Induced Seismicity

What is induced seismicity?

Seismicity refers to the geographic and historical distribution of earthquakes, also referred to as seismic events. Induced seismicity (IS) is a seismic event (earthquake) resulting from human activity and can be caused by industrial activities such as mining, dam impoundment and natural gas development.

How does IS occur?

There are two primary oil and gas activities in northeast B.C. (NEBC) linked to IS: hydraulic fracturing and subsurface fluid disposal.

Hydraulic fracturing is the process that allows natural gas to flow by injecting a mixture of water, chemical additives and a hard granular substance called proppant (usually sand) at high pressures to create fractures or open existing ones in hydrocarbon-bearing rocks deep underground. The proppant holds the cracks open once the injection pressure is lowered, allowing the natural gas to flow from the formation to the wellbore. As the fluid is injected and fractures the rock, it can sometimes trigger or create micro-seismic events and, if there is a pre-existing fault, the pressure increase may cause slippage on a pre-existing fault plane that can result in a seismic event. Typically, the hydraulic fracturing process lasts two to four weeks.

Disposal is a strategy used to manage wastewater from hydraulic fracturing. It is an injection process that uses disposal wells to permanently store fluids in deep, subsurface rock formations. These disposal operations can also potentially trigger seismic events when the fluids encounter pre-existing, susceptible faults in the subsurface.

50%

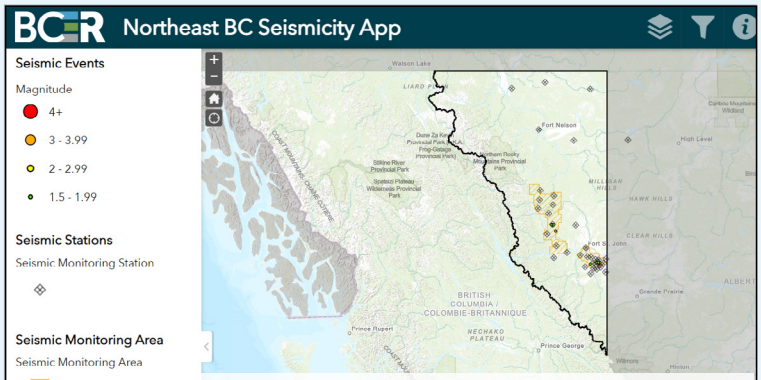
The number of disposal wells is decreasing, which has been attributed to on-going efforts to reuse flowback water. **Preliminary data shows over half of the water used for hydraulic fracturing is recycled.**

How is seismicity measured in NEBC?

To accurately record seismic event locations and magnitudes, we worked with seismologists to establish local magnitude calculations tailored specifically for the geology of NEBC.

Currently, our seismic monitoring network is comprised of a real-time seismometer array of 35 stations strategically positioned in proximity to energy resource activities. The array records seismic data and allows the BCER to attribute IS events to specific activities and is available for research purposes.

This region-specific monitoring has resulted in differences in recorded magnitude when compared to other agencies. By implementing a seismic array designed for NEBC, the BCER can accurately oversee energy activities and ensure timely enforcement of our regulatory framework that is designed to reduce the likelihood of additional IS events. For regulatory decisions, our calculation is the authoritative determination.



Seismic events are analyzed by the BC Seismic Research Consortium - a joint partnership between the BCER, Geoscience BC and the BC Oil and Gas Research and Innovation Society (BC OGRIS).

Those who experience felt events may use our **NEBC Seismicity App Webmap** to locate recent and past seismic events of greater than local magnitude 1.5. and to find nearby industry activity and seismic monitoring stations.

BRITISH COLUMBIA ENERGY REGULATOR

Public Concerns and Complaints

1-250-794-5200 (24-hour public number)

1-877-500-BCER (2237) (24-hour toll free)
Report concerns such as odours, spills or noise.

Incident Reporting for Industry

1-800-663-3456 (24-hour emergency number)
Report oil and gas related incidents.

February 2025

What are we doing to lessen IS?

We established Special Project Orders in the Kiskatinaw Seismic Monitoring and Mitigation Area (KSMMA) within the Farmington region and North Montney Seismic Monitoring and Mitigation Area (NMSMMA) within the Wonowon-Pink Mountain region to address IS in these areas of increased development. The Orders require permit holders operating in these areas to:

- Complete a seismic pre-assessment prior to starting fluid injection activities.
- Submit a seismic monitoring and mitigation plan to us and provide notification before operations begin.
- Within the KSMMA, engage with nearby residents ahead of commencing hydraulic fracturing activities, describe the schedule of operations and explain that felt events may occur.
- Deploy a seismic array capable of transmitting near-real time data and immediately suspend operations if a local magnitude 3.00 or greater event occurs in the KSMMA or local magnitude 4.00 or greater event occurs in the NMSMMA. Fracturing operations may continue with written permission from the BCER once the well permit holder has submitted operational changes satisfactory to the BCER to reduce or eliminate the initiation of additional induced seismic events.

Outside the KSMMA and NMSMMA boundaries, the Drilling and Production Regulation applies, requiring the immediate suspension of fluid injection activities if a magnitude 4.0 or greater event is recorded and linked to that activity, as well as the mandatory reporting of felt events to the BCER. Injection operations may continue once the well permit holder has implemented operational changes satisfactory to the BCER to reduce or eliminate the initiation of additional IS events.

KSMMA suspension threshold

The KSMMA's mandatory mitigation threshold of M_L 2.00 and suspension threshold of M_L 3.00 take into account the impacts seismicity can have within the Farmington community.

The complex subsurface geology of the Kiskatinaw subregion makes it prone to frequent, sub M_L 2.5 seismic events during hydraulic fracturing operations. The surface geology, which is part of the Agricultural Land Reserve, is characterized by soft soils which can exaggerate vibrations from seismic waves. These two factors combined can result in felt reports during hydraulic fracturing, even from small magnitude events, which can be disruptive to nearby residents.

vs.

NMSMMA suspension threshold

The NMSMMA's mandatory mitigation threshold of M_L 3.00 and suspension threshold of M_L 4.00 are higher than in the KSMMA, but they take into consideration the infrequent and rarely perceived impact seismic events have in that region.

The subsurface geology of the Northern Montney subregion is influenced by the Rocky Mountains and can experience infrequent M_L 2.5+ seismic events during hydraulic fracturing. The surface geology is characterized by bedrock being close to or at the surface, which does not amplify vibrations from seismic events. This combination of infrequent events and harder surface rocks means small magnitude events are rarely perceived at the surface.

Learn More

Induced Seismicity Online

Our Induced Seismicity Data and Submission page provides guidance and resources for the standards, data and reporting of IS in NEBC.

To Report a Felt Event

We respond to and investigate felt events. Contact us with the date, time and location of a felt event by email at SeismicMonitoring@bc-er.ca or call 1-877-500-2237.

BCER
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