Hydraulic Fracturing & Public Health:

What we know, what we can infer and how we can move forward

Merry Turtiak, Alberta Health

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Overview

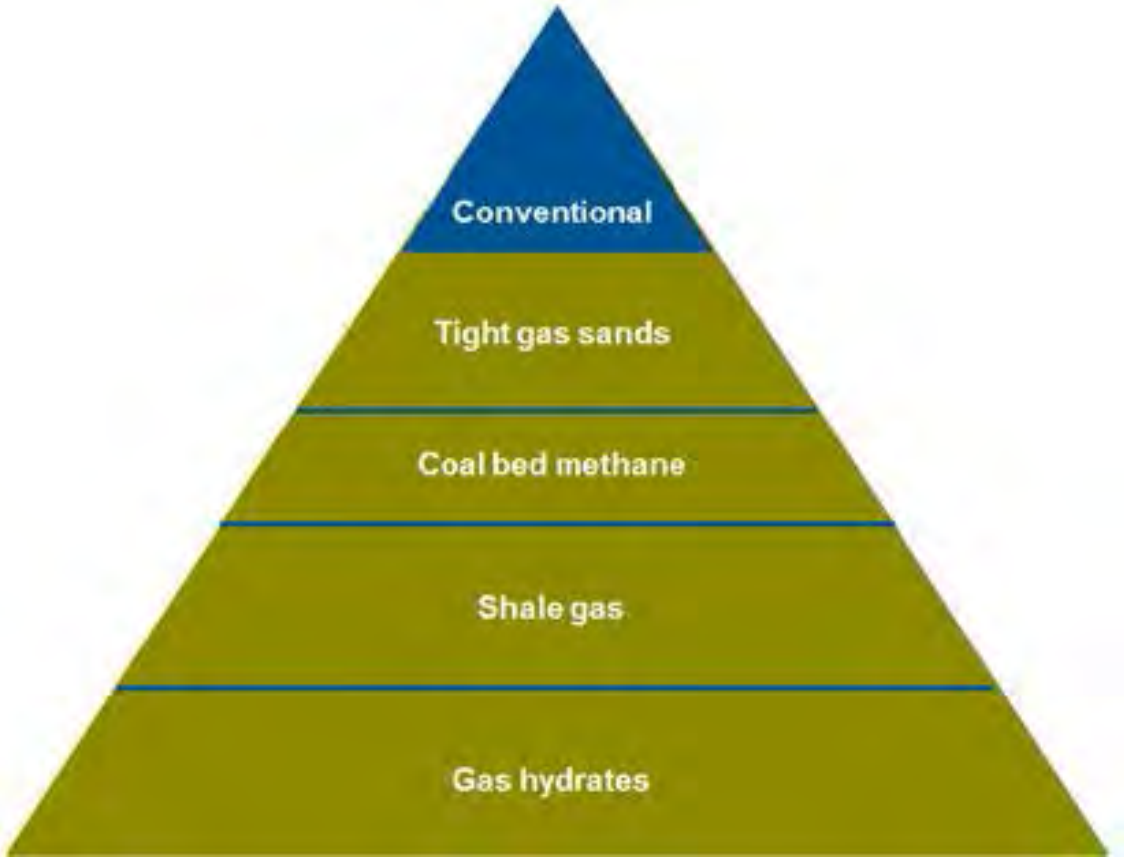
- The Basics: Unconventional Oil & Gas, Shale Gas and Hydraulic Fracturing
- Media & Public Perception
- Public Health Concerns & Challenges
- Alberta's Activities

The Basics:
Conventional vs. Unconventional

- Conventional (easier to produce)
  - Oil or gas “flows” easily into the wellbore
  - Easy and inexpensive to develop
  - Do not need special technology to “stimulate” the flow.

- Unconventional (more difficult to produce)
  - Little to no ability for the oil or gas to flow through the rock and into a wellbore as its trapped in low permeability rock
  - More expensive to develop, need special technology (i.e. hydraulic fracturing)

The Basics:
Why Develop Unconventional Resources?

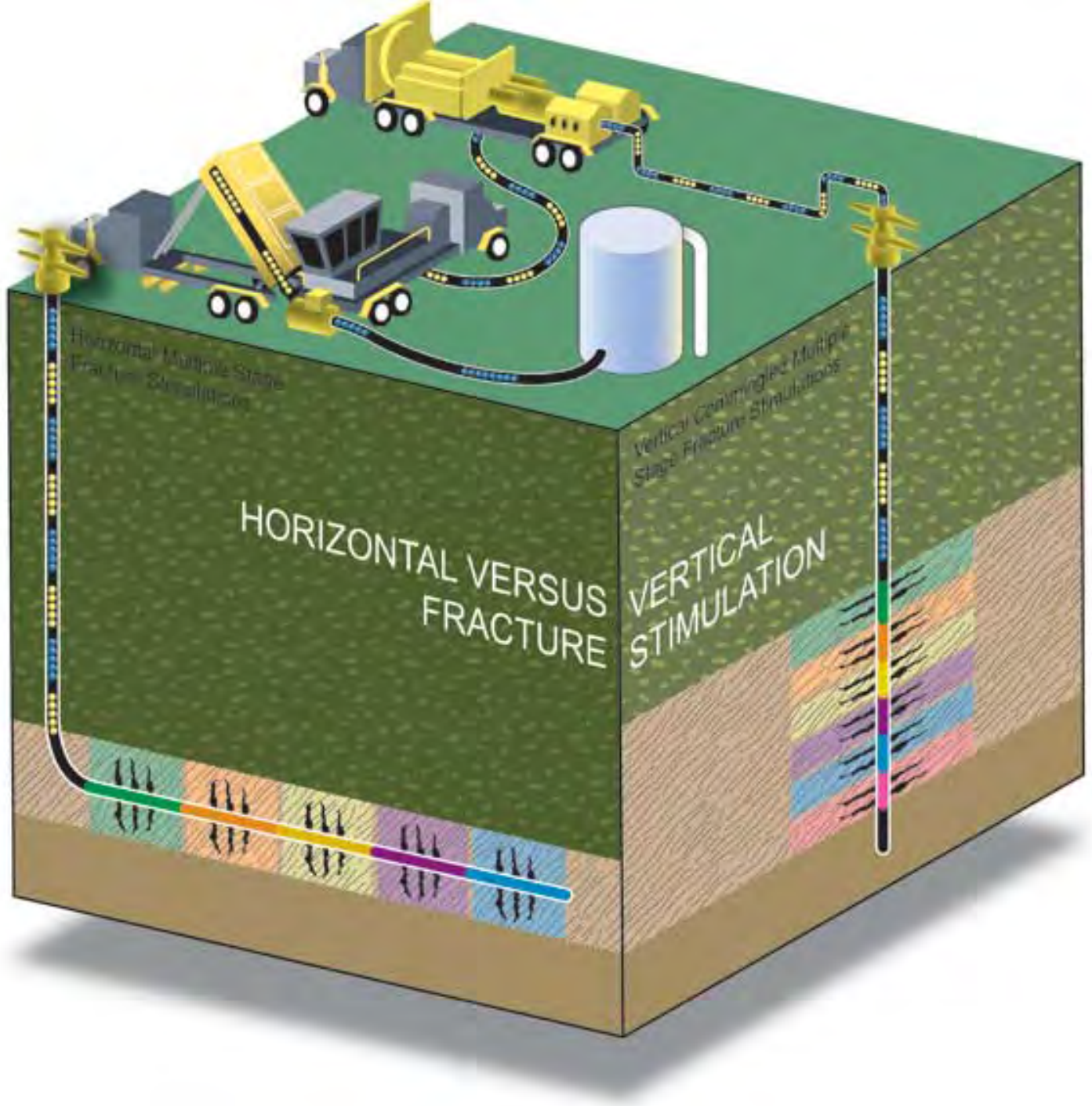


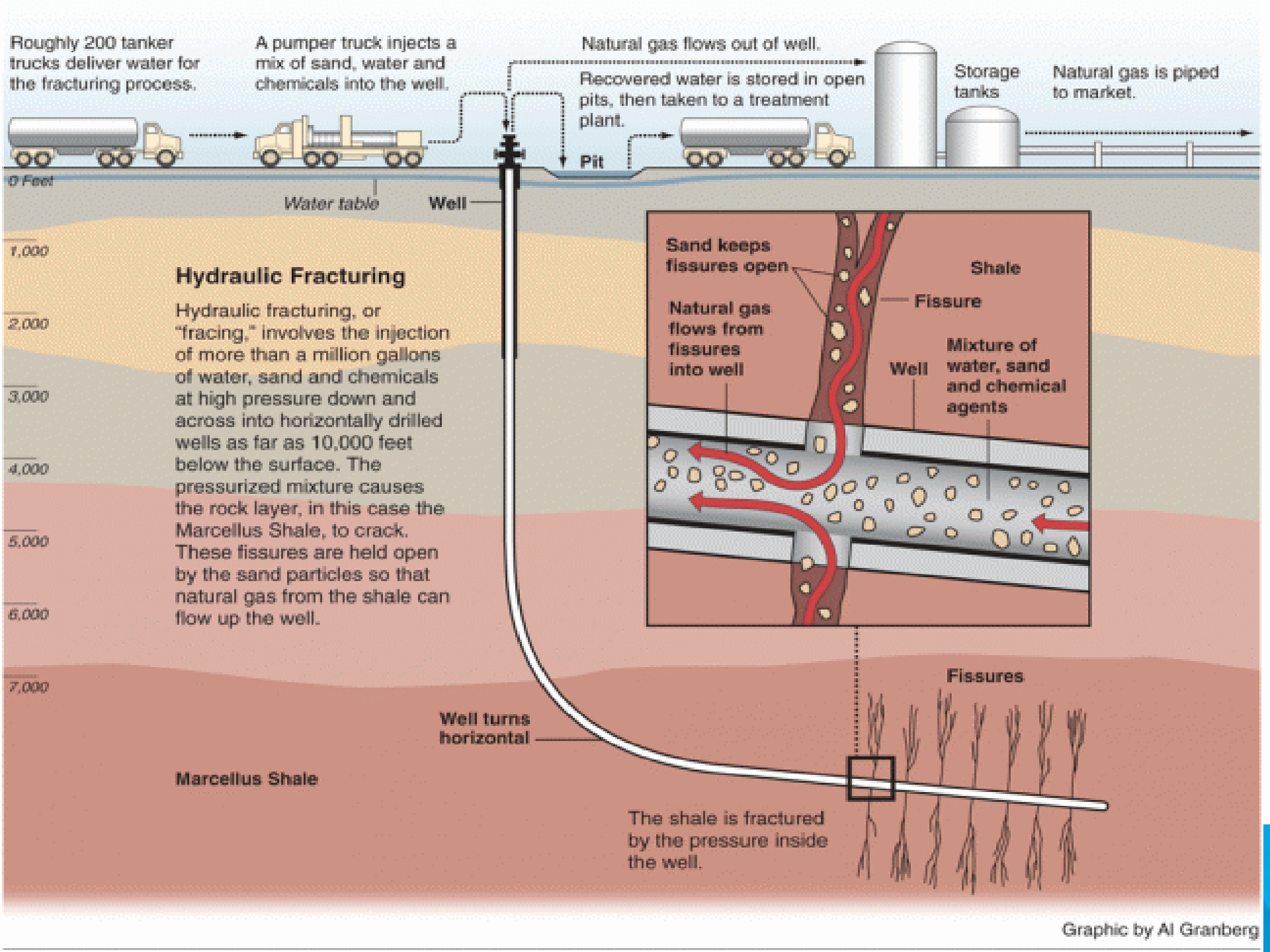
Source: Canadian Association of Petroleum Producers

The Basics:
What is Hydraulic Fracturing?

- **Hydraulic Fracturing** is a process that injects fluids into a wellbore under high pressure to fracture or crack the rock to allow hydrocarbons to flow.

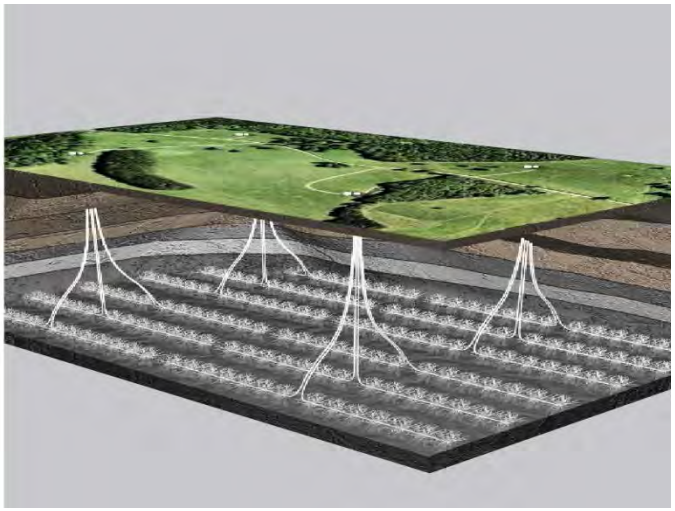
- **Horizontal Multi-Stage Hydraulic Fracturing** is the process by which multiple fractures are created along the horizontal section of the well bore and are injected with fluids to allow hydrocarbons to flow.


HORIZONTAL VERSUS VERTICAL
FRACTURE STIMULATION



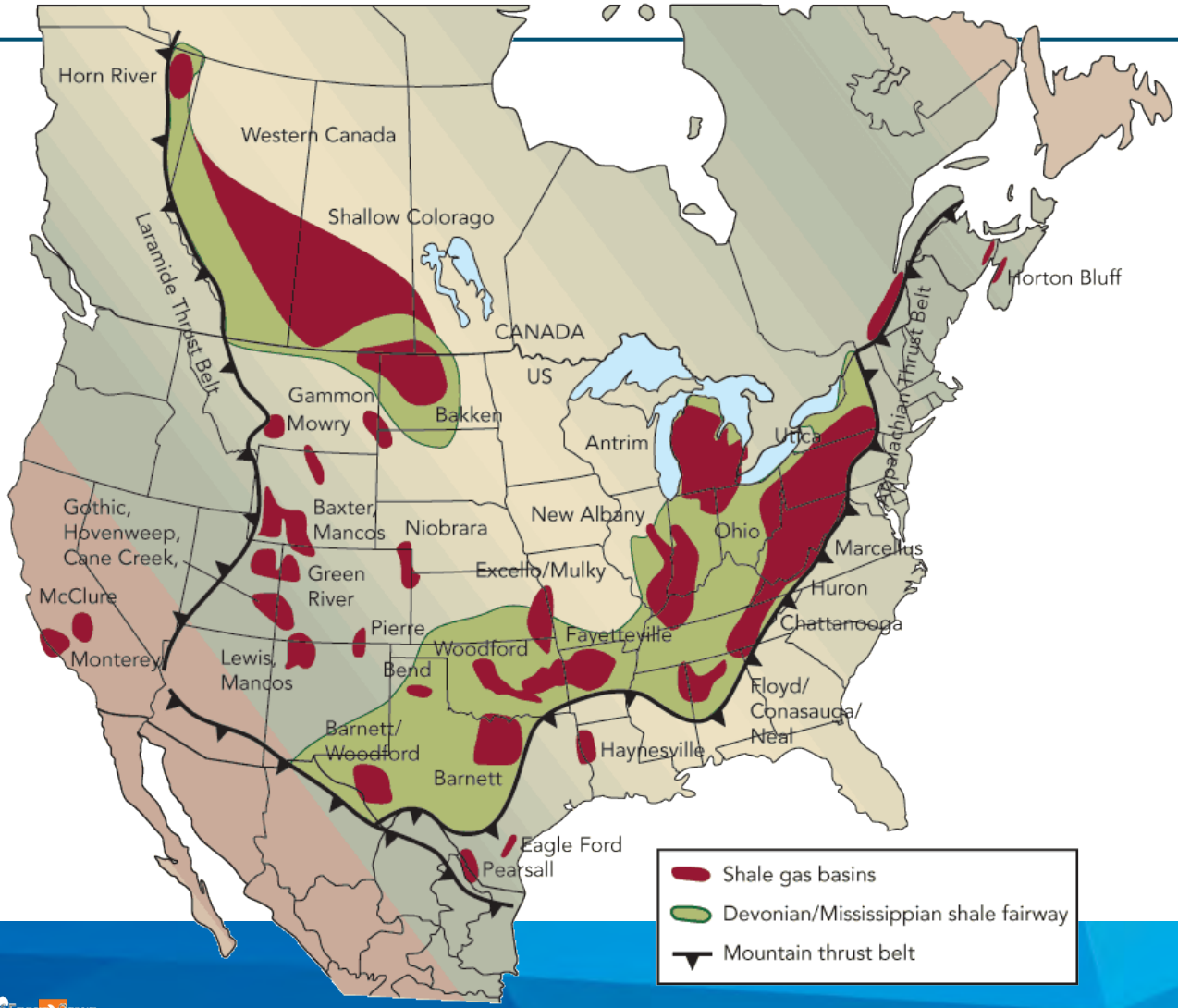
Graphic by Al Granberg

Why “Frack”?



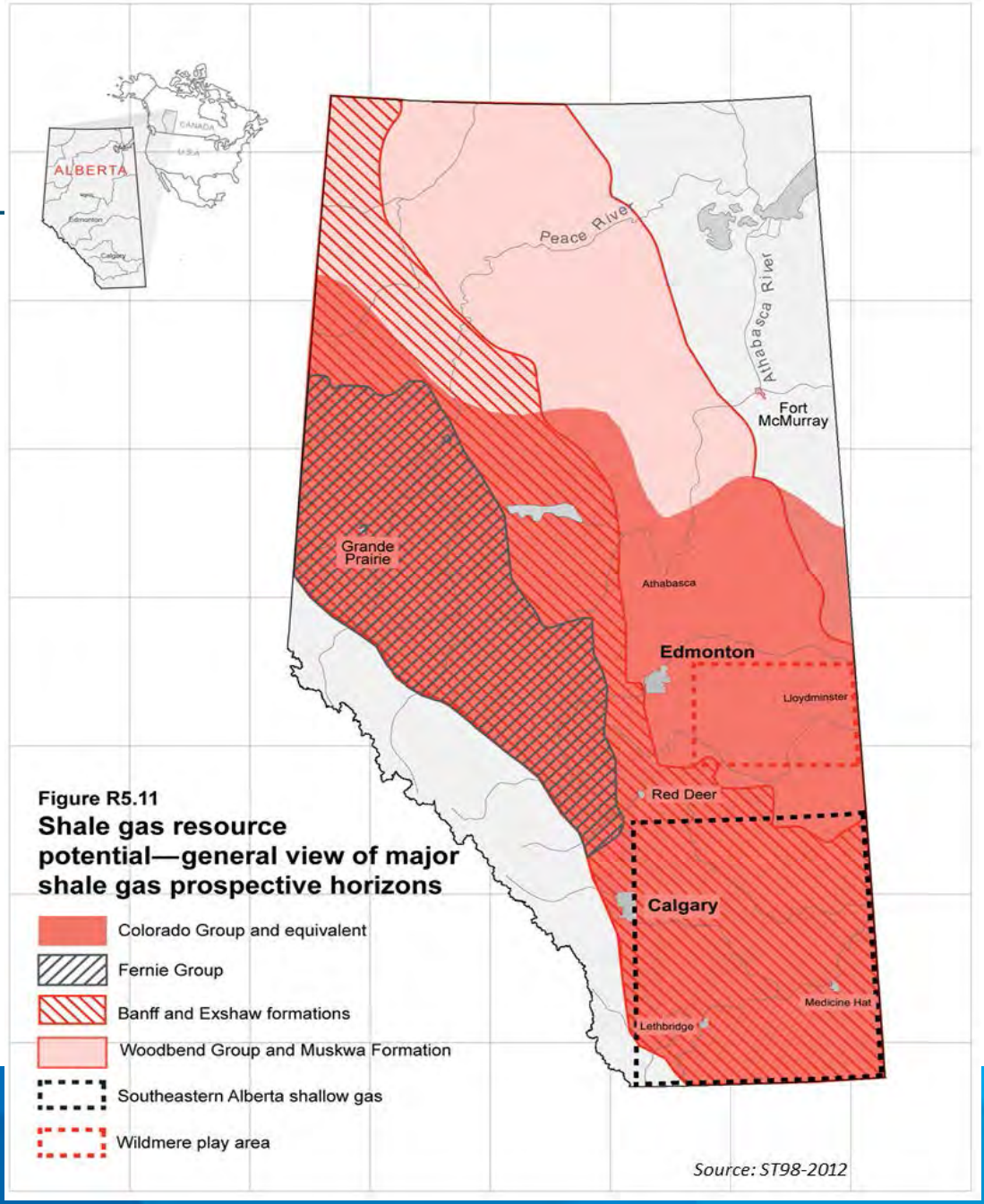
- Accessibility to more oil and gas products
- Multiple well-bores off of one well pad
- Cost efficient practice for industry
- Employment opportunities & broad economic benefit

Shale Gas Plays of North America



Source: Advanced Resources, SPE/Holditch Nov 2002 Hill 1991, Cain, 1994 Hart Publishing, 2008. Modified from Ziff Energy Group, 2008

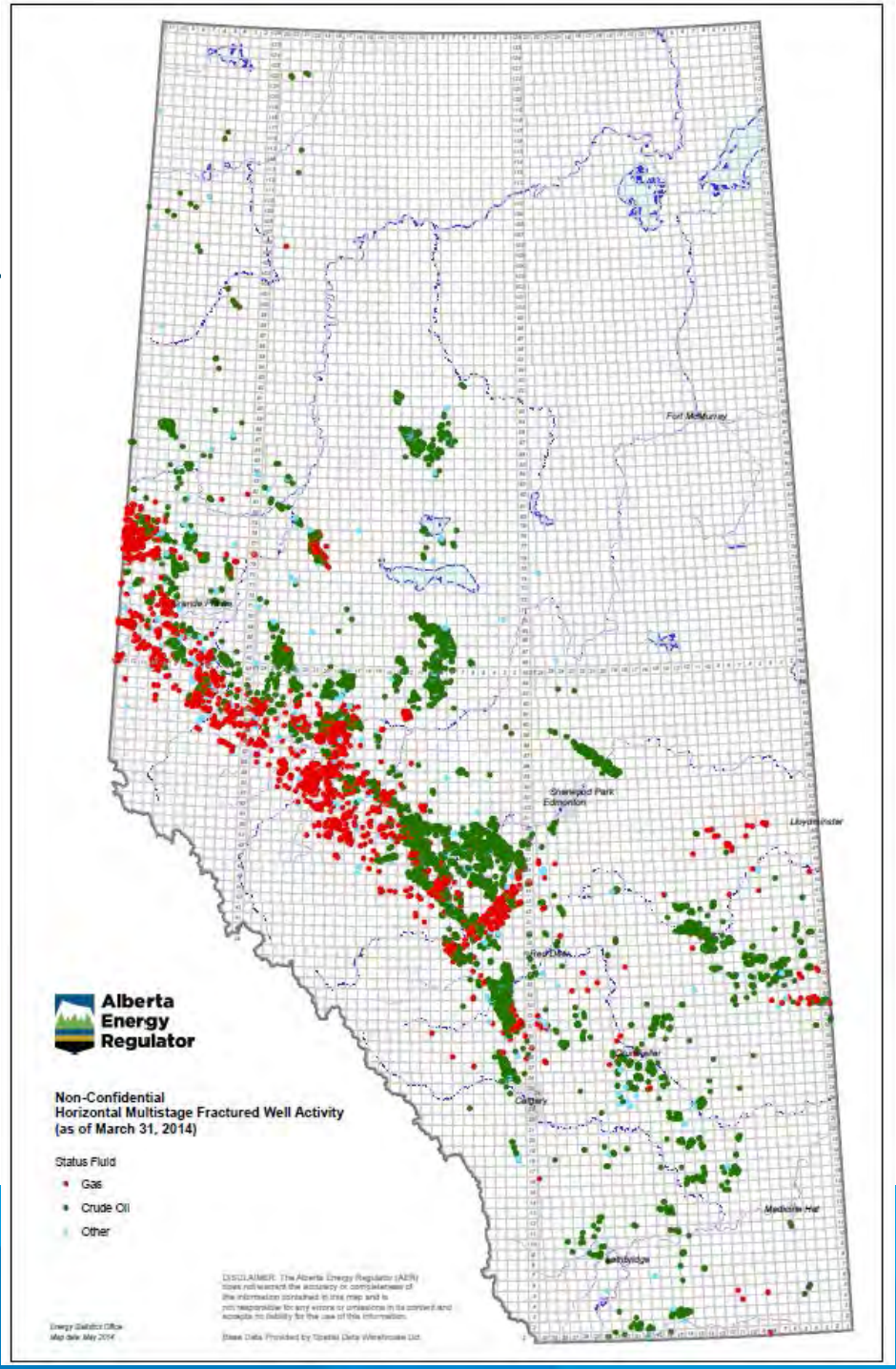
Shale Gas Plays of Alberta




Surge Tanks
Diesel
Electrical Wireline Units
Well Test Equipment
Command Centre
Frac Sand
Frac Pumps
Coiled Tubing
Wellheads
Frac Line

Source: AER

Horizontal Multistage Fractured Well Activity by Fluid Type March 31, 2014



Environmental Public Health Issues & Challenges

Media & Public Concerns

- Documentaries & Mainstream Movie
- United States Experience
- Canadian Research & Recommendations
  - New Brunswick Chief Medical Officer of Health's Recommendations Concerning Shale Gas (2012)
  - Council of Canadian Academies (2014)
- Alberta Community Concerns & Events

Alberta's Activities

Unconventional Oil & Gas Development

- Enhanced Collaborative Cross Government Work
- Single Energy Regulator
- Integrated Resource Management System
- Unconventional Regulatory Framework & Play Based Regulation
- Regional Land Use Planning

Alberta's Activities
Regulatory Policy

- Enhanced requirements introduced in 2013 include:
  - Well integrity
  - Inter-wellbore Communication
  - Protection of Non-Saline Aquifers
  - Fracturing near domestic water wells
  - Notification requirements
  - Electronic submission of Fracture Fluid Composition
  - Trade secret – hazardous/non-hazardous
  - Reported publicly via FracFocus.ca
  - Water Usage Data - source & quantity

Hydraulic Fracturing Fluid Product Component Information Disclosure

Last Fracture Date:	March 04, 2013
Last Submission Date:	April 30, 2013
Province:	AB
ERCB Field Centre:	Drayton Valley
Surface location:	01-01-059-02W6
Well Licence Number:	0450078
Licensee Name:	Tourmaline Oil Corp.
Unique Well Identifier:	02/04-01-059-02W6/2
Well Name:	TOURMALINE 102 HZ SMOKY 4-1-59-2
Number of Stages:	18
Bottom Hole Latitude:	54.066891
Bottom Hole Longitude:	-118.172514
Lat/Long Projection:	NAD 83
Production Fluid Type:	Not Applicable
True Vertical Depth (TVD):	3,177.90
Total Water Volume (m3):	4,063

Example from FracFocus.ca

Hydraulic Fracturing Fluid Composition:

Fracture Start/End Date:	Component Type	Trade Name	Supplier	Purpose	Ingredient/Family Name	CAS # / HMIRC #	Concentration in Component (% by mass)	Concentration in HFF (% by mass)
Mar 3 2013 - Mar 4 2013	CARRIER FLUID				Water	Not Available	100.000000%	78.495435%
	PROPPANT	Frac Sand - regular	Trican		silica crystalline	14808-60-7	300.000000%	17.188625%
	PROPPANT	Frac Sand Resin Coated Cured	Trican		silica crystalline	14808-60-7	100.000000%	3.961015%
	PROPPANT	Frac Sand Resin Coated Cured	Trican		hexamethylenetetramine	100-97-0	1.000000%	0.039610%
	ADDITIVE	HCl 15%	Trican	Acid	water	7732-18-5	85.000000%	0.000944%
	ADDITIVE	HCl 15%	Trican	Acid	hydrochloric acid	7647-01-0	15.000000%	0.000167%
	ADDITIVE	Busan 94	Trican	Bactericide/Biocide	polyethylene glycol	25322-68-3	60.000000%	0.008291%
	ADDITIVE	Busan 94	Trican	Bactericide/Biocide	2,2-dibromo-3-nitrilopropionamide	10222-01-2	30.000000%	0.004145%
	ADDITIVE	Busan 94	Trican	Bactericide/Biocide	sodium bromide	7647-15-6	4.000000%	0.000552%

Alberta's Activities

Regulatory Policy

- Casing Requirements
- Injection & Disposal Wells
- On-site Storage & Treatment of Waste
- Emergency Response
- Noise & Light

Alberta's Activities

In Progress

- Odour Management & Assessment
- Baseline Water Well Testing Requirements
- Water Allocation & Surface Storag
- Use of Human Health Impact Assessments in Play developments
- Urban Drilling Policy Development

Alberta's Activities

In Progress – Research Towards Policy

- Air Quality
- Induced Seismic Activity
- Chemical Usage
- Support to the Canadian Water Network
  - Wastewater Management
  - Subsurface impacts
  - Landscape impacts
  - Water Safety Frameworks

Questions?

Email contact: Merry.Turtiak@gov.ab.ca