

Regulating hydraulic fracturing in B.C.

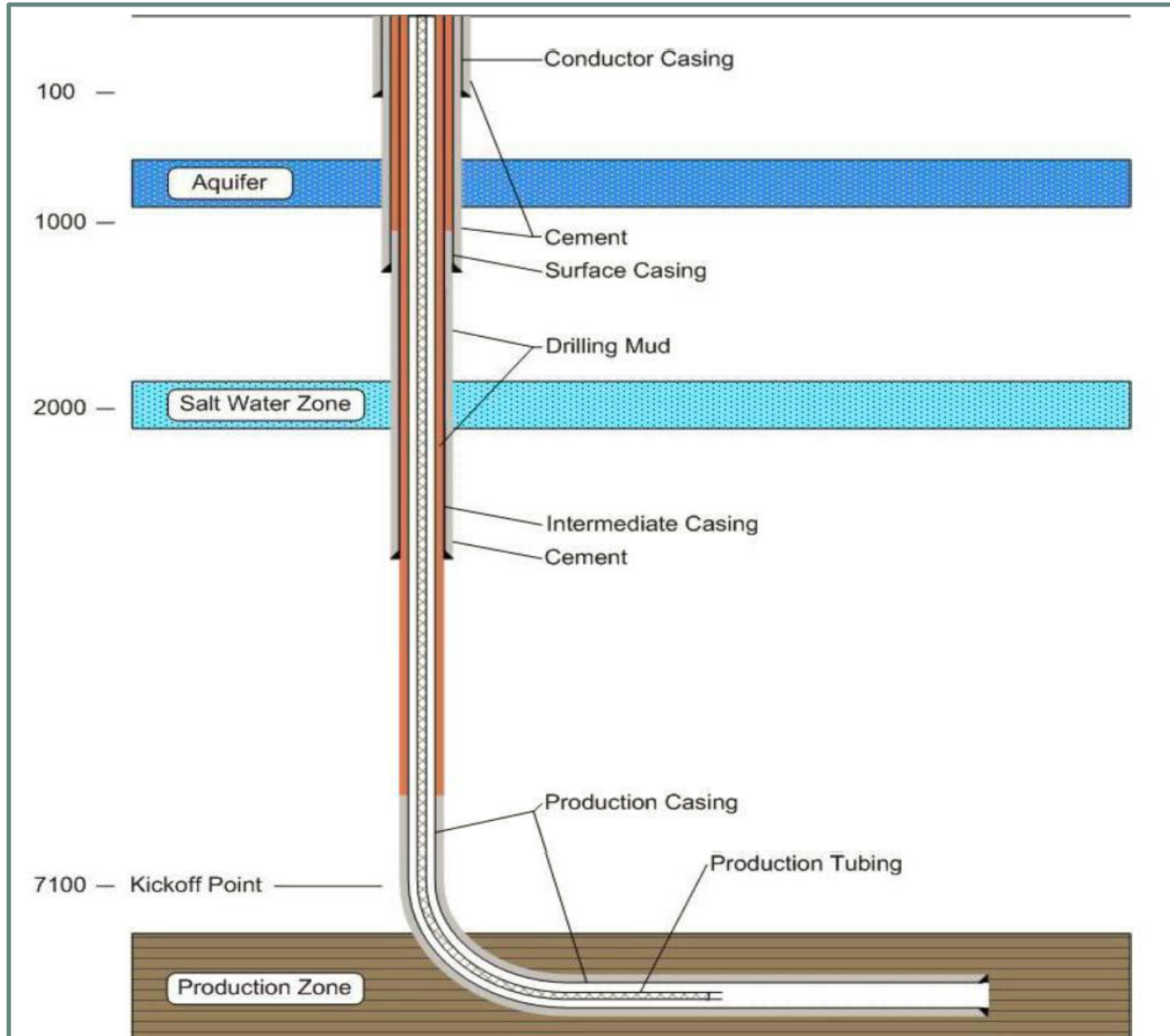


Kevin Parsonage

Supervisor, Field Engineering and Technical Investigations

KEVIN.PARSONAGE@BCOGC.CA

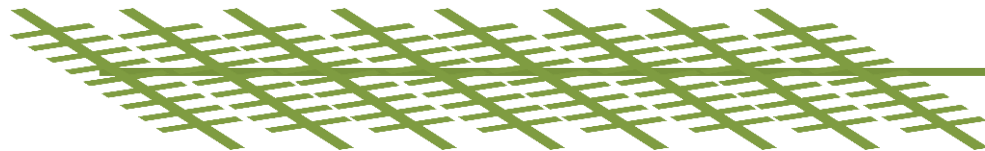
WELL CONSTRUCTION



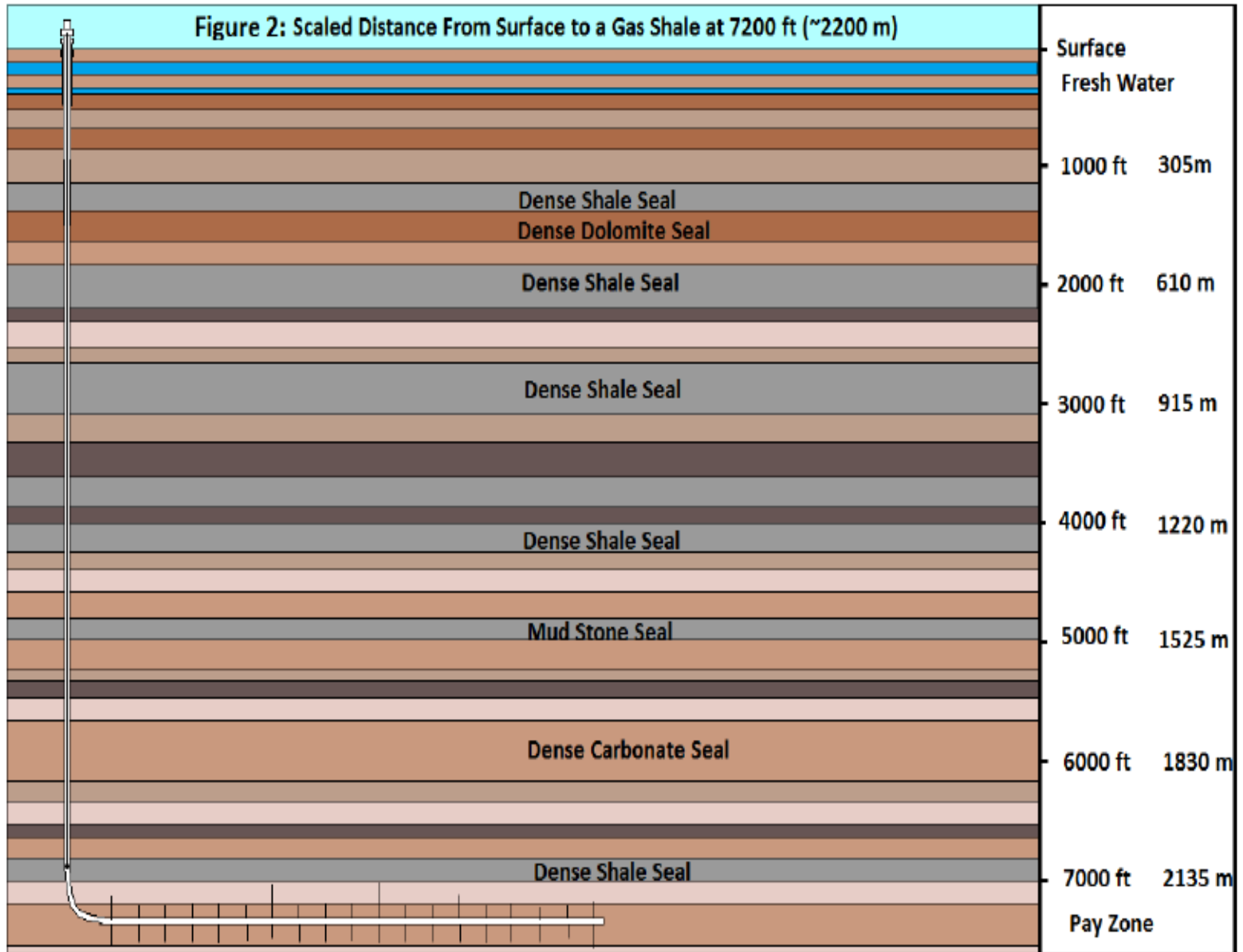
HYDRAULIC FRACTURING

The process of transmitting pressure by fluid to create cracks or open existing cracks in hydrocarbon bearing rocks underground.

The purpose is to enable the gas to flow more easily from the formation to the wellbore.



HYDRAULIC FRACTURING



MATERIALS INVOLVED

- Base Fluids
- Proppant
- Fluid Additives
- Pumping equipment

HYDRAULIC FRACTURING OPERATION



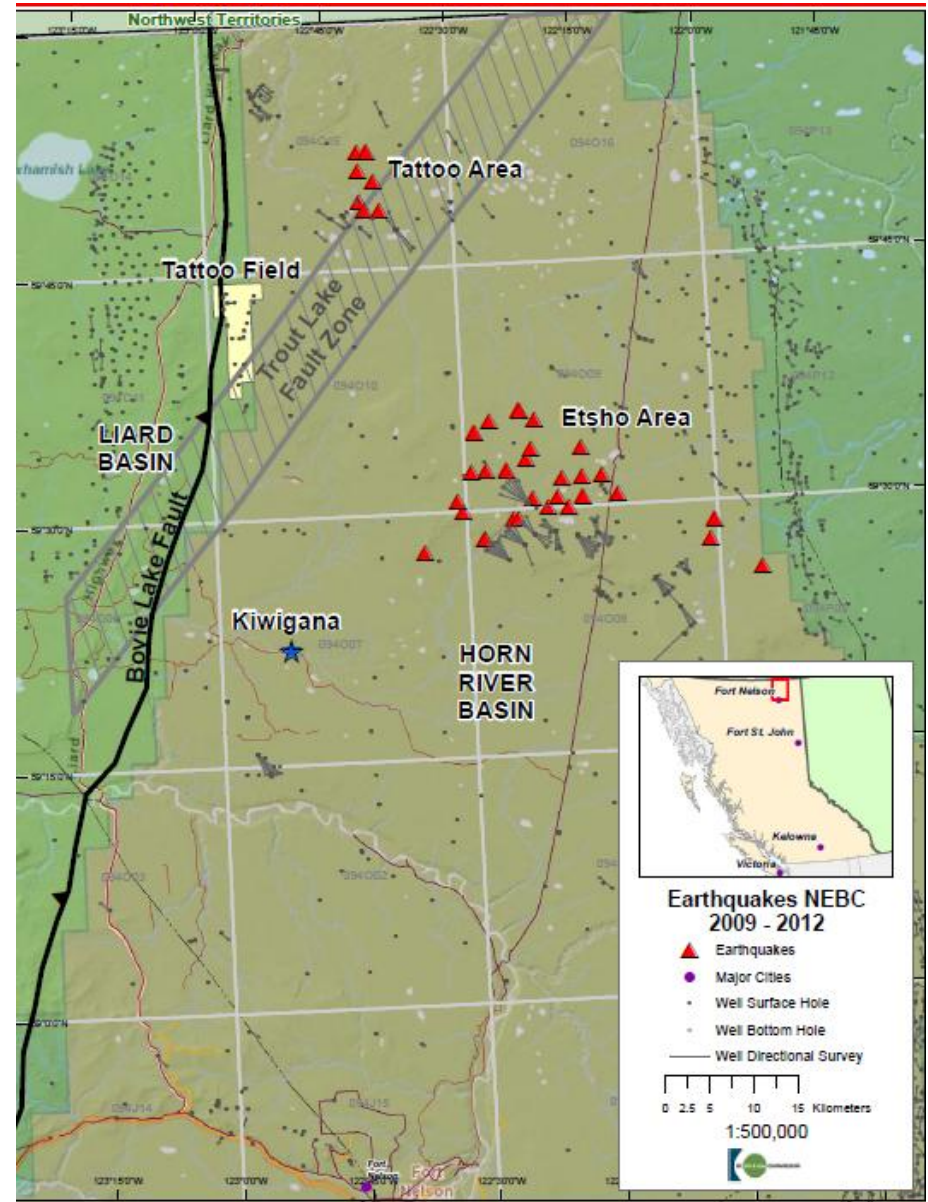
CHALLENGES

- Induced Seismicity
- Water Management
- Sand Erosion
- Interwellbore Communication
- Flaring and Venting

INDUCED SEISMICITY

Injection of fluids during hydraulic fracturing has caused minor seismic events in British Columbia.

The Commission's report Investigation of Observed Seismicity in the Horn River Basin (2012) used extensive seismic information to conclusively link small magnitude events (max. 3.8 Richter) to completion operations in an isolated area of the Horn River Basin.

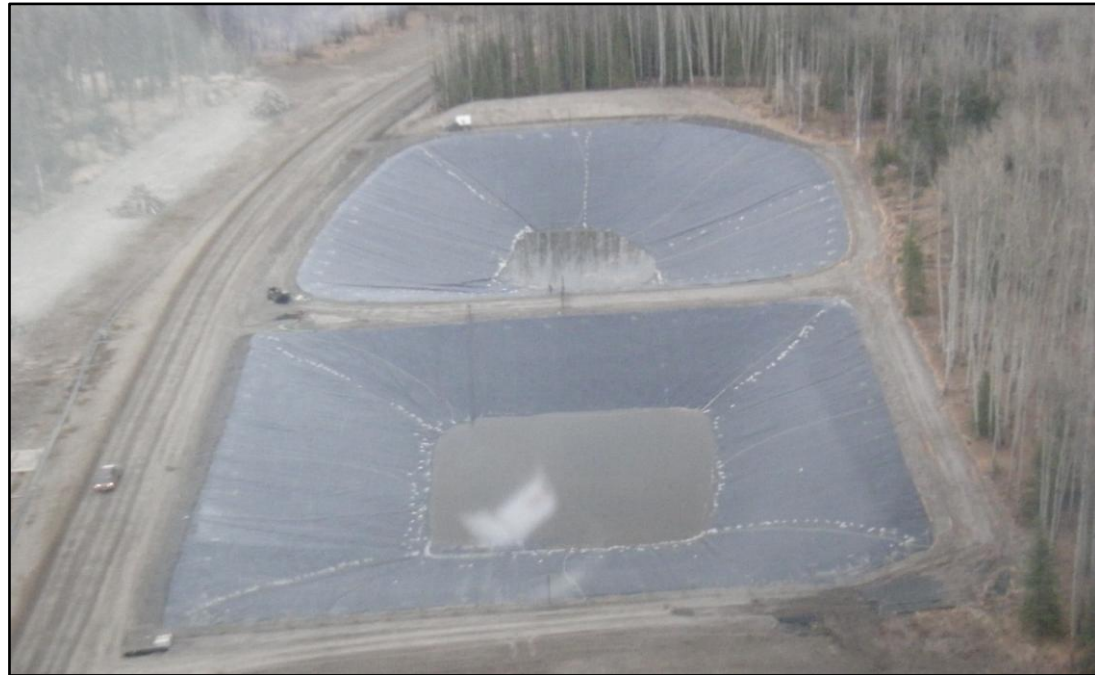


INDUCED SEISMICITY RESPONSE

1. Installed additional seismograph stations in northeast B.C. in order to improve monitoring of seismic activity.
2. Mapping of areas at risk of induced seismicity.
3. Permit conditions on wells in the Horn River Basin to cease activity if seismic activity exceeds a tolerable threshold.
4. Avoid placing water disposal wells in high-risk areas.

WASTE WATER MANAGEMENT

- No surface discharge of produced water.
- Permitting of fracturing fluid storage sites.
- Storage pond requirements
 - No hydrocarbons
 - Dual liner
 - Leak detection
 - Wildlife protection



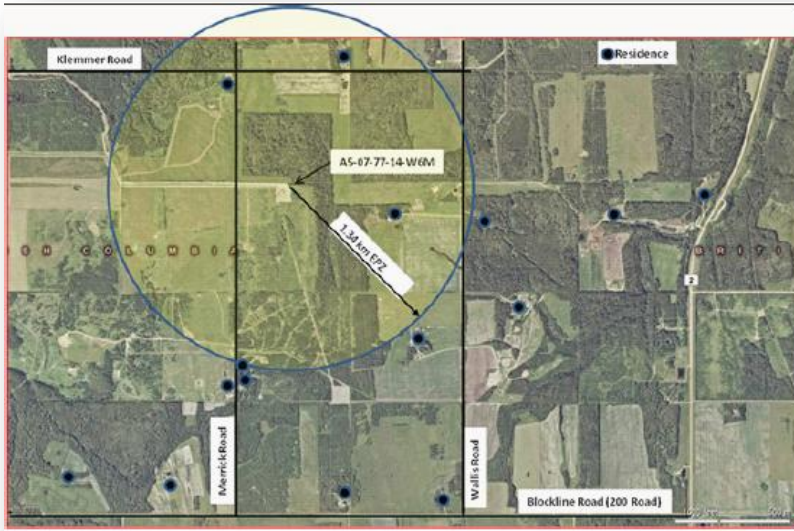
WASTE WATER MANAGEMENT

Shell Sunset Water Hub

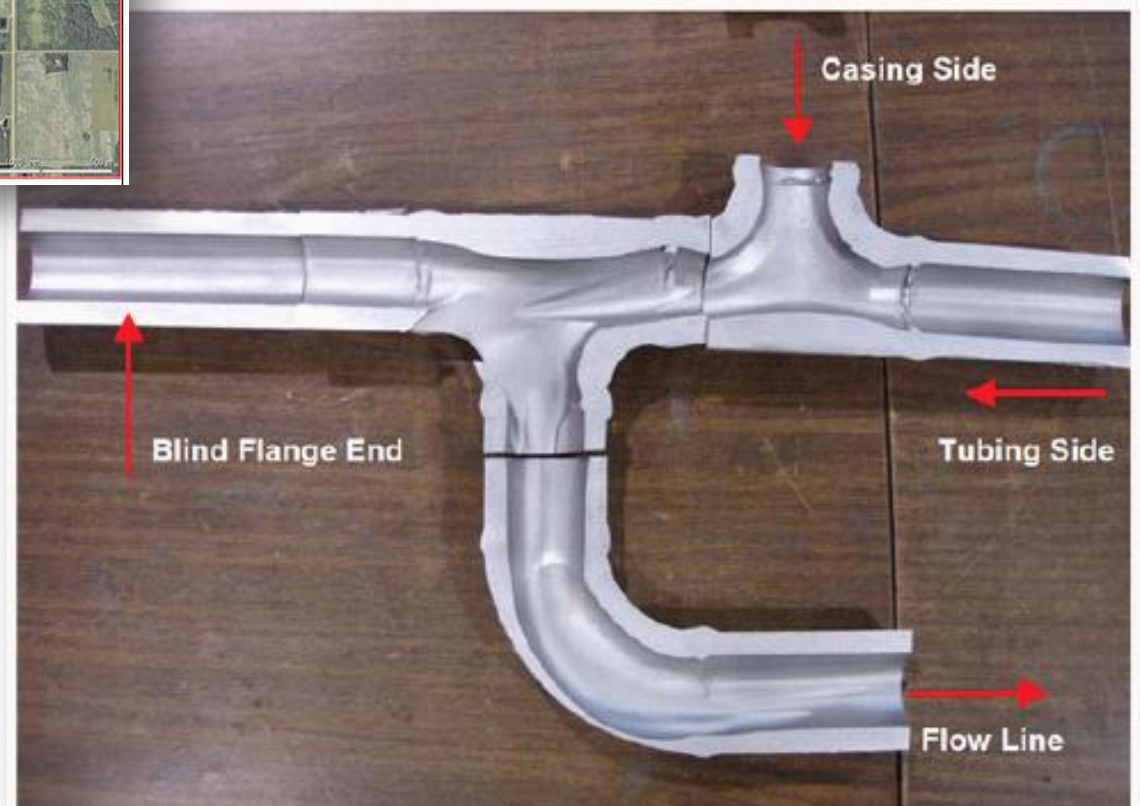


SAND EROSION

November 2009 failure of wellsite piping due to sand erosion



Location: Near Pouce Coupe, Northeast B.C.



Eroded Piping

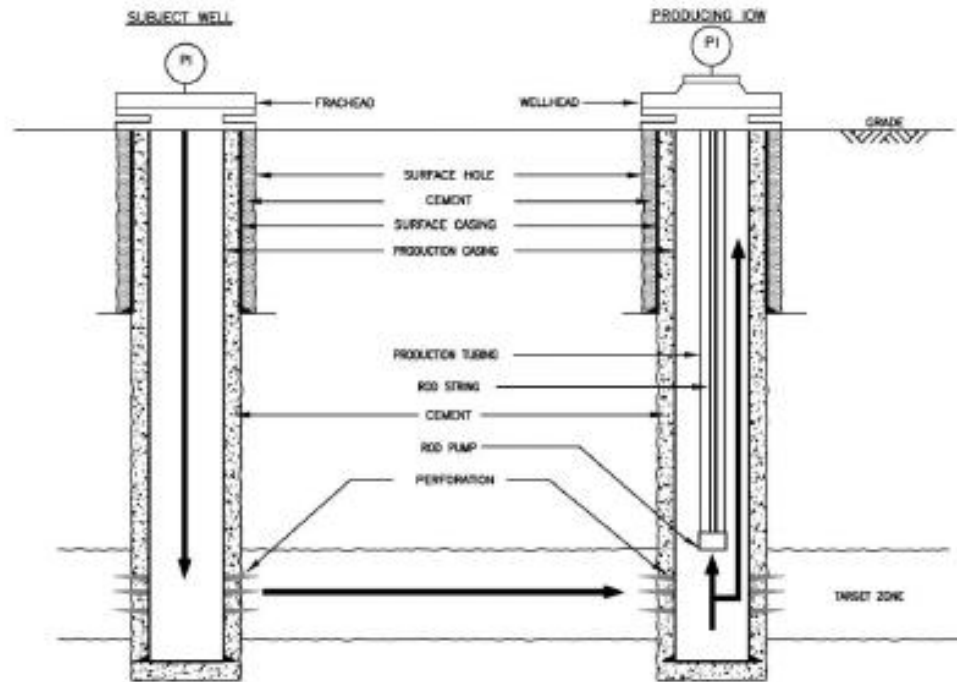
SAND EROSION RESPONSE

Sand Management Plan

- De-sanding equipment
- Piping configuration
- Leak detection
- Ultrasonic testing
- Velocity control



INTERWELLBORE COMMUNICATION



- Primary issue in B.C. has been communication with drilling wells causing drilling kicks.
- Secondary issue has been disruption of production from producing wells.

INTERWELLBORE COMMUNICATION



SAFETY ADVISORY 2010-03

May 20, 2010



COMMUNICATION DURING FRACTURE STIMULATION

A large kick ⁽¹⁾ was recently taken on a well being horizontally drilled for unconventional gas production in the Montney formation. The kick was caused by a fracturing operation being conducted on an adjacent horizontal well. Fracture sand was circulated from the drilling wellbore, which was 670m from the wellbore undergoing the fracturing operation.

To date, the BC Oil and Gas Commission (Commission) is aware of 18 fracture communication incidents in B.C. and one in Western Alberta as follows:

- Five incidents of fracture stimulation resulting in communication with an adjacent well during drilling.
- Three incidents of drilling into a hydraulic fracture formed during a previous stimulation on an adjacent well and containing high pressure fluids.
- Ten incidents of fracture stimulations communicating into adjacent producing wells.
- One incident of fracture stimulation communication into an adjacent leg on the same well for a multi-lateral well.

To date, all kicks taken during drilling were successfully controlled through conventional drilling safety measures (e.g. circulation with kill mud and/or reduction of the invading fracture stimulation pressure through controlled venting). Large kicks resulted in volumes up to 80m³ of fluids produced to surface. Invading fluids have included water, carbon dioxide, nitrogen, sand, drilling mud, other stimulation fluids and small amounts of gas.

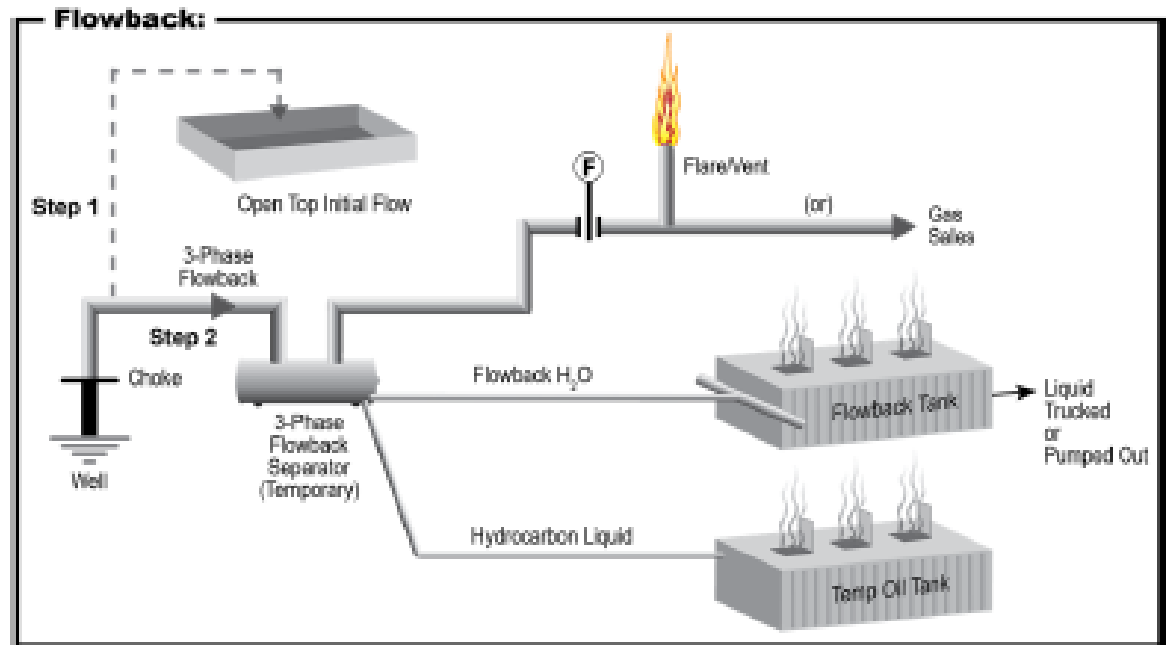
Fracture fluids introduced into producing wells result in suspended production, substantial remediation costs and pose a potential safety hazard.

Incidents have occurred in horizontal wells with separation distances between well bores ranging from 50m to 715m.

Fracture propagation via large scale hydraulic fracturing operations has proven difficult to predict. Existing planes of weakness in target formations may result in fracture lengths that exceed initial design expectations.

**For oil and gas incidents and emergencies, please contact the Commission at:
1-800-663-3456 (24 hours).**

FLARING AND VENTING



Note: Sand Filter may be installed upstream of Separator. Also, there may be 2-stage (HP, LP) Separation.

Climatic Change
DOI 10.1007/s10584-011-0061-5

LETTER

Methane and the greenhouse-gas footprint of natural gas from shale formations

A letter

Robert W. Howarth · Renee Santoro ·
Anthony Ingraffea

FLARING AND VENTING

2006	2011	2012	2013
~ 0%	45%	60%	74%

- Percentage of wells using inline cleanup/testing.
- Gas is recovered instead of flared.



FUGITIVE EMISSIONS MANAGEMENT



BEST MANAGEMENT PRACTICE

Management of Fugitive Emissions at Upstream Oil and Gas Facilities

January 2007



COMPLIANCE AND ENFORCEMENT

- Once an application is approved and construction commences, the Commission's inspection staff monitors regulatory compliance.
- Inspections are generated by:
 - Risk-based inspection model.
 - Annual computer modelling.
 - Public requests, complaints and reported incidents.

INSPECTION PROCESS

- 1** Inspection identified, prioritized and planned.
- 2** Results communicated to operator.
- 3** Follow-up on deficiencies to ensure corrections are made in the allotted timeframe.
- 4** Site compliance measured and overdue deficiencies communicated to operator.
- 5** Enforcement actions pursued, if necessary.

The Commission's field inspection process provides the operator an opportunity to work toward compliance.

Thank you



Questions?