On shaky ground: Evidence of public health impacts from shale gas production and hydraulic fracturing

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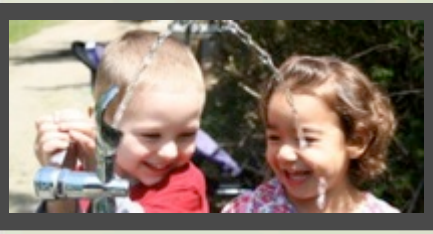
National Collaborating Center for Environmental Health

NCCEH Environmental Health Seminar
February 25, 2016




National Collaborating Centre for Environmental Health
Centre de collaboration nationale en santé environnementale

BC Centre for Disease Control
An Agency of the Provincial Health Services Authority

Outline

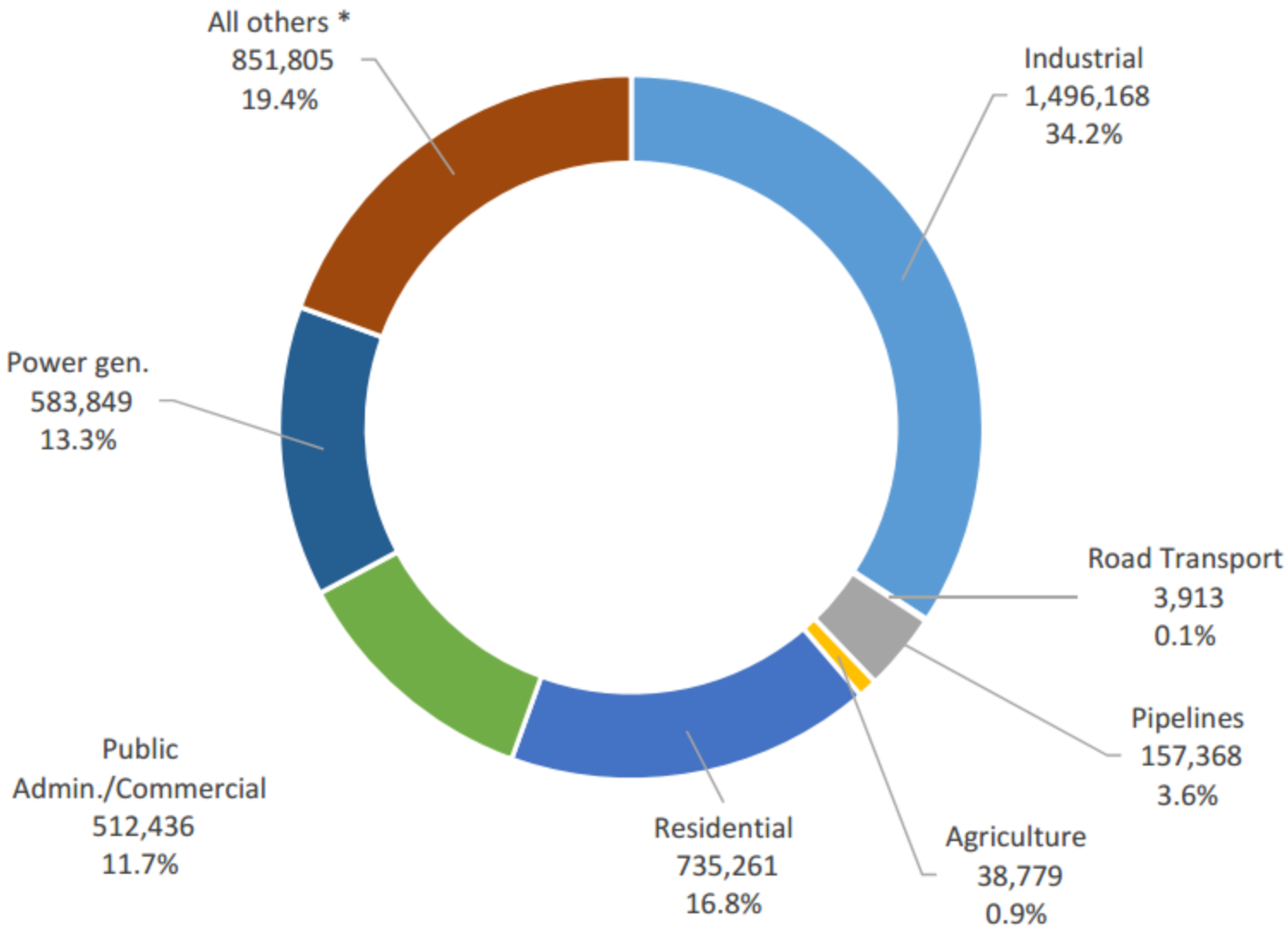
- What is hydraulic fracturing?
- Public Health Issues in brief:
  - Water contamination
  - Air quality
  - Traffic and Noise
  - Psycho-social issues
  - Seismic Issues
- Summary

What is Shale Gas?

Natural gas (**essentially methane**) that is trapped in fine-grained, sedimentary **(shale)** rock and has low permeability

"Unconventional" implies it is difficult to extract and requires different drilling procedures

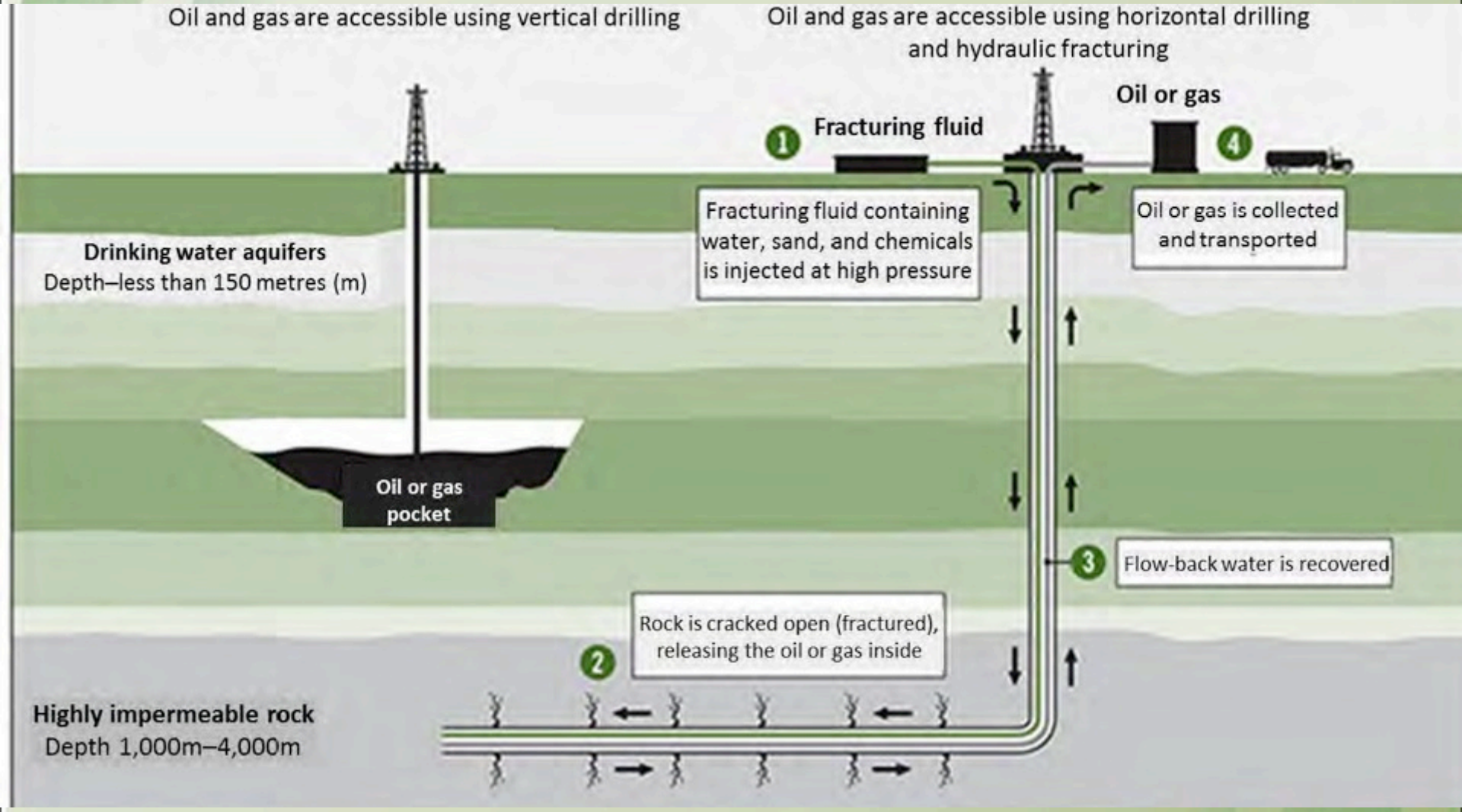
Natural gas - demand by sector 2014 (TJ,%)



Source: Statcan 128-0016

*transformed to RPP or steam, producer use, non-energy use

Conventional versus Unconventional

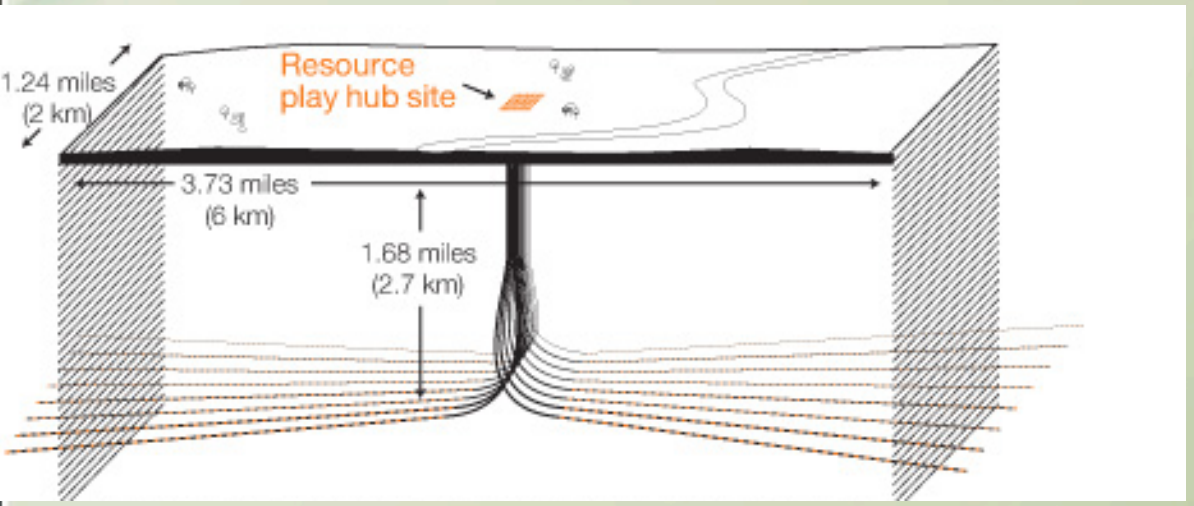


Multistage hydraulic fracturing

Involves the use of more than one stage of fracturing in the wellbore.

Horizontal drilling and high-pressure hydraulic fracturing at multiple intervals along the horizontal portion of the well.

Relatively new technology that has opened up resources that were previously inaccessible



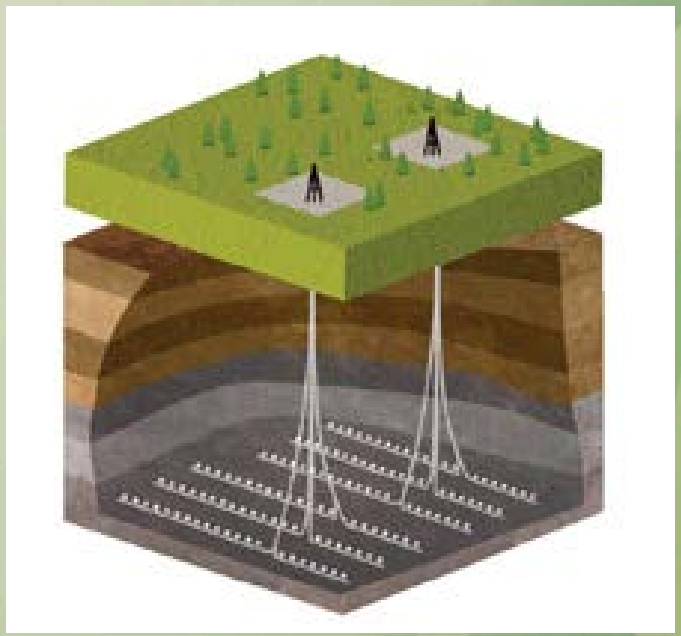
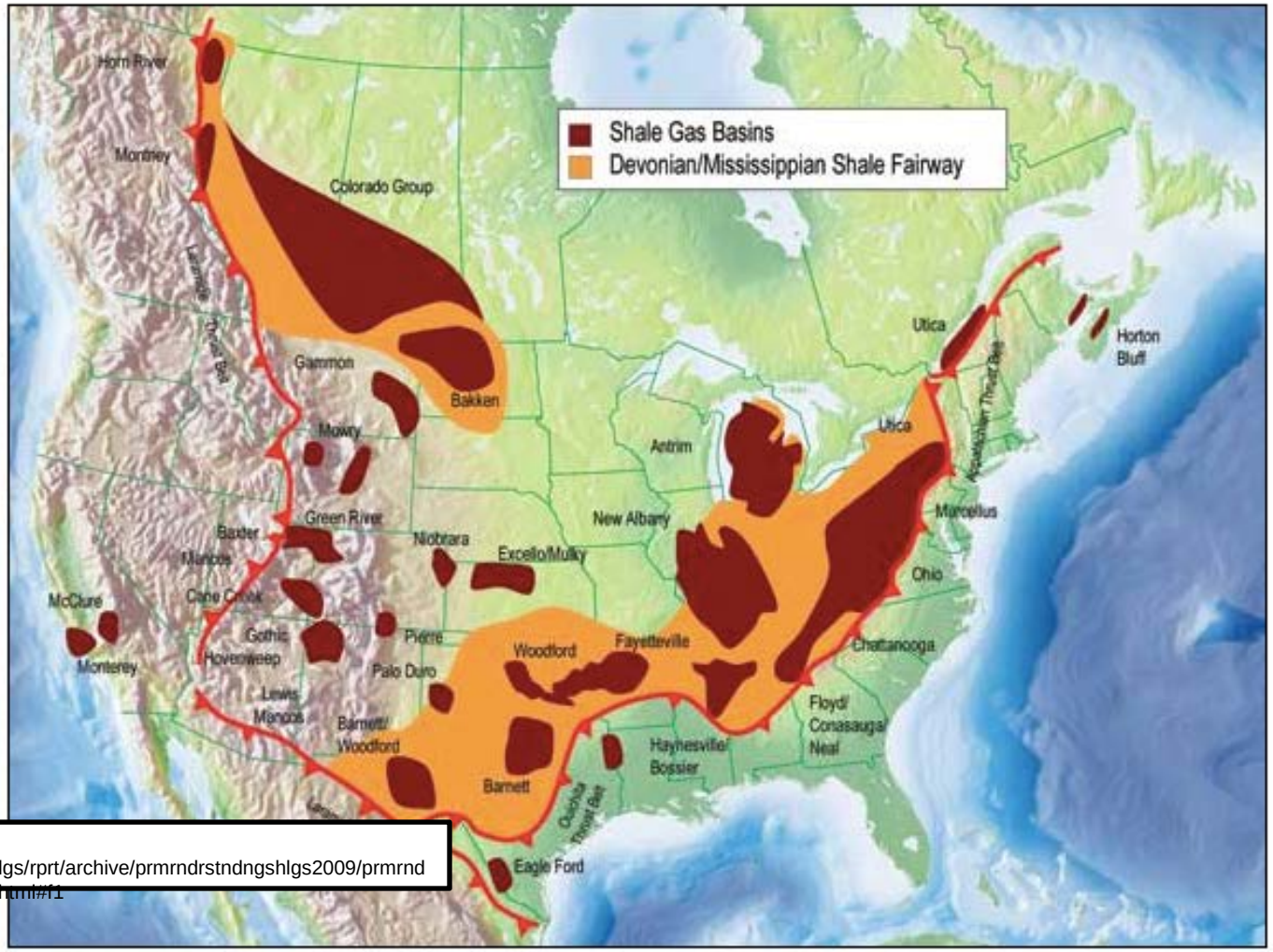


Figure 1: Shale Gas Plays of North America



https://www.neb-one.gc.ca/nrg/sttstc/ntrlgs/rprt/archive/prmrndrstndngshlgs2009/prmrndrstndngshlgs2009-eng.html#f1

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

Shale gas and HF across Canada

- Majority of shale gas activity in BC & Alberta
  - Montney shale is particularly productive but there are >15 potential shale gas deposits in Alberta
- Saskatchewan- some exploration of Bakken shale play
- Ontario- no current activity for the few shale deposits
- Quebec- moratorium on shale gas due to social and environmental risks (2011)
- Nova Scotia
  - Moratorium on on-shore high volume hydraulic fracturing
- New Brunswick- will reconsider current ban in 2016
- Territories - Some exploration on Yukon and NWT

Ottawa sued over Quebec fracking ban

Company's suit based on NAFTA provisions

The Canadian Press Posted: Nov 23, 2012 11:05 AM ET | Last Updated: Nov 23, 2012 12:23 PM ET

Hydraulic fracturing has come into widespread use in North America. (Associated Press)

An American company intends to sue the Canadian government for more than $250 million over Quebec's controversial moratorium on hydraulic fracturing or fracking.

General public perception

Google lighting water on fire from faucet

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Light Your Water On Fire from Gas Drilling, Fracking ...
https://www.youtube.com/watch?v=4LBjSXWQRV8

Water makes up the majority of what is pumped down the well

Shale Gas Play	Average Volume of Water per Well (m^3)
Horn River Basin (BC)	76,900
Montney (BC)	6,700 - 9,700
Colorado (vertical wells in SK)	200 - 400
Utica (QC)	12,000 - 20,000
Frederick Brook (NB)	2,000 - 20,000
Horton Bluff (NS) (2 wells only)	5,900 - 6,800

CCA, 2014, p.88

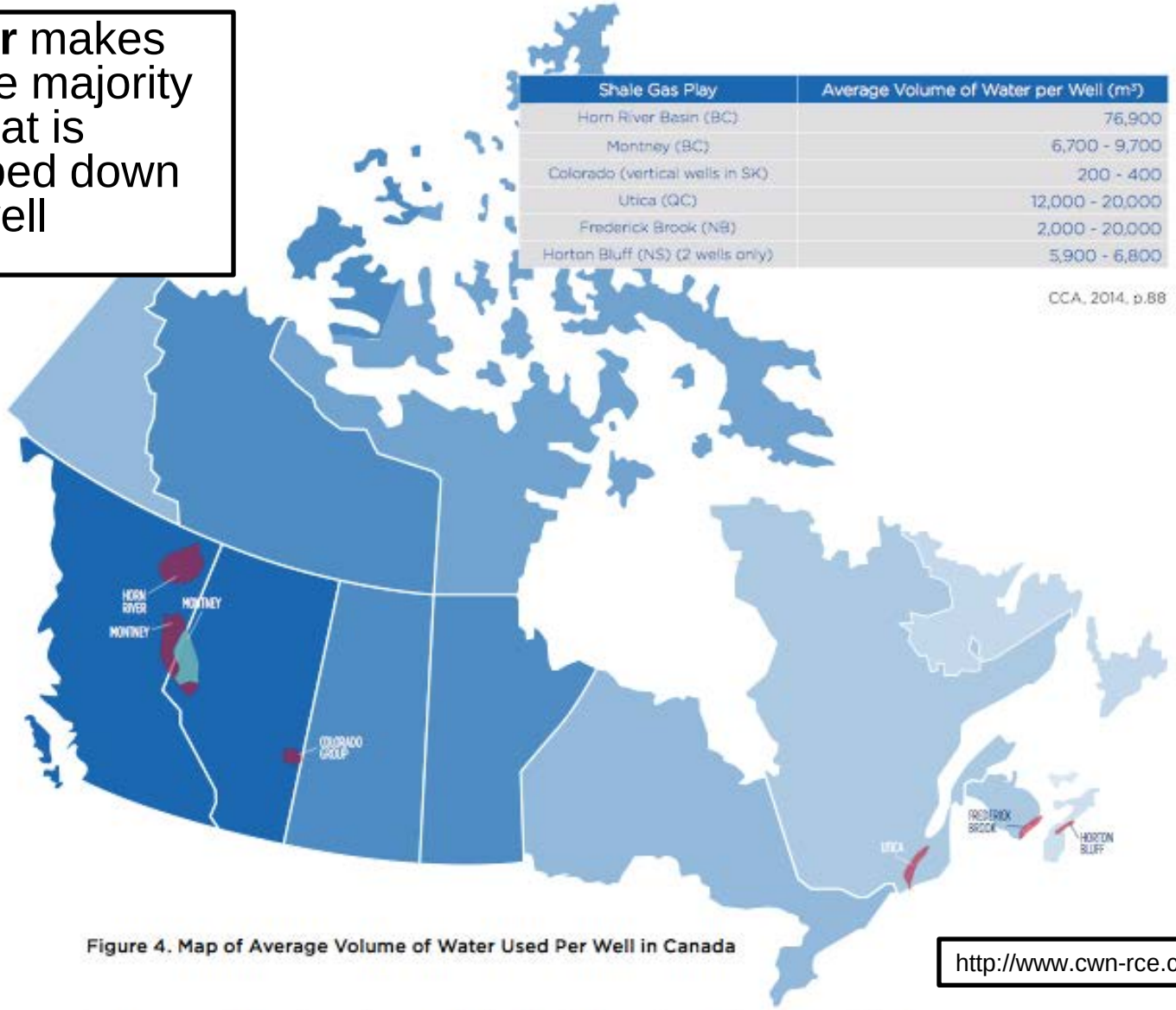


Figure 4. Map of Average Volume of Water Used Per Well in Canada

http://www.cwn-rce.ca/assets/resources/pdf/

Concerns regarding water use have resulted in industry innovations such as opportunities to reduce demand through water conservation measures, use of non-potable water and reuse/ recycling strategies. Innovations in freshwater conservation include methods to draw on municipal wastewater sources (e.g., Shell Canada in Dawson Creek) and use of other non-potable sources (e.g., saline groundwater in the Montney). While reuse strategies have obvious appeal from the point of view of conserving freshwater, the longer-term consequences of these

New report advances the discussion around hydraulic fracturing and water issues in Canada

October 6, 2015

October 6, Waterloo, ON – Central to the vast majority of conversations about hydraulic fracturing is the issue of water – its use, its management and protection, and its ecological, social and economic importance. There are many unknowns, but this is a fast-paced and important area in which decisions being made should hinge upon scientific knowledge.

A new report, Water and Hydraulic Fracturing: Where knowledge can best support decisions in Canada, issued by Canadian Water Network (CWN), provides a comprehensive and up-to-date assessment of where effective access to research can lead to better decisions. The report summarizes what we know now, what we most need to know and what is reasonably obtainable through targeted research.

"The focus of the report is about helping to ensure decision makers get real value from existing knowledge to support their decisions on what to do now and where to go next," says Bernadette Conant, chief executive officer of CWN.

The report draws widely on the knowledge base; in particular, on five CWN-funded projects from 2014-2015 that focused on where the unknowns – the knowledge gaps – are most centrally connected to our needs and questions involving water, including:

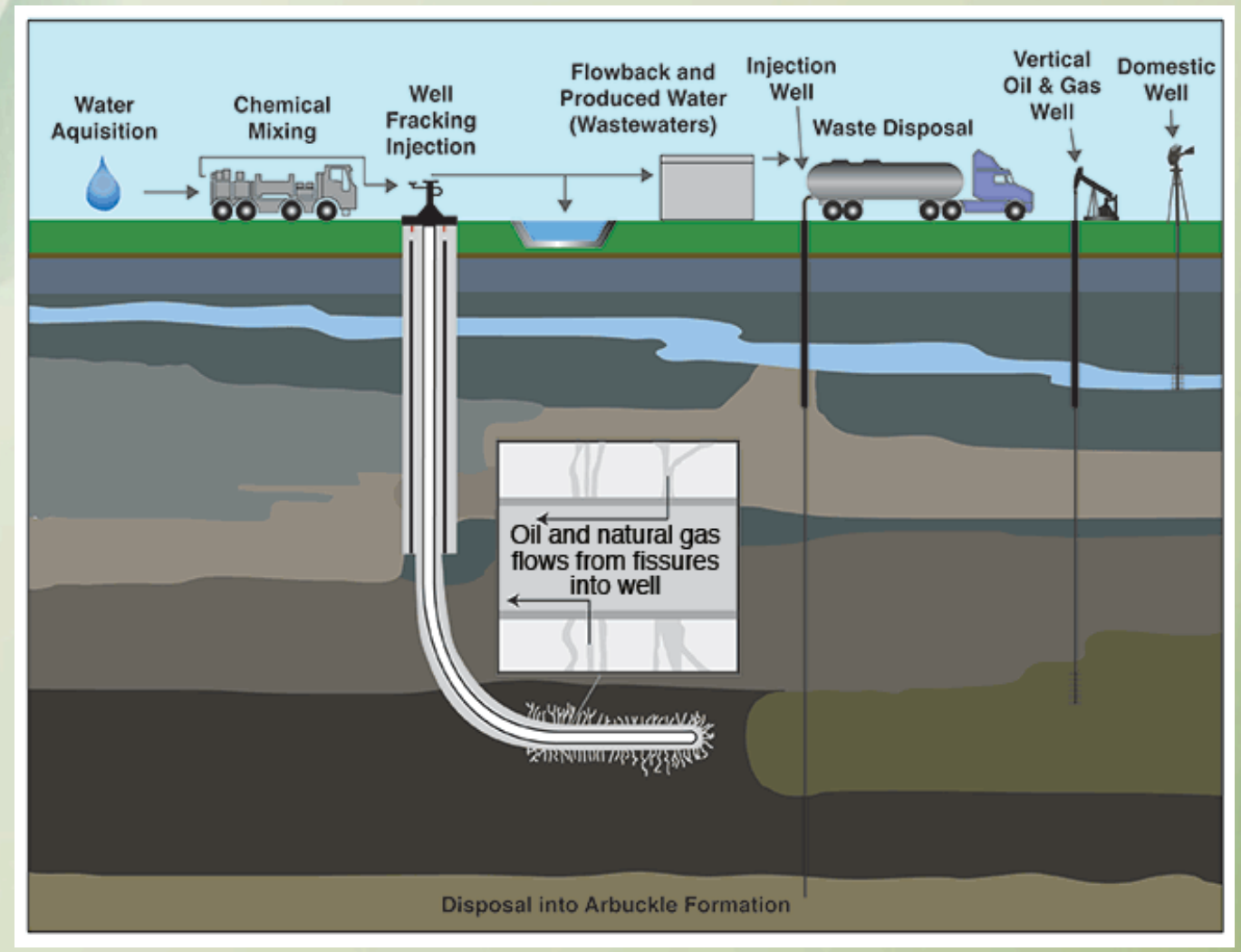
- Watershed governance and Aboriginal issues,
- Groundwater and subsurface impacts,
- Wastewater management, and
- Impacts of hydraulic fracturing on surrounding water resources.

These projects involved over 70 researchers from 18 universities across Canada, along with 20 partners, including Aboriginal organizations, government, industry and non-governmental organizations. The report also draws on the collective experience and expertise of federal, provincial and territorial government and industry representatives.

"There is a huge need for scientific knowledge to help decision makers," says Dr. Simon Courtenay, scientific director of CWN. "Ensuring that leading science underpins decisions being made in Canada about hydraulic fracturing is extremely important, not only for responsible resource development but for our collective health and the environment."

Falling oil and gas prices have recently slowed the pace of development, but continued development of unconventional reserves in Canada can be expected going forward. This slowdown in pace is an excellent opportunity to focus on key

Potential sources of Water Contamination



Hydraulic Fracturing Fluid Product Component Information Disclosure

Fracture Date:	06/07/2012
Province:	BC
Region:	Brassey
Well Number:	27912
Operator Name:	ConocoPhillips Canada Operations Ltd.
Well Name:	COPOL ET AL HZ BRASSEY A12-10-077-20
Longitude:	-121.013223
Latitude:	55.393787
Long/Lat Projection:	NAD83
Production Type:	Undefined
True Vertical Depth (TVD):	4,894
Total Water Volume (m3)*:	947

FracFocus Chemical Disclosure Registry

What is a Hazardous Material Information Review Act Claim Exemption?

Within Canada, any supplier who is required, pursuant to the provisions of the Hazardous Products Act, to disclose the chemical identity or concentration of any ingredient of a controlled product may, if the supplier considers such information to be confidential business information, claim an exemption from the requirement to disclose that information by filing a claim for exemption under the Hazardous Material Information Review Act.

Hydraulic Fracturing Fluid Composition:

Trade Name	Supplier	Purpose	Ingredients	Chemical Abstract Service Number (CAS #)	Maximum Ingredient Concentration in Additive (% by mass)**	Maximum Ingredient Concentration in HF Fluid (% by mass)**	Comments
Water	Operator	Carrier	Water		1.00%	0.31987%	
Nitrogen	Trican	Carrier	nitrogen	7727-37-9	1.00%	0.19047%	
Carbon Dioxide	Trican	Carrier	carbon dioxide	124-38-9	1.00%	0.47332%	
AI-7NR	Trican	Acid Inhibitor	propargyl alcohol	107-19-7	0.01%	0.00000%	
			non-hazardous ingredients		0.99%	0.00001%	
CC-77	Trican	Clay Control	1,3-propanediaminium-2-substituted, -hexaalkyl-, di halide		0.60%	0.00049%	HMIRC #7744
			non-hazardous ingredients		0.40%	0.00033%	HMIRC #7744
FC-1S	Trican	Surfactant	isopropanol	67-63-0	0.60%	0.00556%	HMIRC #7948
			quaternary ammonium compound		0.30%	0.00278%	HMIRC #7948
			non-hazardous ingredients		0.10%	0.00093%	HMIRC #7948
FC-2	Trican	Surfactant	organic salt		0.40%	0.00169%	HMIRC #7947
			water	7732-18-5	0.65%	0.00275%	HMIRC #7947
FCB-1	Trican	Breaker	severely refined mineral oil		1.00%	0.00061%	
HCl 5%	Trican	Acid	hydrochloric acid	7647-01-0	0.05%	0.00007%	
			water	7732-18-5	0.95%	0.00132%	
IC-8	Trican	Iron Control	2-mercaptoethanol	60-24-2	0.90%	0.00000%	
			cupric chloride	7447-39-4	0.10%	0.00000%	
			monoethanolamine	141-43-5	0.10%	0.00000%	
IF-2	Trican	Inhibitor Fortifier	potassium iodide	7681-11-0	1.00%	0.00000%	
S-4W	Trican	Surfactant	methanol	67-56-1	0.30%	0.00000%	
			fatty acid alkanolamide	68603-42-9	0.50%	0.00001%	
			diethanolamine	111-42-2	0.15%	0.00000%	

Evidence of drinking water contamination?

Clearly documented drinking water contamination is rare

- Pennsylvania – drinking water wells had methane concentrations 6x higher in homes < 1km from shale gas wells compared to farther away *(Jackson et al. 2013)*
- Texas, Barnett Shale formation, chemicals exceeded the EPA Drinking Water Maximum Contaminant Limit for private water wells located within 3 km of active natural gas wells. *(Fontenot et al. 2013)*

Contamination not associated with fracturing process itself

Leaks and spills more likely sources

- **Well integrity can decline over time and leak into surrounding water sources** *(Rahm et al. 2015)*
- **Spill** in January 2012 in Red Deer Alberta of of 500 barrels of flowback and production fluid, affected 4.5 hectares of surface area *(Rivard et al. 2014).*

Major problem- lack of baseline monitoring

Waste water disposal

Recycling/re-use of wastewater

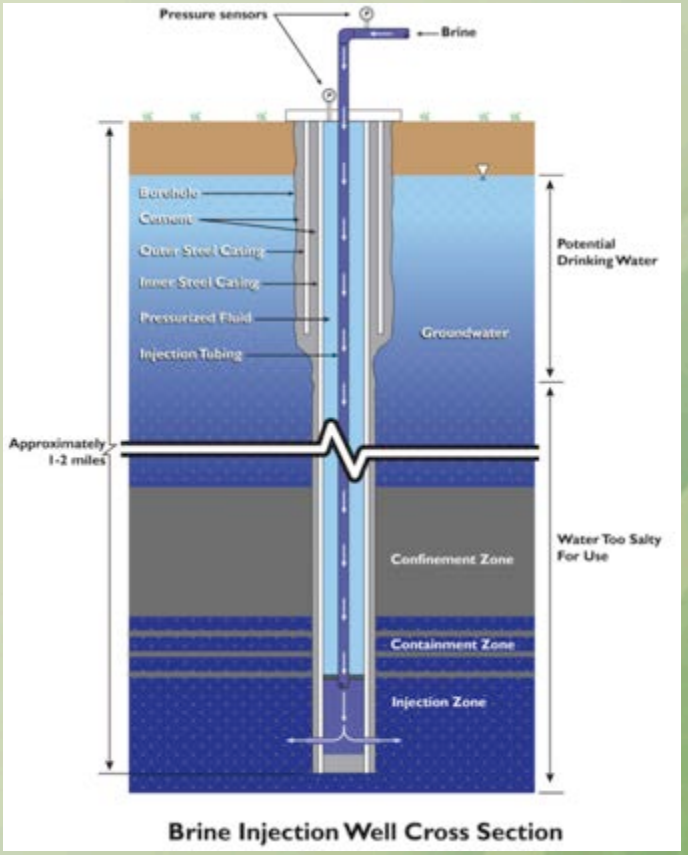
- Problem of contaminants including radioactive materials
- Surface spill leaks from storage

Deep well injection

– Wells extend far below aquifers

– Steel casings and cement is used to keep wells from leaking

– BUT risk of aquifer contamination if the well lacks integrity- leaks

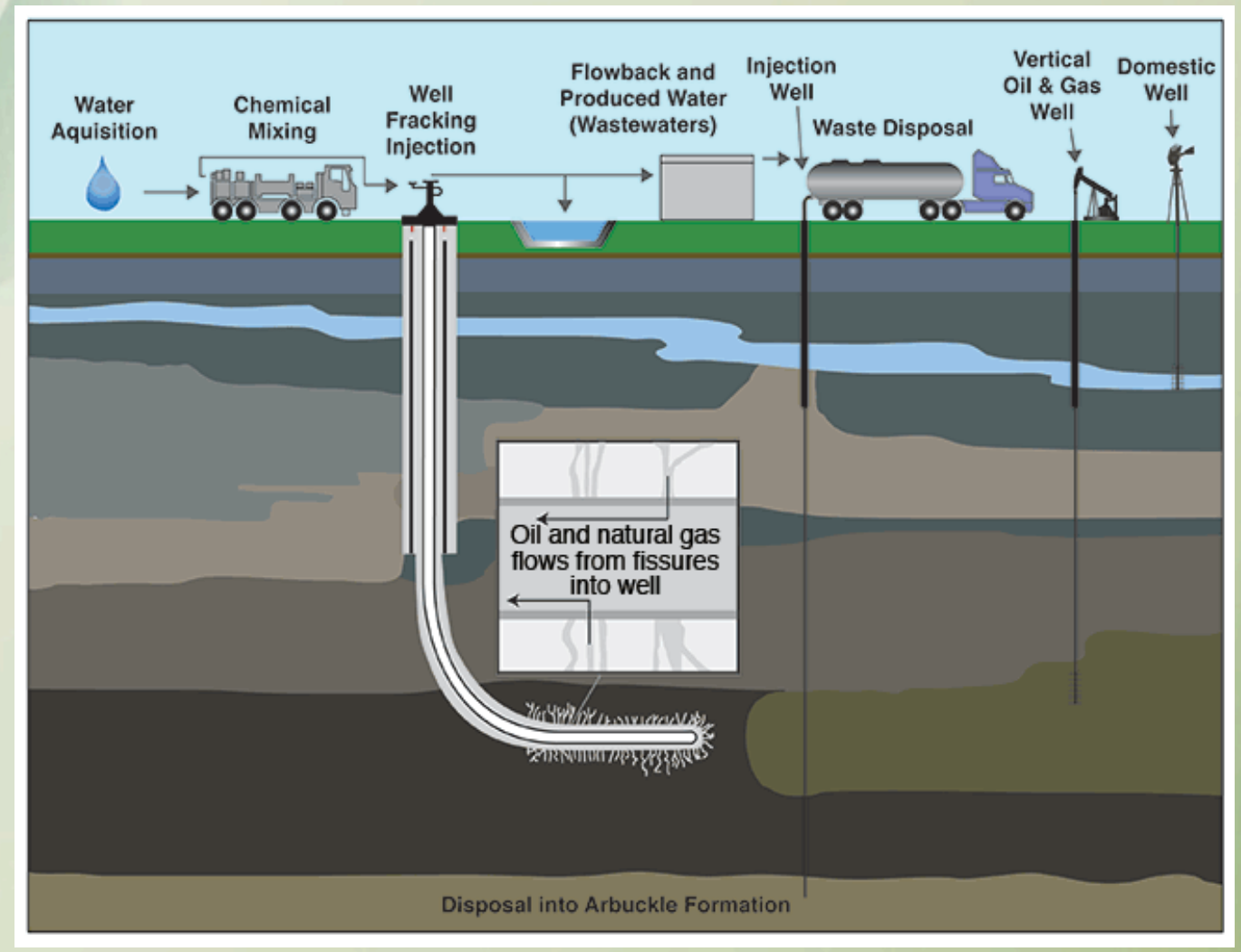


Brine Injection Well Cross Section

Summary of water issues

- Water use
- Potential contamination of drinking water
  - Surface spills, well integrity and disposal of waste water
  - Vertical propagation of fractures from the shale gas formations is rare
- Raises issues of water stewardship, conservation and governance
  - Particularly for remote communities
- Lack of research and monitoring (including base-line status)

Potential sources of Water Contamination



Air emissions during shale gas production

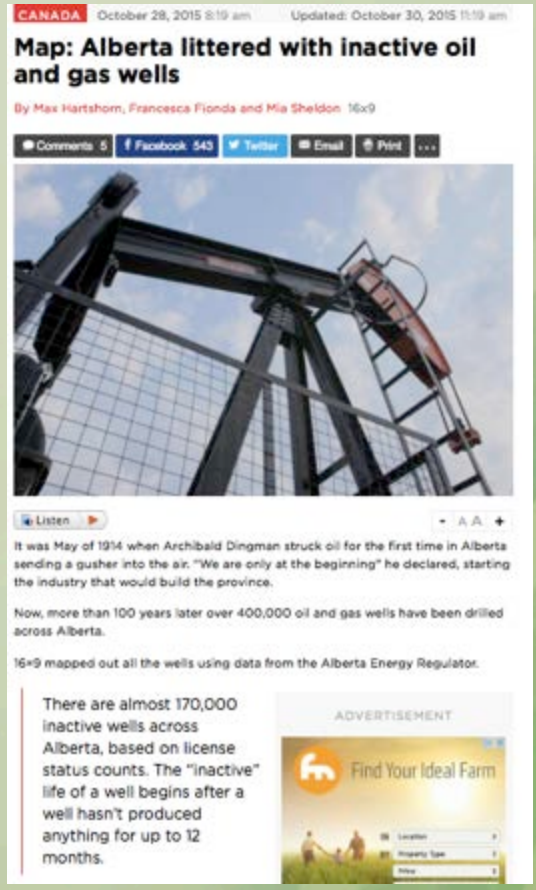
Emissions	Source
Nitrogen Oxides and Sulphur Oxides (NOx, SOx)	Diesel engines, natural gas compressors, fluid evaporation, flaring
Ozone (O_3)	By-product, created by mix of NOx and VOC at ground level
Volatile Organic Compounds (VOCs): **Benzene,** Toluene, **Ethylbenzene and** Xylene **(BTEX)**	Flowback during well completion, dehydration, condensate, evaporation processes, fugitive emissions, venting and flaring, spills
Crystalline Silica (respirable fraction)	Large amounts used as proppant in fracturing fluids, exposure during loading and unloading can be considerable
Diesel exhaust (includes particulate matter (PM) Carbon monoxide (CO) Hydrocarbons (HC), NOx and VOCs)	Large number of heavy vehicles travelling to and from drilling sites, diesel engines use, including generators, during drilling and production, compressors
Hydrogen Sulphide (H_2S)	Released during flaring and venting, well blow outs, line releases, and fugitive emissions from equipment and compressors. A component of sour gas.
Particulate Matter (PM)	Site preparation, fracturing process, road building, traffic, venting and flaring, engine exhaust from equipment on site
Methane, ethane, propane and butane (light VOCs)	Fugitive emissions during drilling and production, engine exhaust from production equipment and pneumatic pumps on site, leakage from well integrity problems (i.e. from poorly constructed wells). Routine venting and flaring, engine exhaust from equipment on site and improperly decommissioned sites
Carbon Dioxide (CO_2)	Venting and flaring
Radioactive materials (Radon)	Present naturally in varying concentrations in the earth. Can be brought to the surface through flowback fluids and produced water brine.[28] Airborne exposure is via radon gas

Evidence of air quality impacts?

- Proximity and stage of production are important determinants of exposure
- Outdoor air to indoor air: little research being done
  - Excess silica exposure for workers (NIOSH)- effects on residents unknown
- Residents situated closer to well sites (within 1 km) reported a greater prevalence of symptoms than those situated farther away. *(Rabinowitz et al 2015; McKenzie et al. 2012)*,

Orphaned and Abandoned Wells

- Over 550,000 oil and gas wells have been drilled in Canada
- Potential for leakage
  - Eg Methane (climate change issues)
- Inter-well communication
  - Also known as “frack hits”
  - Wells in densely drilled areas connect with others, active or dormant, deep underground
  - Although rare, can lead to leaks and blow outs
    - Eg Drayton Valley, Edmonton 2011



CANADA October 28, 2015 8:19 am Updated: October 30, 2015 11:19 am

Map: Alberta littered with inactive oil and gas wells

By Max Hartshorn, Francesca Fionda and Mia Sheldon 16x9

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It was May of 1914 when Archibald Dingman struck oil for the first time in Alberta sending a gusher into the air. “We are only at the beginning” he declared, starting the industry that would build the province.

Now, more than 100 years later over 400,000 oil and gas wells have been drilled across Alberta.

16x9 mapped out all the wells using data from the Alberta Energy Regulator.

There are almost 170,000 inactive wells across Alberta, based on license status counts. The “inactive” life of a well begins after a well hasn’t produced anything for up to 12 months.

Community Concerns – Truck traffic

With more truck traffic there is an increase in automobile accidents, excess noise and air pollution (especially diesel emissions and particulate matter)

A multistage well requires about 1000 truck round trips to deliver equipment, chemicals, sand and water.
Increased truck traffic increases the frequency of collisions and need for road maintenance.

Community Issues

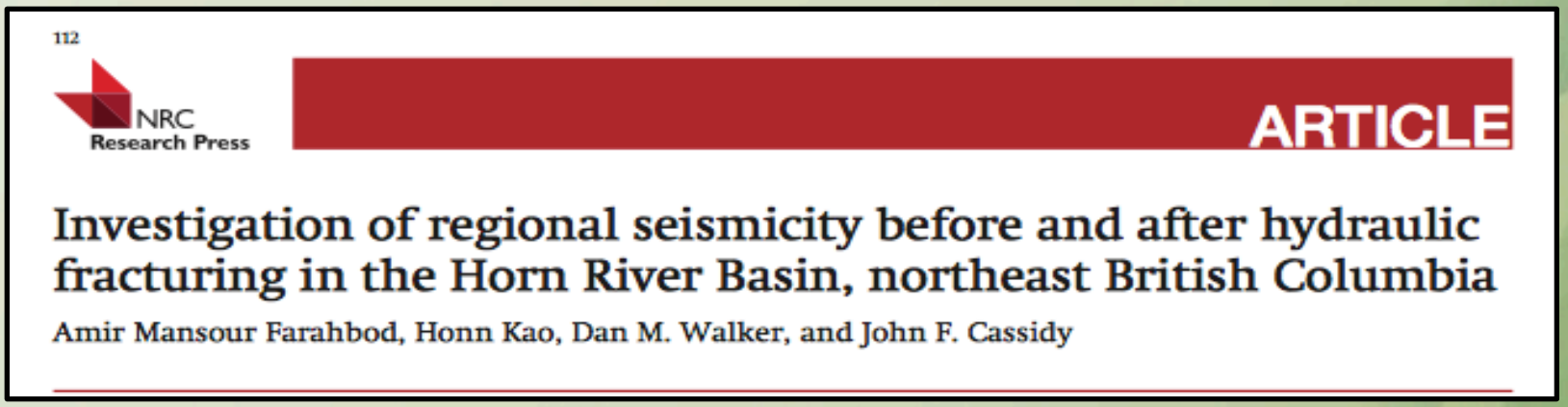
- **Positive side:** Economic opportunities for local economy and job creation, improved road network.
  - Direct and indirect employment opportunities
- **Negative:** stress on roadways, law enforcement, schools and housing, hospitals and clinics
  - In Pennsylvania counties with the highest density of UNGDP well (>15 wells per square mile) had greater increase in disorderly conduct, drunk driving and public intoxications arrests than counties with no wells. The rural Pennsylvania counties with UNGDP had a 61% greater increase in STI rates than counties without UNGDP.
- **First Nations:** complex issues around land.
  - Habitat destruction can affect cultural practices and identity, impacting health and resilience. *(see* Shale gas development and community response: perspectives from Treaty 8 territory, British Columbia *Garvie 2014)*
- **Anxiety** is fostered by the perception of a lack of transparency about risks from industry and government authorities.
- Rise of lawsuits in both Canada and the US

Evidence of community impacts on health?

- Few epidemiological studies
  - Cross-sectional survey in the Marcellus shale formation, in Pennsylvania: *(Rabinowitz et al. 2015)*
  - The odds of reporting of skin conditions and upper respiratory symptoms were significantly higher for residents <1 km from gas wells.
- Studies on fetal growth effects have mixed results
  - Pennsylvania retrospective study of infants whose mothers resided in areas with more shale gas wells when pregnant, had lower birth weight and a higher incidence of small-for-gestational age, but not of preterm birth. *(Stacy et al. 2015)*
  - A similar study of infants showed a higher incidence of pre-term birth but not lower birth weight whereas another found no associations with fetal growth (but an increase in congenital heart defects)
- Need most robust study designs and better exposure measures

Seismic risks

- The process of hydraulic fracturing intentionally creates tiny cracks deep in the earth
- This action can cause changes in pressure underground
  - Slips can occur on dormant or unknown faults



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NRC Research Press

ARTICLE

Investigation of regional seismicity before and after hydraulic fracturing in the Horn River Basin, northeast British Columbia

Amir Mansour Farahbod, Honn Kao, Dan M. Walker, and John F. Cassidy

Earthquake in Northern B.C. caused by fracking, says regulator

'This seismic event was caused by hydraulic fracturing,' says regulator's CEO

By Betsy Trumpener, CBC News Posted: Dec 16, 2015 6:53 AM PT | Last Updated: Dec 16, 2015 11:52 AM PT

Hydraulic fracturing involves pumping water and chemicals deep into the earth to fracture shale rock beds and release natural gas for extraction. ((Brennan Linsley/The Associated Press))

Fox Creek fracking operation closed indefinitely after earthquake

Magnitude 4.8 quake rattles area, but no injuries or damage reported, energy regulator says

CBC News Posted: Jan 12, 2016 2:14 PM MT | Last Updated: Jan 14, 2016 7:15 PM MT

Fox Creek earthquake 2:23

A hydraulic fracturing operation near Fox Creek, Alta., has been shut down after an earthquake hit the area Tuesday.

The magnitude 4.8 quake was reported at 11:27 a.m., says Alberta Energy Regulator, which ordered the shutdown of the Repsol Oil & Gas site 35 kilometres north of Fox Creek.

Carrie Rosa, spokeswoman for the regulator, says "the company has ceased operations … and they will not be allowed to resume operations until we have approved their plans."

Rosa added the company is working with the energy regulator to ensure all environmental and safety rules are followed.

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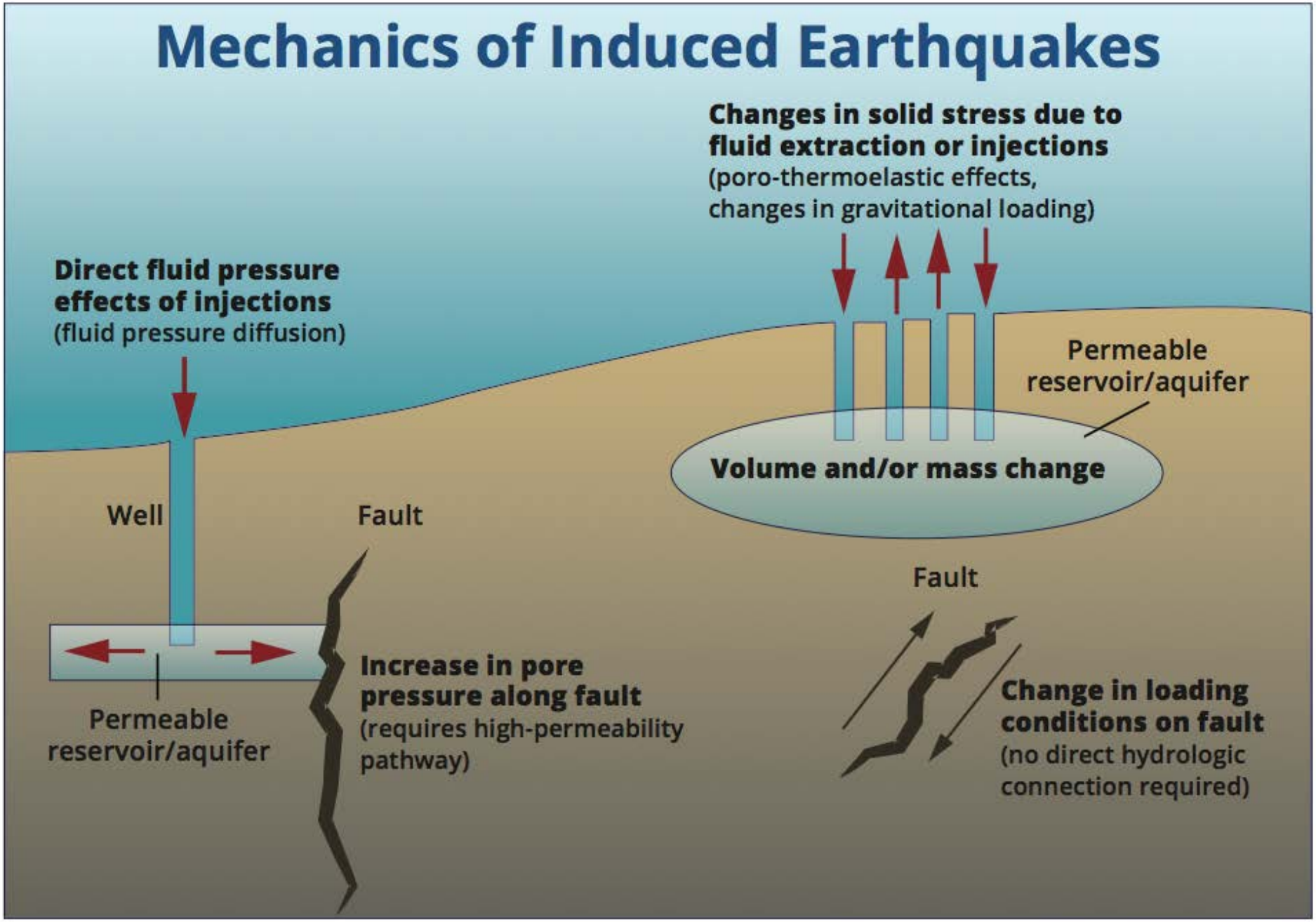


Ellsworth et al. 2013

What causes induced earthquakes?

- "If we look at tens of thousands of wells that have been stimulated with hydraulic fracking in Western Canada, less than half a percent (0.4) are associated with induced earthquake activity," said David Eaton, a University of Calgary geophysicist.

- Why earthquakes happen in some regions rather than others is not clear and is currently being studied

- “"Waste-water disposal, at least in the U.S., has been the primary cause of earthquakes," said (Arthur) McGarr (USGS). "In Canada, it's not clear that things work the same way. That's still a debated question.””

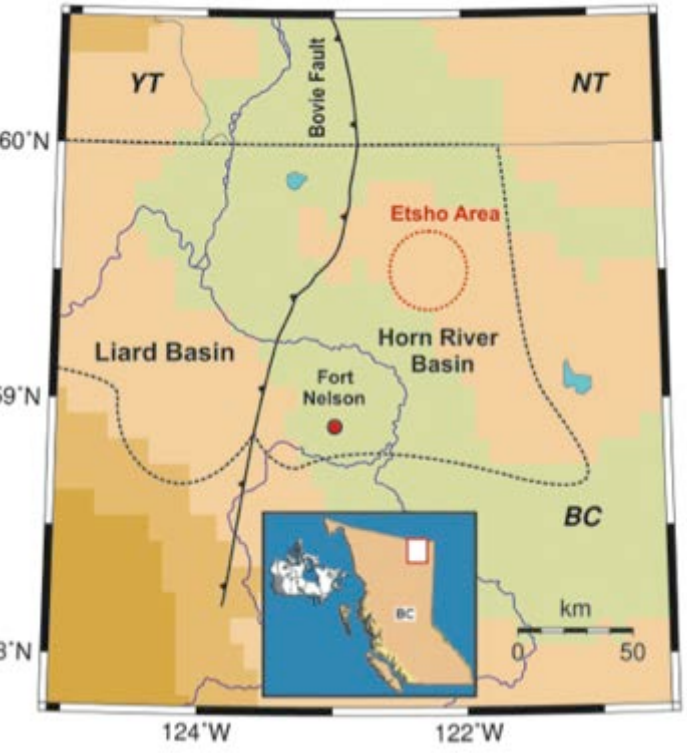
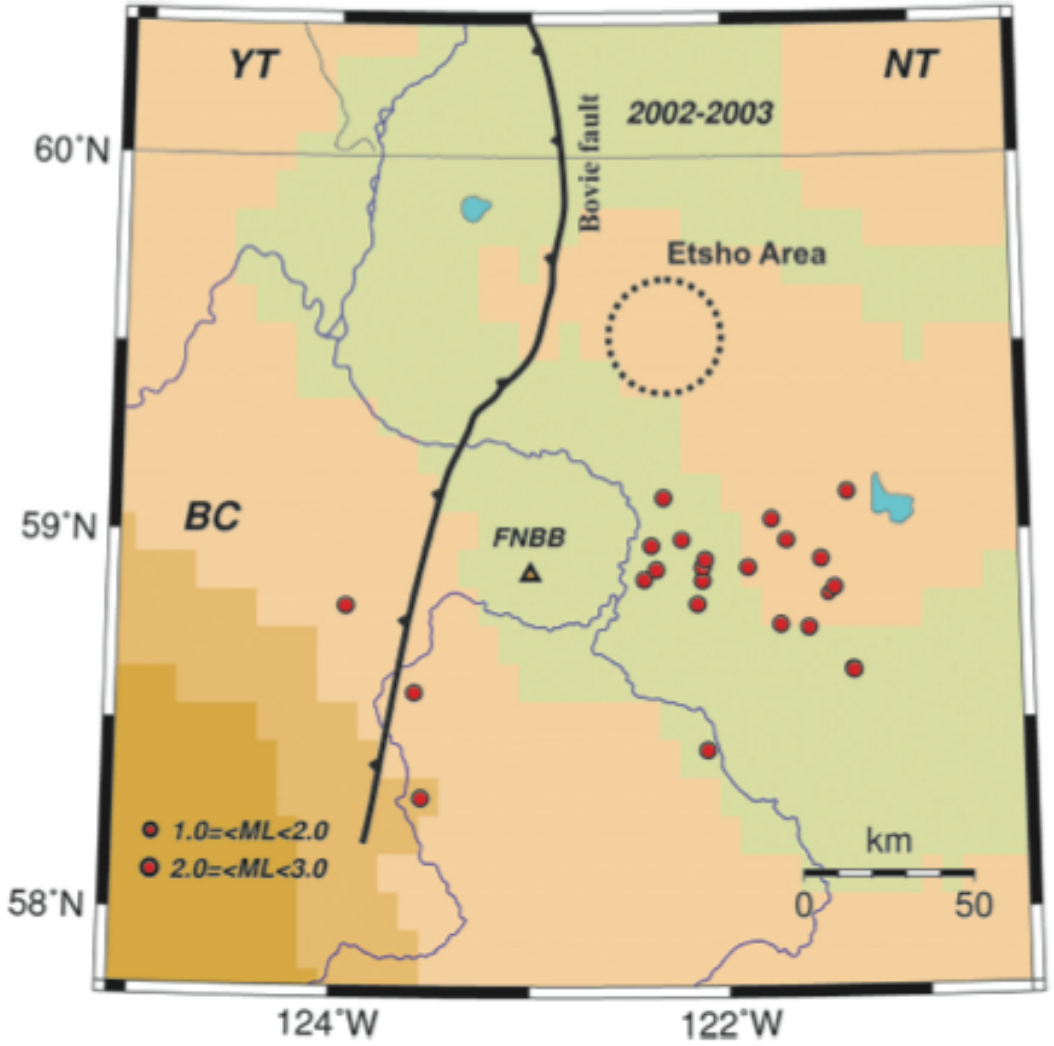
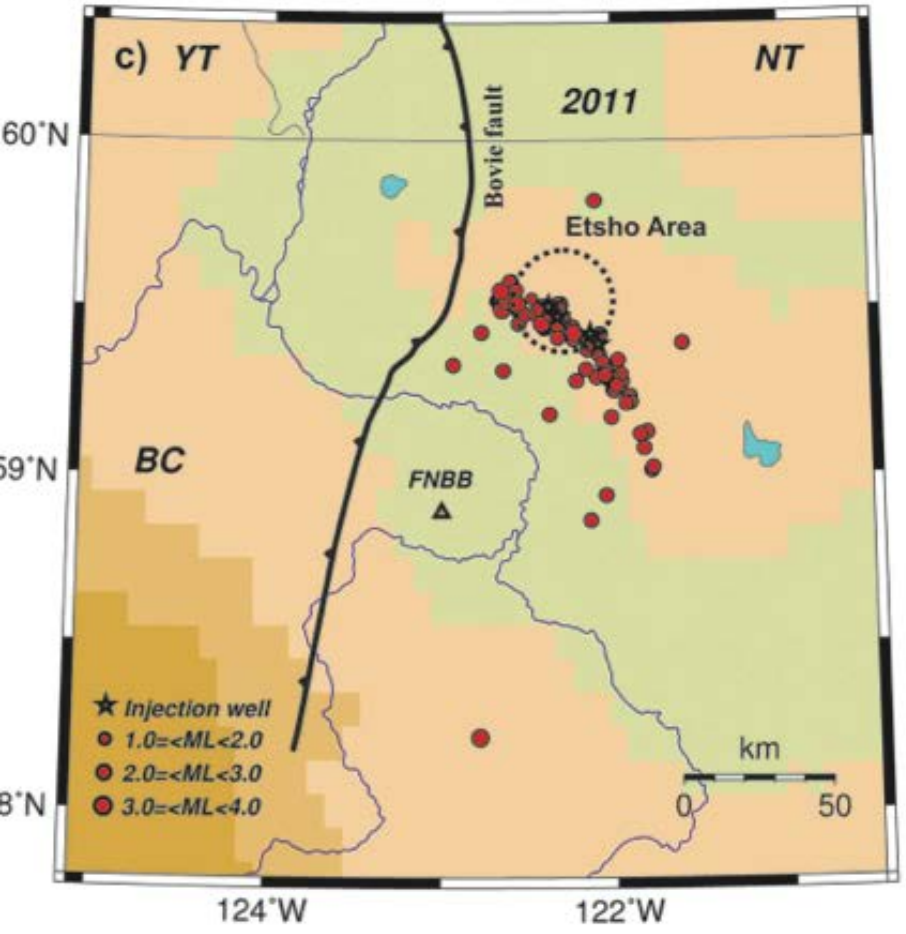


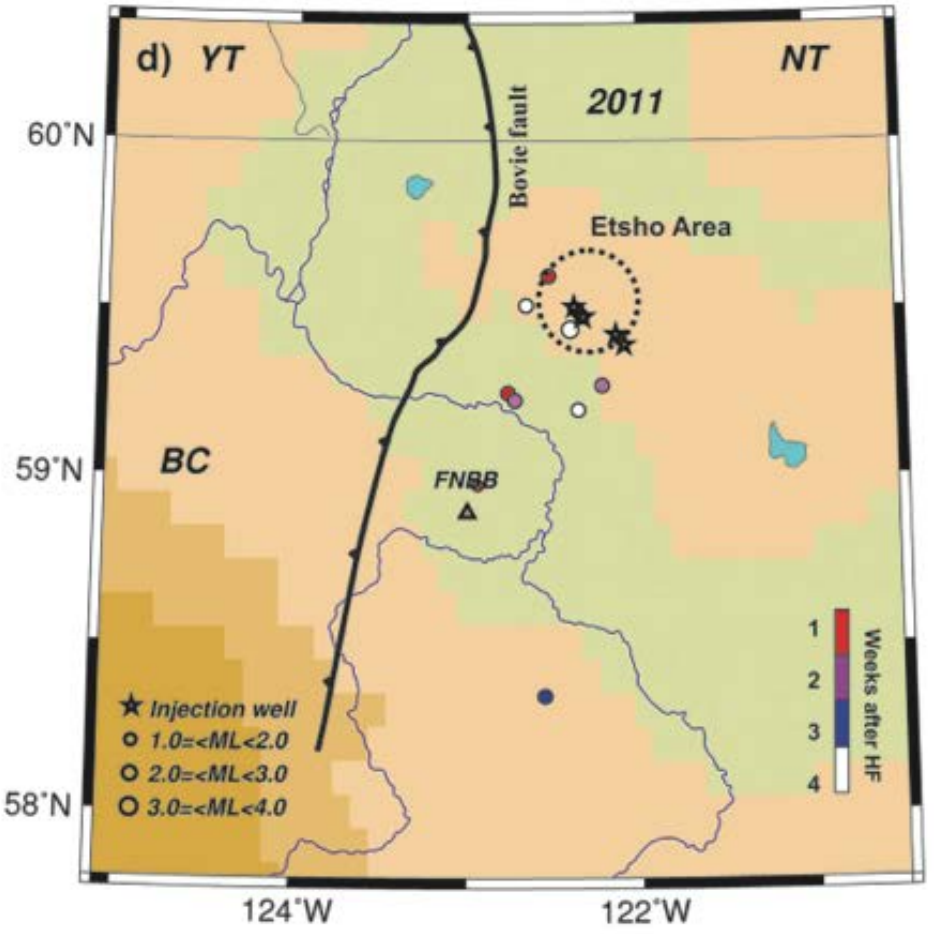
Fig. 6. Background seismicity within 100 km from station FNBB during the period of July 2002 – July 2003. This time window is more than three years before the start of any hydraulic fracturing operations in the Etsho area (dashed circle) of the Horn River Basin. Local earthquakes scattered in the southern part of the Horn River Basin and to the west of FNBB, but no events were detected near Etsho.



July 2002-03 Near Fort Nelson

- The number of local earthquakes per month during HF days increased from 24 in 2002-3 to 131 in 2011 (Farahbod 2015)
- Average magnitude increased from 2.9 to 3.6
- Rate during non-HF days increased more than 3 times as well. The dramatic variation in earthquake occurrence rate seems to suggest a link to local HF operations.





Horn River Basin research suggests that the frequency and magnitude of earthquakes in including

Injected volume and the specific geology are key variables

Earthquakes can months after fracturing occurs

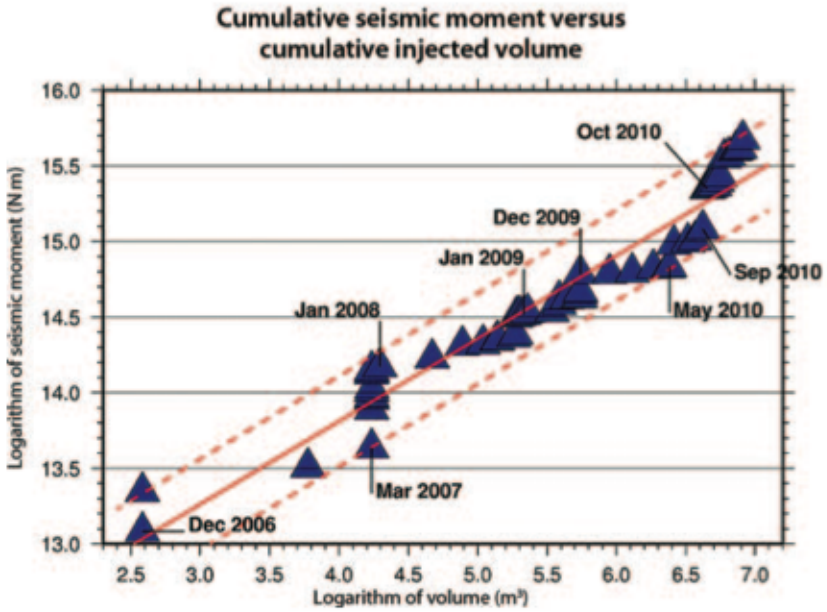


Figure 6. Relationship between the cumulative seismic moment (Mo) and cumulative injected volume (V) of hydraulic fracturing in the Horn River Basin since December 2006. Sample interval is one month. The observed relationship appears as a series of steps, suggesting that the seismic response of the geologic system might lag be

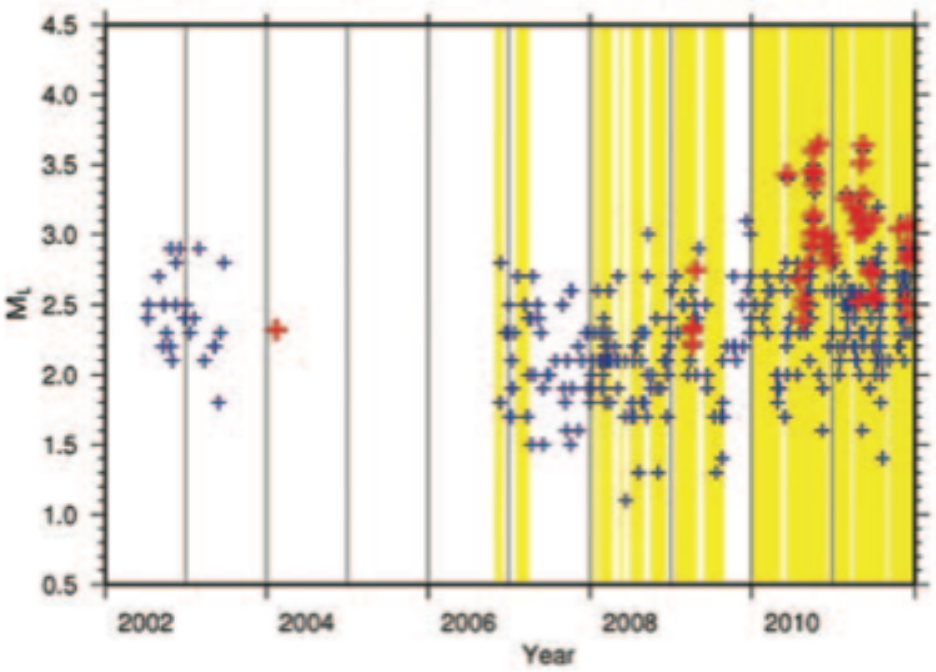


Figure 2. Earthquakes in the Horn River Basin, northeastern Britis Columbia, Canada. Time history of regional seismicity that occurre within 100 km of the Fort Nelson seismic station. Red and blue crosses correspond to events reported in the national earthquake catalog compiled by Natural Resource Canada and in a recent study (Farahbod et al., 2015), respectively. Yellow strips mark the time windows of local hydraulic-fracturing operations.

How did hydraulic-fracturing operations in the Horn River Basin change seismicity patterns in northeastern British Columbia, Canada?

Shale gas and deep well injection in the US

Injection wells are a common disposal option

Uses more pressure than fracturing itself

- Injection rate and total volume of injection may be factors

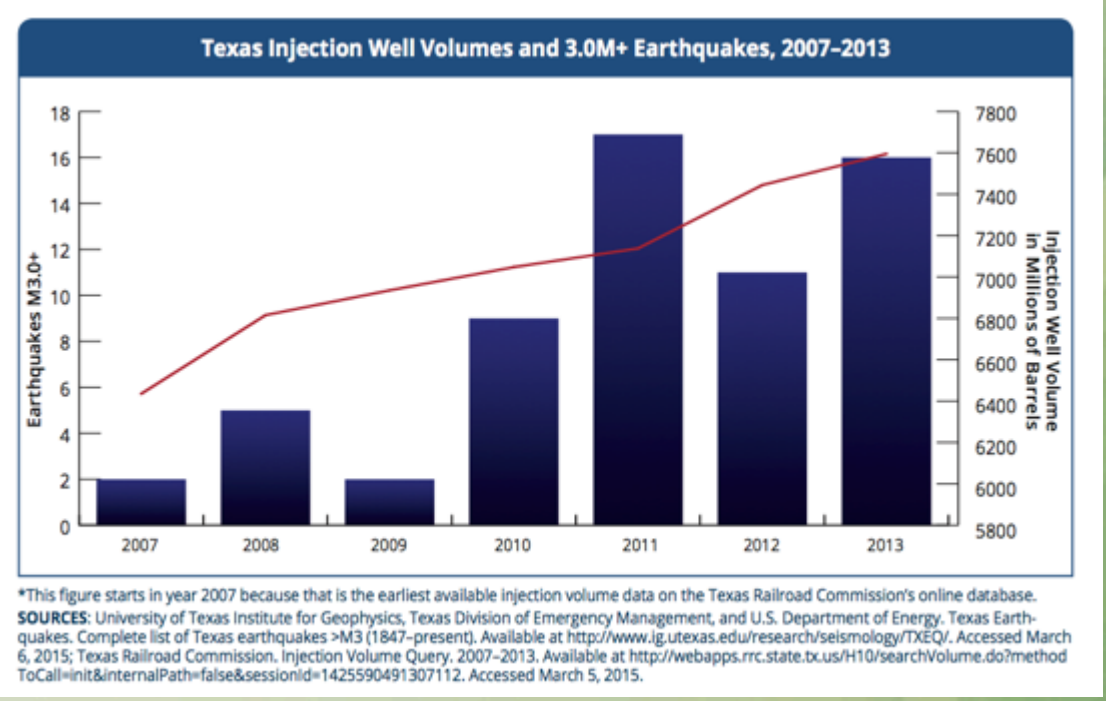
Texas research

8x more quakes

- 2007-2013

Injection volumes

- Increased 18%
- 2007-2013



*This figure starts in year 2007 because that is the earliest available injection volume data on the Texas Railroad Commission's online database.

SOURCES: University of Texas Institute for Geophysics, Texas Division of Emergency Management, and U.S. Department of Energy. Texas Earthquakes. Complete list of Texas earthquakes >M3 (1847–present). Available at http://www.ig.utexas.edu/research/seismology/TXEQ/. Accessed March 6, 2015; Texas Railroad Commission. Injection Volume Query. 2007–2013. Available at http://webapps.rrc.state.tx.us/H10/searchVolume.do?methodToCall=init&internalPath=false&sessionId=1425590491307112. Accessed March 5, 2015.

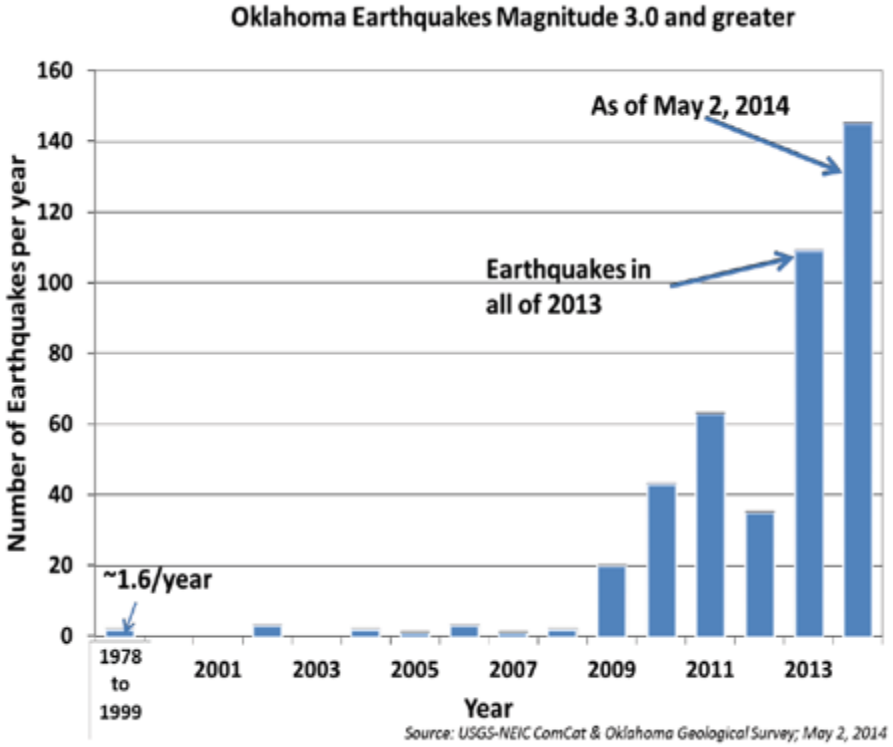
Oklahoma- dramatic seismic increases

Earthquake “swarms”

-Many little earthquakes in clusters

-20 earthquakes of magnitude 4-4.8 have struck since 2009, largest magnitude 5.6

“The more small earthquakes we have, it just simply increases the odds we’re going to have a more damaging event,” USGS geoscientist explained in 2015,



OIL AND GAS

ENERGY | OIL AND GAS | UTILITIES | RENEWABLE ENERGY

Oklahoma goes from two 3.0 quakes a year to two a day

Morgan Brennan | @MorganLBrennan

Tuesday, 21 Apr 2015 | 1:00 PM ET

Record Number of Oklahoma Tremors Raises Possibility of Damaging Earthquakes

Updated USGS-Oklahoma Geological Survey Joint Statement on Oklahoma Earthquakes

Originally Released: 10/22/2013 1:07:59 PM; Updated May 2, 2014

EARTHQUAKES in OKLAHOMA

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EARTHQUAKES in OKLAHOMA

The Office Of The Oklahoma Secretary of Energy and Environment

A one-stop source for information on earthquakes in Oklahoma.

1.4 Million from state emergency fund channeled to investigate

WHAT WE KNOW

We know that Oklahoma experienced 907 magnitude 3+ earthquakes in 2015, 585 magnitude 3+ earthquakes in 2014 and 109 in 2013. This rise in seismic events has the attention of independent scientists, citizens, policymakers, media and industry. See what information and research state officials and regulators are relying on as the situation

WHAT WE ARE DOING

In September 2014, Governor Fallin directed the Oklahoma Secretary of Energy and Environment to assemble the Coordinating Council on Seismic Activity. The body's primary responsibility is to work cooperatively to develop solutions, identify gaps in resources and coordinate efforts among state agencies, researchers and the state's oil and gas industry.

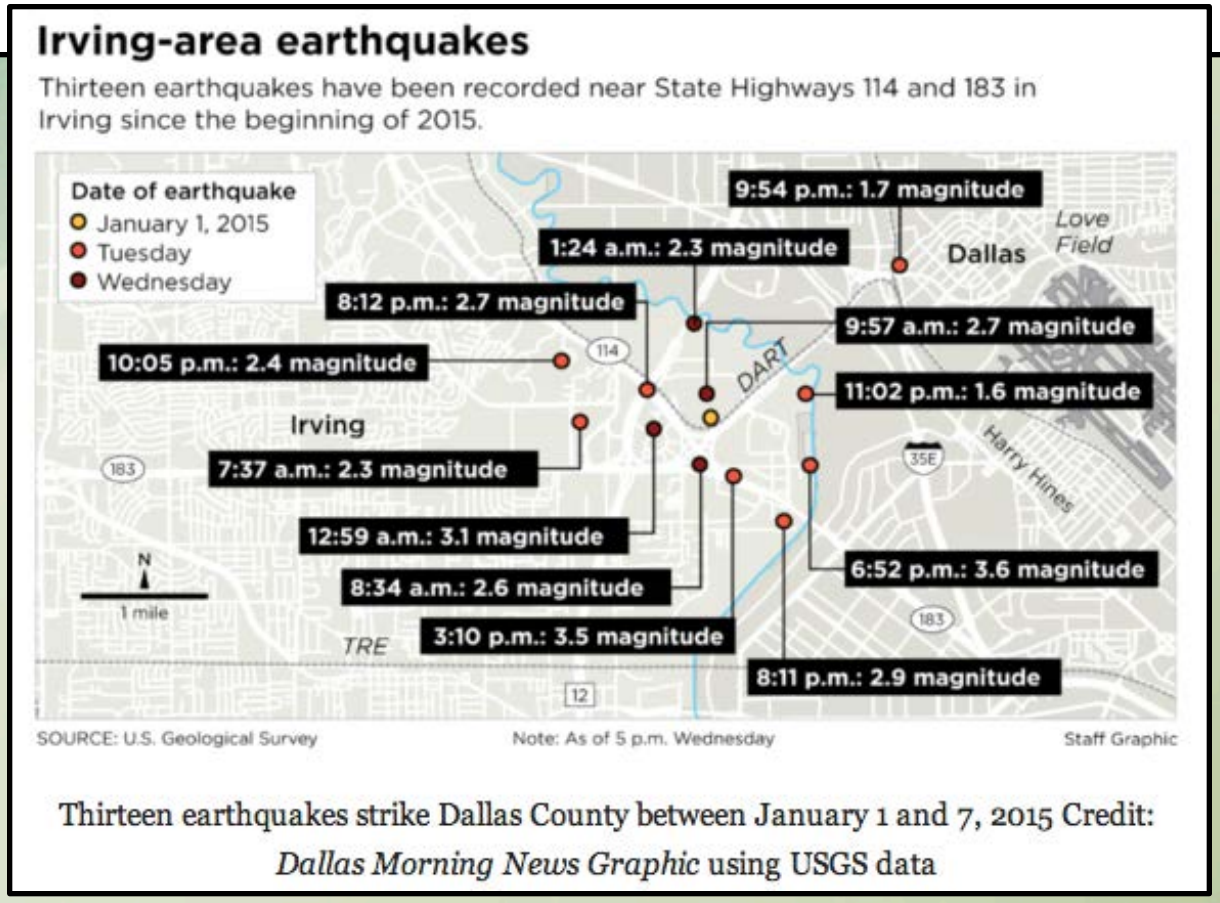
EARTHQUAKE MAP

Click below for a map that shows wastewater disposal wells and recent earthquakes in Oklahoma.

Texas

Previously almost no seismic activity, but there were 38 earthquakes since 2014, with 4 magnitude >3

- 13 earthquakes in one week in Jan 2015



Thirteen earthquakes strike Dallas County between January 1 and 7, 2015 Credit: *Dallas Morning News Graphic* using USGS data

Heavily populated with many “urban drilling” operations

Once earthquakes are felt, officials deploy fire and rescue to canvas region for damage (Texas Railroad commissioner, January 2015)

ENERGY & ENVIRONMENT

Now Arriving at Pittsburgh International: Fracking

By MATTHEW L. WALD AUG. 11, 2014

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FAR FROM THE MADDING CROWD
NOW PLAYING

PITTSBURGH — Where 600 flights used to take off and land every day here at Pittsburgh International Airport, there are now about 300. Partway down Terminal B, the moving sidewalk that used to lead to a dozen gates now stops abruptly at a plain gray wall.

Pittsburgh's airport is struggling financially and mired in debt, with sharply lower traffic ever since US Airways began phasing it out as a bustling hub in 2004. Long g
747s to London, and TWA fl

For salvation, airport officia
quiet runways, it turns out, a
whole state of Pennsylvania
Energy will drill its first wel

How Pittsburgh Airport Will Frack for Gas Under Active Runways

Sarah Zhang
Filed to: FRACKING 8/12/14 3:21pm

10,009 1

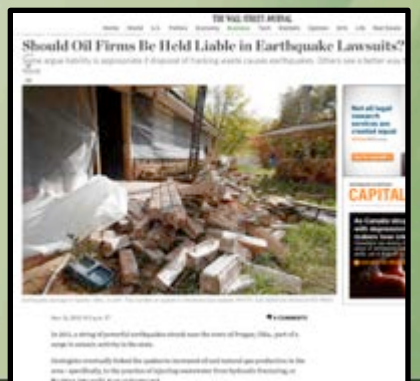
Are we considering implications of how and where underground changes can impact surfaces?

Overall summary of determinants of public health impacts

- Proximity to communities
  - Important for air quality, seismic impacts, leaks and spills to groundwater
- Geology
  - e.g. impacts the amount of water used
- Stage of production
  - e.g. air toxics
- Intensity of production- more wells more problems

Public Health and Shale Gas Production?

- Should Public Health have a larger role in regulating or intervening in HF?
  - New well applications
  - Inter-Ministry communication?
- How close should drilling be to communities
  - Set-backs from operations/pipelines
  - Need more research to evaluate impacts
- If there are impacts/damages, who pays the damage?
  - Eg earthquake damages



Research Gaps

- Lack of good quality health impact studies that link measured exposures to adverse health outcomes.
- Baseline exposure measurements need to be conducted prior to drilling and production activity
  - Across all exposures
  - Including seismic analyses
- Need Canadian specific research!

© Photo special to The Guardian by Corridor Resources Inc.

Corridor Resources undertakes drilling and hydraulic fracturing activities on a natural gas well pad in Penobsquis, N.B.

NB Commission on HYDRAULIC FRACTURING | Commission du N-B sur la FRACTURATION HYDRAULIQUE

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Public health, public trust

As we stated in our Opening Perspective, we recognize that there is anger, frustration and a strong sense of weariness on all sides, and our goal is to engage New Brunswickers in a conversation about our shared energy future in an open and respectful way.

We remain committed to that goal as we begin our final deliberations.

Read More >

http://www.nbchf-cnbfh.ca

Sign up to receive the Commission's final report

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Alberta Energy Regulator

Compliance Dashboard

Home | Incidents | Investigations | Compliance & Enforcement

The AER's incident reporting provides Albertans with information about energy incidents in the province. The information published here is based on incident information reported to the AER. The AER posts information as soon as possible following its receipt and is not able to verify its accuracy before publication. The information is subject to change as more details become available.

The incidents posted here meet the following criteria:

- a reportable release that involves hydrogen sulphide (H_2S);
- a reportable release that affects a water body, whether on or off lease;
- a reportable release of hydrocarbon or produced water (this includes releases that migrate off lease, including on pipeline right-of-ways); or
- a seismic event of local magnitude (M_L) 4.0 or greater in the Duvernay Zone that is subject to Subsurface Order No. 2 (see also our news release that describes the traffic light system).

The Compliance Dashboard summar collected at different points in time ar necessarily represent the most curre available. This summary should not b any person intending to deal with the property, assets, or interests of the co information is provided without warra and the AER disclaims any liability fo damages resulting from the use of or information.

The AER is committed to protecting public safety and the environment, and it monitors and responds to energy-related incidents 24 hours a day, 7 days a week. The AER ha in emergency response, environmental protection, air quality, and investigation. These staff assist, coordinate, and support the activities of the responsible operator, as well municipal authority and other provincial and federal responders to ensure a coordinated, effective response and that requirements are followed.

Data last updated February 3, 2016 at 11:00:43 PM PST Mountain Time

Show 10 entries Search:

Reference No.	Incident Date	Company	Location	Operation Type	Product	Status
20160298	2016-02-01	Pembina Pipeline Corporation		Pipeline	Drilling Mud (H20)	
20160296	2016-02-01	ARC Resources Ltd.	Redwater (2 km N)	Pipeline	Crude Oil and Salt/Produced Water	No emergency phase.

Thank You/Merci

Questions?

Are you responding to community level queries on this topic?

Comments to share?

We would like to connect

www.ncceh.ca | www.ccnse.ca

Funded by the Public Health Agency of Canada

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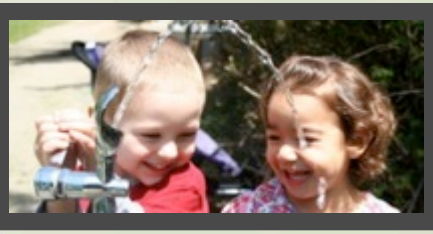


National Collaborating Centre for Environmental Health

Centre de collaboration nationale en santé environnementale

BC Centre for Disease Control

An Agency of the Provincial Health Services Authority

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