

Induced SEISMICITY



Earthquakes pointing to fracking activity trigger orders to cease operations

By Jim Bentein

Several seismic events recorded in the Fox Creek area in northwestern Alberta this year have sparked debate over whether hydraulic fracturing can trigger earthquakes.

Shawn Maxwell, an expert in microseismic and geomechanical evaluation, isn't dismissing the fact that recent microseismic events in that area need to be closely monitored. But he maintains that those expecting a massive earthquake as a result of fracking will be waiting forever.

Maxwell, president and chief technology officer of ITASCA Microseismic and Geomechanical Evaluation, which has offices in Calgary, Houston and the U.K. and monitors fracs as well as developing geomechanical models predicting where microseismic activity will occur, says there's no evidence the technique has been responsible for the kind of cataclysmic results depicted by critics.

Maxwell holds a Ph.D. in microseismicity from Queen's University, has 28 years of experience in microseismic analysis and is considered a pioneer in microseismic fracture

imagining services. He says measurable seismic activity possibly linked to fracking—and more often by wastewater disposal related to fracking—could be described as rare events.

In an article he and two other scientists authored in June for *The Leading Edge*, the journal of the Society of Exploration Geophysicists, they conclude that “known incidents of fracturing-induced seismicity” are isolated, mentioning specifically incidences in Blackpool, England, in Oklahoma, in the Utica area of Ohio, in the Horn River and Montney basins of B.C. and in the Duvernay of Alberta (where the Fox Creek seismic events took place).

“Considering the widespread practice of hydraulic fracturing around the globe, these problem areas remain relatively isolated,” they conclude in the paper. “For example, approximately 70 felt induced earthquakes occurred in the regions above, in comparison to 3,000,000 wells that have been treated [fracked]. Indeed, in the Montney, it is estimated that only 0.15 per cent of hydraulic stages resulted in a felt earthquake (British Columbia Oil and Gas Commission Report, 2014) and so, even in a relatively active region, ►

the occurrence rate [suggests] seismicity occurs along previously unidentified faults..."

However, in an interview Maxwell stresses that he isn't suggesting regulators should not be concerned about seismic events cause by fracking, which led to an order by the Alberta Energy Regulator (AER) in mid-June for the producer in the Fox Creek area (which wasn't identified) to cease operations.

4.4 MAGNITUDE QUAKE RECORDED

This order was triggered after a second seismic event occurred in the area, measuring 4.4 in magnitude, like one that occurred in January.

The first event occurred about 33 kilometres from Fox Creek. The Alberta Geological Survey, a part of the AER, confirmed the January incident, which it said was one of a sequence of seismic events in the Crooked Lake area beginning in early January.

At that time, the AER released a statement suggesting fracking was the cause.

"Preliminary information indicates the event may be related to hydraulic fracturing operations in the area," a spokesman said then. "It is, however, impossible to definitively state that it was not a naturally occurring event."

Meanwhile, in B.C., the provincial and federal governments initiated the Induced Seismicity Monitoring Project (ISMP) in 2012. The project is a five-year study of suspicious seismic events occurring near oil and gas operations in northeastern B.C., which involves the funding of several stations to monitor activity.

Alireza Babaie Mahani, a seismologist who was hired earlier this year to head the ISMP, suggested in an interview in mid-June with the *Daily Oil Bulletin* that operators may have to cease operations for long periods in order to prevent potentially damaging seismic events.

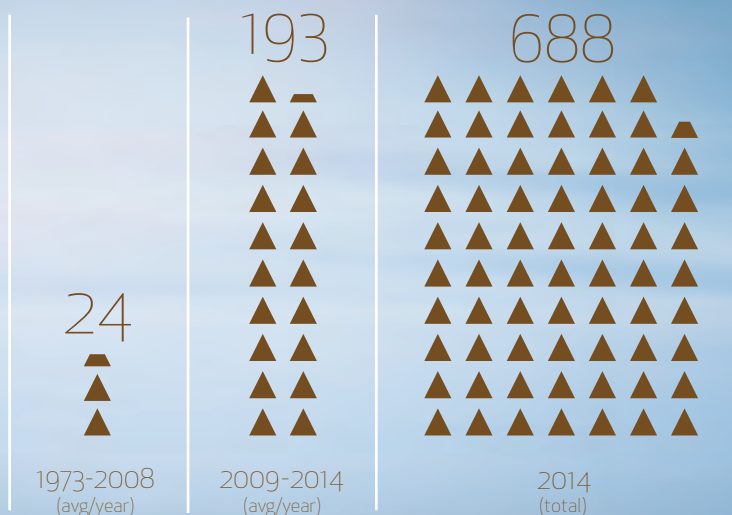
Induced events, which appear to be caused by fracking or water disposal, tend to occur at depths of two to three kilometres, as opposed to natural events that occur at depths of around 10 kilometres.

Maxwell says there are clearly areas where seismic events are more likely to be caused by fracking, water disposal, geothermal development or other man-made activities.

For example, the closer the activity occurs to the Pacific Rim, where tectonic earthquakes occur, the more likely seismic events will occur.

However, there is no question seismic activity has increased throughout North America, much of it traceable to oil and gas and other activities.

SEISMIC EVENTS ON THE RISE IN CENTRAL, EASTERN U.S.



"This [fracking] is a process we need to understand and manage."

— Peter Duncan, founder and co-chair of Houston-based MicroSeismic

For instance, the U.S. Geological Survey (USGS) reports that seismic activity in the central and eastern U.S. has increased dramatically over the past six years.

From 1973 to 2008, there were an average of 24 seismic events of magnitude three or larger per year. But from 2009 to 2014, the rate steadily increased, averaging 193 a year and peaking in 2014 with 688.

The USGS concludes that wastewater injection, fracking and enhanced oil recovery are likely responsible for this increase in seismic activity.

USGS PROTOCOLS

The USGS has developed protocols to estimate the earthquake hazard associated with induced events, which include enhanced monitoring.

Peter Duncan, founder and co-chair of Houston-based MicroSeismic, which specializes in hydraulic fracture stimulation surveillance and evaluation, says that while Maxwell may be correct in saying only a small number of fracs end up leading to measurable seismic events, it's a mistake to minimize the impacts.

"Just because the number of events is small doesn't suggest we shouldn't be concerned," says Duncan, a Canadian who holds a Ph.D. in geophysics from the University of Toronto and who worked as a geophysicist for Shell Canada and others before helping to found MicroSeismic in 2003. "This [fracking] is a process we need to understand and manage."

INDUCED SEISMICITY WORKSHOP

The Canadian Society for Unconventional Resources (CSUR) plans a one-day Induced Seismicity Workshop on November 19. The workshop will be divided into four sessions: Government, Academic, Service and Industry. Each session will contain three panelists, who will make a short presentation and be available during a 30-minute question period following the panel presentations.

For more information, contact Cynthia Lamont, CSUR's operations & events manager, at clamont@csur.com.

He says effective monitoring of the fracking process, as well as using microseismic technology to better target fracs offers the potential to minimize seismic events.

Duncan says it's clear that there are some areas where the technology should not be deployed.

"We shouldn't be pumping water into known faults," he explains.

Whether the number of seismic events is minimal or not, "the public is concerned" and so the industry and regulators must respond.

Microseismic detection technology today is so sophisticated, he said producers can utilize it to determine where there's a fault "and they can stay away from it."

Martus Ermisch, a spokesman for the Canadian Association of Petroleum Producers (CAPP) says industry takes concerns about microseismic activity seriously, as is highlighted by CAPP's financial contribution to the Canadian National Seismographic Network, which has deployed a network of seismographic devices to detect seismic events across Canada (10 of those are deployed in B.C.).

CAPP has put into place a guideline document for members on hydraulic fracturing operating practices and continues to respond to calls for continued monitoring of seismic events.

However, it remains a fact that the number of measurable seismic events caused by fracturing is small, he says.

For instance, between Aug. 13, 2014, and Oct. 30, 2014, when there were 7,500 fracturing stages performed in the Montney, 11 produced measured seismic activity. That is equivalent to 0.15 per cent.

"But that doesn't mean we don't take the issue seriously," he says.

CAPP fully supports the approach the regulators are taking, he says, but remains convinced hydraulic fracturing is a safe process.

"From our perspective, as long as regulations are in place, we don't know of any area where fracking should not proceed," he says. ●

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