

INDUCED SEISMIC ACTIVITY IN CANADA

Comprehensive data and information on seismic activity in Canada is available on Natural Resources Canada's website: <http://www.earthquakescanada.nrcan.gc.ca/index-eng.php>

WHAT IS INDUCED SEISMICITY?

Seismic activity resulting from human activity is called induced seismicity. Research in this area is well established but little known to the public.

Seismic activity is associated with several industrial processes, including geothermal energy extraction, mining, dam building, construction and hydraulic fracturing in natural gas development.

Emerging evidence indicates minor activity is associated with hydraulic fracturing, which is the process used to extract natural gas from deep shale rock formations. Seismic activity related to hydraulic fracturing is rarely felt on the surface and usually occurs near where the rock is being fractured, or 2,000 to 3,000 metres below ground.

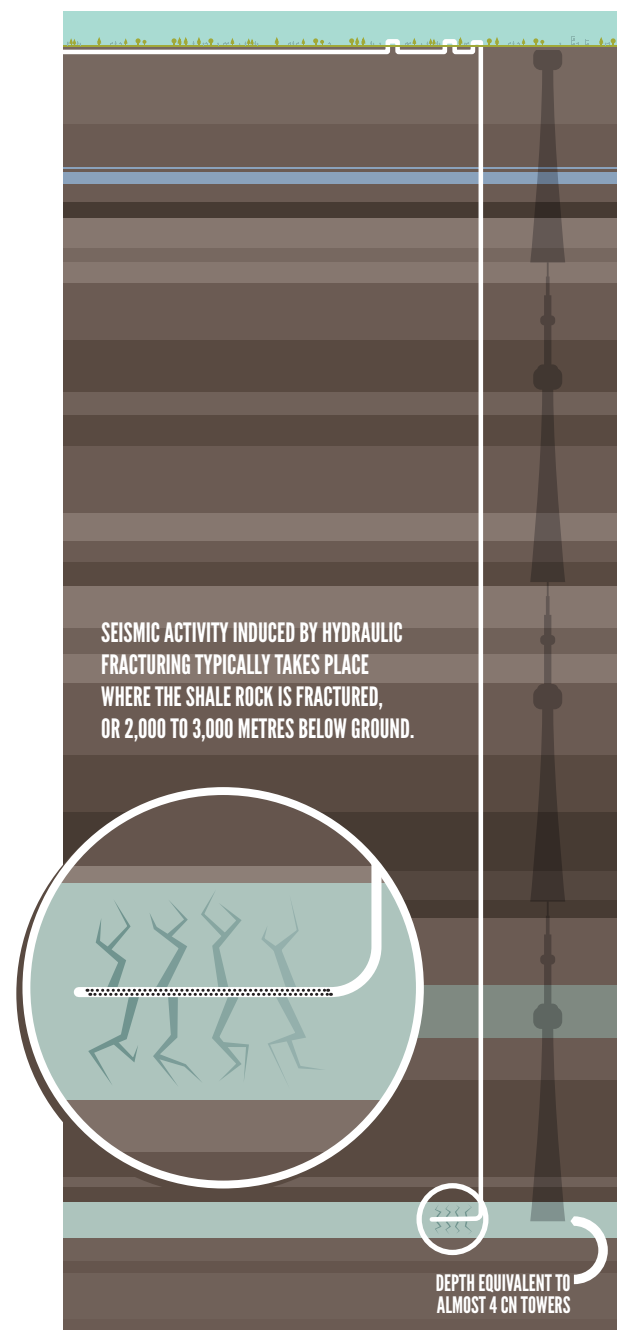
The evidence also indicates that seismic activity resulting from hydraulic fracturing causes no injury or property damage, or poses a risk to public safety or the environment.

HOW CAN HYDRAULIC FRACTURING CAUSE SEISMIC ACTIVITY?

Hydraulic fracturing is a controlled process that injects pressurized fluids to the geological formations where natural gas is locked in dense rock, such as shale. The pressurized fluid cracks the rock and creates fissures that extend up to 100 metres from the horizontal leg of a well. The energy released in this process causes seismic activity.

QUICK FACTS:

- Minor earthquakes occur daily across Canada.
- On average, more than 4,000 earthquakes are recorded in Canada each year, according to the Geological Survey of Canada, of which about 50 are generally felt.
- British Columbia is the province that is most likely to experience earthquakes. Seismicity drops off markedly away from the coast.



WHAT DOES SCIENTIFIC RESEARCH SAY ABOUT HYDRAULIC FRACTURING AND SEISMIC ACTIVITY?

A growing body of independent scientific research says a link exists between hydraulic fracturing and seismic activity.

REPORTS

B.C. Oil and Gas Commission, August 2012

Investigation of Induced Seismicity in the Horn River Basin

- “None of the events caused any injury, property damage or posed any risk to public safety or the environment.”
- More than 8,000 high-volume hydraulic fracturing operations have been performed in northeastern B.C. with no associated anomalous seismicity.
- Seismic activity related to hydraulic fracturing usually occurs near where the rock is being fractured, or 2,000 to 3,000 metres below ground.
- Fractures developed during the hydraulic fracturing operations studied for the report had no effects on shallow aquifers or the environment.

Royal Society & Royal Academy of Engineering, June 2012

Shale gas extraction in the UK: A review of hydraulic fracturing

The report can be found here: http://royalsociety.org/uploadedFiles/Royal_Society_Content/policy/projects/shale-gas/2012-06-28-Shale-gas.pdf

- There is emerging consensus that the magnitude of seismicity induced by hydraulic fracturing can be felt by few people and the risk of surface impacts, if any, is negligible.
- “Microseismic events are a routine feature of hydraulic fracturing and are due to the propagation of engineered fractures.”
- Larger seismic events due to hydraulic fracturing are rare but can be induced in the presence of a pre-stressed fault.
- Seismic events of magnitude 3 M_L at a depth of 2,000 to 3,000 metres are unlikely to cause structural damage at the surface.

U.S. National Research Council, June 2012

Induced Seismicity Potential in Energy Technologies

The report can be found here: <http://dels.nas.edu/Report/Induced-Seismicity-Potential-Energy-Technologies/13355>

- “The process of hydraulic fracturing a well as presently implemented for shale gas recovery does not pose a high risk for inducing felt seismic events.”
- Hydraulic fracturing a shale gas well was confirmed as the cause for “small felt seismic events” at one location near Blackpool, England (2.3 M_L).
- About 35,000 hydraulically fractured shale gas wells exist in the U.S. Only one case of “felt seismicity” in the U.S., in which hydraulic fracturing “is suspected, but not confirmed, as the cause” (Oklahoma, 2.8 M_L).
- Seismic events of a magnitude greater than 2 M_L can possibly be felt, particularly if they occur at shallow depths. Seismic events of a magnitude smaller than 2 M_L generally are not felt.

Preese Hall Shale Gas Fracturing panel report, April 2012

Review and Recommendations for Induced Seismic Mitigation

The report can be found here: <http://og.decc.gov.uk/assets/og/ep/onshore/5075-preese-hall-shale-gas-fracturing-review.pdf>

- Concludes hydraulic fracturing can proceed if the process is carefully monitored and appropriate precautions are taken.
- “Observed seismicity” at Preese Hall was “induced by the hydraulic fracture treatments.” The largest of these seismic events had a magnitude of 2.3 M_L .
- A seismic event of a magnitude of 3 M_L at a depth of two to three kilometres “is unlikely to cause structural damage.”
- Production casing deformation is common in wells in “highly stressed reservoirs.”