



DRAFT Directive XXX

Month xx, 2012

Hydraulic Fracturing

The Energy Resources Conservation Board (ERCB/Board) has approved this directive on
[Month day, year].

[<original signed by>]

[Name]

[Title-Chair]

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1 Introduction

1.1 Background

Hydraulic fracturing is a well-stimulation process in which a fluid, a proppant, and additives are pumped under high pressure into a hydrocarbon-bearing formation. The fluid pressure creates fractures in the formation and the fluid transports the proppant into the fractures. The proppant keeps the fractures open and allows the hydrocarbons to flow from the formation to the wellbore. The additives serve various purposes, such as reducing friction, preventing the growth of microorganisms, and inhibiting corrosion within the wellbore. After the fracturing process is complete, the fracturing fluids and hydrocarbons are produced at the surface.

Hydraulic fracturing provides access to hydrocarbon resources that otherwise may not have been recoverable. The use of hydraulic fracturing is expected to increase as the technology improves and conventional hydrocarbon deposits are depleted.

1.2 Purpose of This Directive

This directive sets out the ERCB's requirements for managing the risks associated with hydraulic fracturing operations. This directive does not apply to thermal wells approved under *Directive 051: Injection and Disposal Wells – Well Classifications, Completions, Logging, and Testing Requirements*.

These requirements are intended to

- prevent the loss of well integrity at a subject well (a well in relation to which a licensee proposes to conduct hydraulic fracturing operations),
- reduce the risks of interwellbore communication between a subject well and an offset well,
- maintain well control at an offset well in the event of interwellbore communication with a subject well,
- prevent impacts to nonsaline aquifers,
- prevent impacts to water wells, and
- prevent surface impacts.

1.3 What's New in This Directive

This directive rescinds both *Directive 027: Shallow Fracturing Operations – Restricted Operations* and *Bulletin 2012-02: Hydraulic Fracturing; Interwellbore Communication between Energy Wells*. This directive includes

- new requirements to prevent the loss of well integrity at a subject well (Section 2),
- new requirements for a licensee to assess, plan for, and mitigate the risks of interwellbore communication with offset wells (Section 3),
- new requirements to protect nonsaline aquifers from hydraulic fracturing operations at depths less than 100 metres (m) below the base of groundwater protection (Section 4),
- increased vertical setback distances for hydraulic fracturing operations near water wells (Section 5),
- increased vertical setback distances for hydraulic fracturing operations near the top of the bedrock surface (Section 6),

- pumping volume restrictions and exemptions to setback distances for nitrogen fracturing operations for coalbed methane (Section 7),
- new notification requirements to ensure that licensees notify the ERCB (a) prior to commencing hydraulic fracturing operations and (b) in the event that hydraulic fracturing operations have caused an unintended communication event with an offset well or a nonsaline aquifer (Section 8), and
- new requirements for continual improvement (Section 9).

1.4 Compliance Assurance

ERCB requirements are numbered sequentially throughout this directive. The term “must” indicates a requirement for which compliance is required and is subject to ERCB enforcement. The terms “recommends” or “expects” indicate recommended practices and are not subject to enforcement action.

Noncompliance with any requirement may result in a licensee receiving a response in accordance with *Directive 019: Compliance Assurance*. A list of noncompliance events is available from the ERCB website, www.ercb.ca.

The ERCB encourages all licensees to be proactive by monitoring their compliance with ERCB requirements. If a licensee identifies a noncompliance, it should inform the ERCB of the noncompliance for consideration under the ERCB Voluntary Self-Disclosure policy set out in *Directive 019*.

For the purposes of this directive, the term “licensee” is used to designate the responsible duty holder (e.g., licensee, operator, company, applicant, approval holder, permit holder) as specified in legislation.

In its assessment of a licensee’s compliance with the requirements of this directive, the ERCB may at any time request a licensee to produce those documents, records, or plans required to be completed by this directive, and a licensee must provide them to the ERCB.

2 Well Integrity

2.1 Issue

During hydraulic fracturing operations, subject wells can incur significant stresses, which may lead to a loss of well integrity. A loss of well integrity may result in subsurface impacts or result in a release of fluids to the surface, placing the public, workers, and the environment at risk.

2.2 Regulatory Objective

To prevent the loss of well integrity at a subject well.

2.3 Requirements

2.3.1 General

- 1) A licensee must maintain well control at all times (*Oil and Gas Conservation Regulations*, section 8.190(1)).

- 2) A licensee must design, construct, and operate its well with either a dual-barrier system, or a single-barrier system that provides a level of well integrity that is equivalent to a dual-barrier system.

2.3.2 Dual-Barrier System

- 3) A licensee's dual-barrier system must consist of a primary and secondary barrier:
 - a) The primary barrier must be capable of containing and isolating the fracture fluids.
 - b) The secondary barrier must be capable of providing well control in the event of a failure of the primary barrier.
 - c) A primary barrier must not be cemented to the secondary barrier above the fractured interval.
 - d) The internal pressure on each barrier must be monitored during the fracturing operation to detect and respond to a barrier failure.

A dual-barrier system may consist of a combination of intermediate casing, production casing, production liners, tubing, or tie-back strings.

2.3.3 Single-Barrier System

A single-barrier system has a higher risk of failure than a dual-barrier system. In order to minimize the risk of a barrier failure, the ERCB expects a licensee to apply increased diligence in designing a single-barrier system, monitoring hydraulic fracturing loads to ensure that adequate margins of safety are maintained, and detecting and responding to any indication of a barrier failure.

- 4) A licensee must
 - a) document the load capacity and the safety factors it has used in the design of its casing relative to the loads (internal pressure, bending, thermal) and the well environment that the casing will be exposed to,
 - b) document both the threshold pressures it will operate to and its monitoring and response protocols to ensure that the threshold pressures are not exceeded,
 - c) set surface casing to cover the base of groundwater protection,
 - d) be able to demonstrate well integrity (both casing and cement) prior to, during, and following hydraulic fracturing operations, and
 - e) immediately notify the appropriate ERCB field centre if testing does not confirm well integrity.

The ERCB expects a licensee to follow the *Primary and Remedial Cementing Guidelines* (Drilling and Completions Committee) or a technically equivalent standard operating practice, when planning and executing its cementing program.

3 Interwellbore Communication

3.1 Issue

Interwellbore communication means a communication pathway has been established, either intentionally or unintentionally, between a subject well and an offset well. A communication pathway may compromise the well integrity at an offset well. A loss of well integrity may

result in subsurface impacts or result in a release of fluids to the surface, placing the public, workers, and the environment at risk.

3.2 Regulatory Objective

To reduce the risks of interwellbore communication between a subject well and an offset well.

To maintain well control at an offset well in the event of interwellbore communication with a subject well.

3.3 Requirements

3.3.1 General

- 5) A licensee must manage the risks of interwellbore communication between a subject well and an offset well.

3.3.2 Risk Assessment and Risk Management Plan

- 6) A licensee must prepare a hydraulic fracturing risk assessment and risk management plan prior to initiating a fracturing program.
- 7) A licensee must use a documented procedure, such as that described in *Interim IRP 24: Fracture Stimulation: Interwellbore Communication* (Drilling and Completions Committee), to complete its hydraulic fracturing risk assessment and risk management plan.
- 8) A licensee's hydraulic fracturing risk assessment and risk management plan must assess and mitigate the risks of interwellbore communication between a subject well and an offset well. The risk assessment and risk management plan must include
 - a) a hydraulic fracturing program that includes target depths, well locations, well directional plans and surveys, perforation or completion intervals, pumping rates, fluid volumes, pressures, and fluid compositions;
 - b) the determination of a fracture planning zone (FPZ);
 - c) the identification of offset wells within the FPZ;
 - d) the identification of offset wells that lie beyond the FPZ that, due to the uncertainty in determining the FPZ, may be impacted;
 - e) an assessment of well integrity for each offset well;
 - f) a risk assessment for each offset well;
 - g) control and mitigation measures to maintain well integrity for each offset well;
 - h) a monitoring plan for each offset well; and
 - i) a response plan in the event of interwellbore communication with an offset well or in the event of a loss of well control at an offset well.
- 9) A licensee must notify licensees of offset wells of its planned hydraulic fracturing program prior to preparing a risk assessment and risk management plan.
- 10) A licensee must engage licensees of offset wells and make all reasonable efforts to develop mutually acceptable control and mitigation measures, and monitoring and response plans.

On receipt of notification of a planned hydraulic fracturing program, licensees of offset wells are expected to engage and work cooperatively with licensees of subject wells in the development of adequate control and mitigation measures, and monitoring and response plans.

Licensees of both offset and subject wells are responsible for maintaining control of their licensed wells at all times. Failure to develop and implement appropriate well-control measures may result in enforcement action against licensees in the event of a loss of offset well control resulting from hydraulic fracturing operations.

- 11) A licensee must maintain a copy of its risk assessment and risk management plan at the subject well site.

4 Nonsaline Aquifer Protection

4.1 Issue

Nonsaline aquifers are an important natural resource. For that reason, the ERCB has adopted a conservative and precautionary approach to ensure their protection.

4.2 Regulatory Objective

To prevent impacts to nonsaline aquifers.

4.3 Requirements

4.3.1 General

- 12) A licensee's hydraulic fracturing operations must not impact the water quality or quantity of a nonsaline aquifer.

4.3.2 Hydraulic Fracturing Above or Near the Base of Groundwater Protection

- 13) A licensee must prepare a hydraulic fracturing risk assessment and risk management plan prior to initiating a fracturing program above or near the base of groundwater protection.
- 14) A licensee must use a documented procedure, such as that described in *Interim IRP 24: Fracture Stimulation: Interwellbore Communication* (Drilling and Completions Committee), to complete its hydraulic fracturing risk assessment and risk management plan.
- 15) If the FPZ lies at depths shallower than 100 metres below the base of groundwater protection, a licensee's hydraulic fracturing risk assessment and risk management plan must include the information required in section 3.3.2 and the following:
 - a) identification of nonsaline aquifers within the FPZ,
 - b) identification of nonsaline aquifers that lie beyond the FPZ that, due to the uncertainty in determining the FPZ, may be impacted,
 - c) measures that minimize the risks and mitigate the consequences of impacts to nonsaline aquifers, and
 - d) evidence confirming that the fracturing fluids do not contain anything that may cause deterioration in the water quality of nonsaline aquifers.

5 Hydraulic Fracturing Near Water Wells

5.1 Issue

The ERCB has adopted a conservative and precautionary approach to prevent hydraulic fracturing operations near a water well from impacting the well's water quality or quantity.

5.2 Regulatory Objective

To prevent impacts to water wells.

5.3 Requirements

- 16) A licensee's hydraulic fracturing operations must not impact a water well's water quality or quantity.
- 17) A licensee must not hydraulically fracture within a zone that extends 200 metres horizontally from the surface location of a water well to 100 metres vertically from the bottom of the water well (see figure 1).

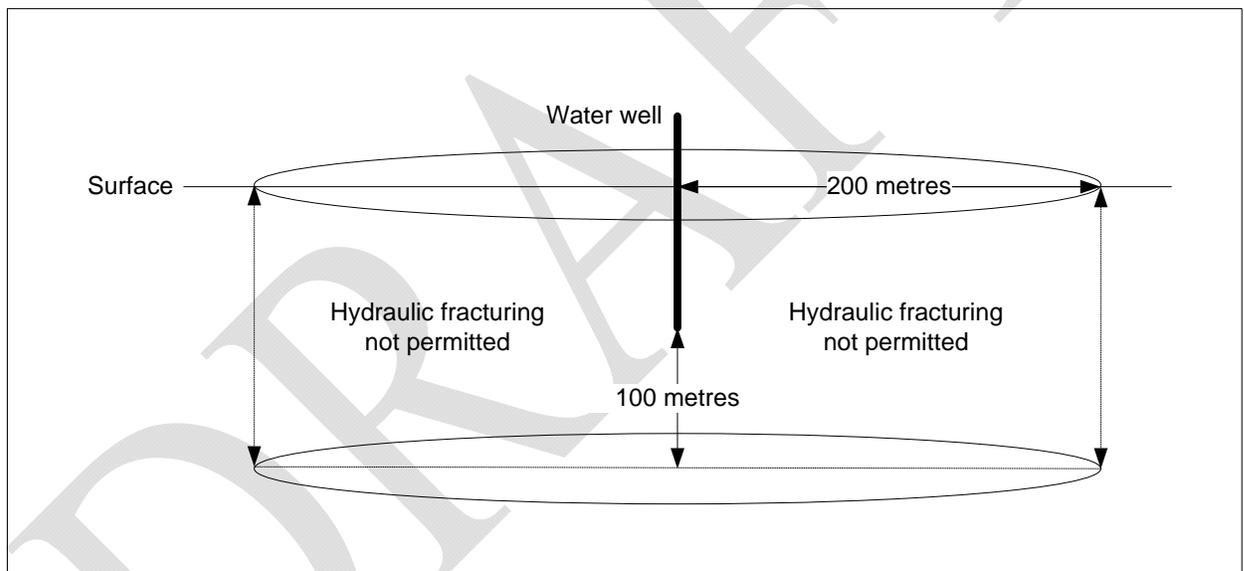


Figure 1. Hydraulic fracturing near water wells.

6 Hydraulic Fracturing Near Top of Bedrock

6.1 Issue

The ERCB has adopted a conservative and precautionary approach to prevent surface impacts from hydraulic fracturing operations near top of bedrock.

6.2 Regulatory Objective

To prevent surface impacts.

6.3 Requirements

- 18) A licensee's hydraulic fracturing operations must not cause surface impacts.
- 19) A licensee must not hydraulically fracture within 100 vertical metres of the top of the bedrock surface (see figure 2).

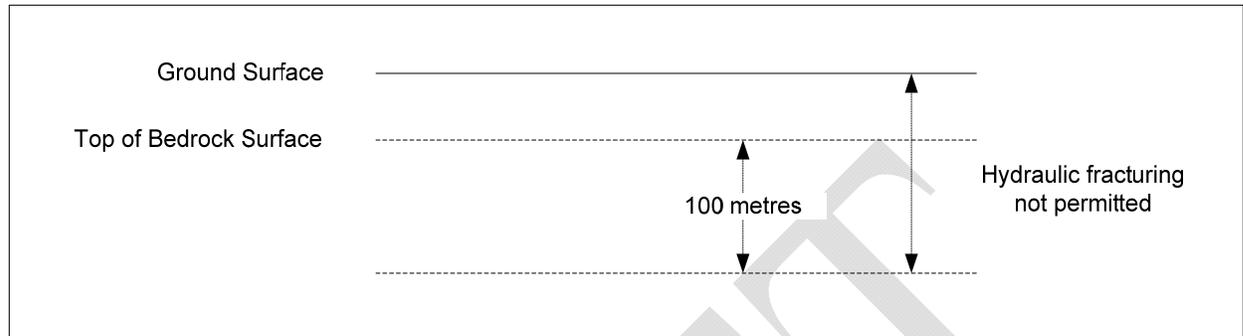


Figure 2. Hydraulic fracturing near top of bedrock.

7 Nitrogen Fracturing Operations – Special Provisions for Coalbed Methane

The following provisions apply to hydraulic fracturing operations using nitrogen as the fracturing fluid for coalbed stimulation.

7.1 Nitrogen Fracturing Near Water Wells

- 20) A licensee's nitrogen fracturing operations must not impact a water well's water quality or quantity.
- 21) A licensee must not perform nitrogen fracturing operations within a zone that extends 200 metres horizontally from the surface location of a water well to 50 metres vertically from the bottom of the water well.

7.2 Nitrogen Fracturing Near Top of Bedrock

- 22) A licensee's nitrogen fracturing operations must not cause surface impacts.
- 23) A licensee must not perform nitrogen fracturing operations within 50 vertical metres of the top of the bedrock surface.

7.3 Pumping Volume Limitations in Coal

- 24) A licensee must not use more than 15 000 cubic metres of nitrogen per vertical metre of coal without prior ERCB approval.

8 Notification Requirements

- 25) A licensee must notify the appropriate ERCB field centre via the ERCB Digital Data Submission system a minimum of five (5) days prior to the commencement of hydraulic fracturing pumping operations.
- 26) A licensee must immediately notify the appropriate ERCB field centre of an unintended communication event with an offset well or a nonsaline aquifer.

9 Continual Improvement

- 27) A licensee must continually improve the planning and execution of its hydraulic fracturing operations by evaluating the effectiveness of its operations in meeting the regulatory objectives of this directive, and revising the planning and execution of its subsequent hydraulic fracturing operations based on this evaluation.
- 28) A licensee must use a documented procedure, such as that described in *Interim IRP 24: Fracture Stimulation: Interwellbore Communication* (Drilling and Completions Committee), to conduct its continual improvement process.

10 Directive 2012-XXX Help

If you have any questions, which cannot be answered by this directive, contact the ERCB's XXX Section:

Phone: XXX-XXX-XXXX

Fax: XXX-XXX-XXXX

E-Mail: XXX@ercb.ca

11 Regulatory Framework

Aspects of hydraulic fracturing that have not been dealt with under this directive, such as the design and operation of surface facilities, subsurface well design, waste management, well licensing, and emergency preparedness, are covered under other ERCB directives, including the following:

- *Directive 008: Surface Casing Depth Requirements*
- *Directive 009: Casing Cementing Minimum Requirements*
- *Directive 010: Minimum Casing Design Requirements*
- *Directive 019: Compliance Assurance*
- *Directive 051: Injection and Disposal Wells – Well Classifications, Completions, Logging, and Testing Requirements*
- *Directive 055: Storage Requirements for the Upstream Petroleum Industry*
- *Directive 056: Energy Development Applications and Schedules*
- *Directive 058: Oilfield Waste Management Requirements for the Upstream Petroleum Industry*
- *Directive 059: Well Drilling and Completion Data Filing Requirements*
- *Directive 071: Emergency Preparedness and Response Requirements for the Petroleum Industry*

12 Definitions

Bedrock:	Bedrock is consolidated rock underlying unconsolidated glacial or drift material.
Fracture planning zone (FPZ):	The area that may be impacted by hydraulic fracturing operations.
Nonsaline aquifer:	A nonsaline aquifer means an aquifer containing water with a total dissolved solids content of less than 4000 milligrams per litre.
Offset well:	An offset well is any active, suspended or abandoned energy well that is near a subject well.
Subject well:	A subject well is a well in relation to which a licensee proposes to conduct hydraulic fracturing operations.
Threshold pressure:	Operating pressure limits at the subject well and the offset wells that include a safety margin and that will not be exceeded.

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