Database eyes human role in earthquakes

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A new database showcasing hundreds of examples of human-triggered earthquakes should shake up policy-makers, regulators and industry executives looking to mitigate these unacceptable hazards caused by our own actions, according to a Western Earth Sciences professor.

"More and more, we are recognizing how many earthquakes are actually human-induced," said Gail Atkinson, Industrial Research Chair in Hazards from Induced Seismicity at Western.

"Researchers at the U.S. Geological Survey are now raising the possibility many of the large, well-known earthquakes in California that happened over the 1930s-50s – like the Long Beach Earthquake (in 1933) or the Kern County Earthquake (in 1952), which was a magnitude of 7.5 – may have been induced by oil-production in southern California at the time," she explained.

Atkinson's research group is studying this phenomenon of human-triggered earthquakes – or, induced seismicity – in western Canada, with a particular focus in Alberta. Her team has found evidence showing a significant increase in the number of earthquakes in the last five years or so in the active region. More than half of those appear to be related to hydraulic fracturing.

These findings are included in the new Human-Induced Earthquake Database – or HiQuake – which contains 728 examples of earthquakes (or sequences of earthquakes) that may have been set off by humans over the past 149 years.

While her team has uncovered evidence linking hydraulic fracturing to an increase in earthquakes, research also suggests a link between earthquakes and wastewater disposal in Alberta.

"There's only a relatively small fraction of earthquakes purely tectonic or natural – so most of the seismicity we see in western Alberta and eastern British Columbia appears to be related to the oil and gas industry," Atkinson noted.

"And that's been raising a whole host of new issues in terms of how we should be planning and regulating hydraulic fracturing and oil and gas activity so we're not causing unacceptable hazards – from seismic activity in particular – and ensuring we don't conduct fracturing operations close to major infrastructure such as major dams or cortical facilities that (we don't want to damage)."

With all these findings of human-induced seismicity emerging, and a new encyclopedic database storing the instances, researchers have been trying to wedge themselves between science and public policy in order to mitigate damage caused by human-triggered earthquakes, she continued.

"We've been trying to translate that knowledge into suggested guidelines, for example, for exclusion zones around critical infrastructures. We've suggested there shouldn't be any hydraulic fracturing within 5 km of major dams or critical infrastructure," Atkinson said.

"That's the beginning. We're working with regulators and policy-makers to try to get those ideas out there. The ideas are gaining traction. With some of the larger players – oil companies, Canadian associations for petroleum producers, and so on – if we can get them to start building that kind of thinking into best practices, that might actually be more achievable than regulation, which seems difficult to enforce. We've certainly started a dialogue; we have people talking. But how to translate

findings into concrete policy, that is going to take time."

Having something like HiQuake compile all documented instances of human-triggered earthquakes in one place makes it easier for researchers when they try to conduct studies establishing links between factors, Atkinson continued, adding this establishes the possibility of, at the very least, mitigating damage caused by such events.

"Unlike with natural earthquake hazards, we can do something about this. That's what really motivates us. Whereas, with natural hazards, you can't do anything about it, other than be prepared. You can't stop an earthquake from happening; you can't predict where it might happen. Similarly, with other natural disasters like hurricanes, you can be prepared, but you can't stop it.

"This is something within our power to control. We really do have an opportunity here to make sure we don't cause a major environmental disaster through actions we've taken that we didn't need to take."

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