

# Study: Oklahoma's daily small quakes raise risk of big ones

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Small earthquakes shaking Oklahoma and southern Kansas daily and linked to energy drilling are dramatically increasing the chance of bigger and dangerous quakes, federal research indicates.

This once stable region is now just as likely to see serious damaging and potentially harmful earthquakes as the highest risk places east of the Rockies such as New Madrid, Missouri, and Charleston, South Carolina, which had major quakes in the past two centuries.

Still it's a low risk, about a 1 in 2,500 years' chance of happening, according to geophysicist William Ellsworth of the U.S. Geological Survey.

"To some degree we've dodged a bullet in Oklahoma," Ellsworth said after a presentation to the American Association for the Advancement of Science.

But, he added, "This is not to say we expect a large earthquake tomorrow."

During the 90-minute session on human-induced earthquakes, three quakes larger than 3.1 magnitude hit northern Oklahoma. Federal records show that since Jan. 1, Oklahoma has had nearly 200 quakes that people have felt. These quakes started to increase in 2008 and made dramatic jumps in frequency in June 2013 and again in February 2014, Ellsworth said.

They are mostly in areas with energy drilling, often hydraulic fracturing, a process known as fracking. Many studies have linked the increase in [small quakes](#) to the process of injecting wastewater deep underground because it changes pressure and triggers dormant faults.

Until now, those quakes were mostly thought of as nuisances and not really threats. But Ellsworth's continuing study, which is not yet published, showed the mere increase in the number of tiny temblors raises the risk of earthquakes that scientists consider major hazards. That's generally above a magnitude 5 with older buildings and a magnitude 6 for modern ones, Ellsworth said.

"The more small earthquakes we have it just simply increases the odds we're going to have a more damaging event," Ellsworth said.

A 2011 [earthquake](#) in Prague, Oklahoma, was a 5.7 magnitude, causing some damage and hurting two people. Some studies said that was a side effect of the drilling process, but other scientists are not convinced.

Experts at the science session said Ellsworth's finding of a higher risk for big quakes makes sense.

"We are worried about this, no question about it," said Rex Buchanan, interim director of the Kansas Geological Survey.

Not all states with fracking and wastewater injections are seeing increased quakes and not all those with increased quakes, such as Texas and Ohio, are at a higher risk for major quakes, Ellsworth said. Arkansas and Ohio, for example, are also now seeing fewer man-made quakes, he said.

Much depends on geology and how the wastewater is injected, said Stanford University geophysics professor Mark Zoback. He said industry

and regulators can be smarter about where they inject wastewater and where they do not, and can avoid many of these problems.

**More information:** U.S. Geological Survey's Did You Feel It earthquake program: [tinyurl.com/yaqmeyw](https://tinyurl.com/yaqmeyw)

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