undertaking.*

Upon receipt of an EIS, the Minister of EC will seek input from “*interested persons*” and will “*consult with and obtain the opinions of all other ministers of the Crown whose departments may have an interest in an undertaking that may be subject to an EIS*”. In the case of an undertaking involving hydraulic fracturing operations, that consultation would include the Minister of Natural Resources. The Minister of EC may request public hearings be held regarding the proposed undertaking before making his decision.

Section 67 authorises the Minister of EC to recommend to the Lieutenant Governor in Council that an undertaking be released, subject to terms and conditions, and the Lieutenant Governor in Council may issue that release subject to its own terms and conditions. Section 76 authorises the Lieutenant Governor in Council to amend a release and authorizes, as a term or condition, the posting of a bond or other form of security by the proponent of that undertaking.

Section 68 prohibits approval or authorization of an undertaking under another Act until the undertaking has been exempted or released under the EPA by the Minister of EC. This will require the Minister and Director to work closely with the Minister of EC in issuing approvals or authorizations for oil and gas activities involving hydraulic fracturing operations, and in practise generally means these approvals and authorizations will be issued concurrently with a release under the EPA.

Water Resources Act

Section 14 of the *Water Resources Act* (WRA) requires a licence issued by the Minister of EC, after considering the potential adverse effects, with or without terms and conditions, *“to divert or use water for a municipal, agricultural, institutional, commercial or industrial purpose, and for water and thermal power generation and other purposes that the minister considers necessary”*. Because operators of hydraulic fracturing operations will require use of water, potentially large volumes, they will require a water licence from the Minister of EC, who has considerable discretion in terms of consideration of adverse effects and application of terms and conditions in the issuing of this licence.

Subsection 15(1) establishes priorities in water use, and industrial uses, such a hydraulic fracturing in oil and gas operations, would have lower priority than domestic, municipal or agricultural uses. Under Subsection 15(5), existing water licences may be diminished or pre-empted by an application for a licence by a higher priority user.

Section 41 authorizes the Minister of EC to *“require and direct the owner, operator or other person responsible for an undertaking to carry out those tests on water emitted from, surrounding or connected with that undertaking that the minister considers necessary”*. This authorizes the Minister of EC to require testing of water from wells “surrounding” a hydraulic fracturing operation, and to have those results reported in a manner directed by the Minister of EC. The authority in Section 41 extends to both groundwater and surface water.

Section 62 authorizes the Minister of EC to *“order studies, monitoring and investigations for the purpose of collecting data and information on the availability of groundwater, sustainable rates of water withdrawal, spacing of wells, quality of household water supplies, pumping test methods, hydrogeological mapping, groundwater flow systems, groundwater quality and other matters that the minister considers necessary in the interest of the conservation, development, control, improvement and proper utilization of groundwater resources”*. This authority specifically relates to groundwater and, in complement with Section 41, authorizes for the Minister of EC to require baseline testing and monitoring water wells.

The WRA defines sewage as *“residential, municipal, commercial or industrial waterborne and solid wastes which would, if left untreated, cause an adverse effect, and drainage and storm water collected from natural runoff”*, and would include flowback fluids from hydraulic fracturing operations. Section 36 requires an operator to *“submit to the minister the plans, specifications and an engineer’s report of the sewage works to be undertaken and the location of the discharge of the effluent, together with other*

information that the minister may require", and requires a permit for sewage works which the Minister of EC may issue, subject to terms and conditions he considers necessary.