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The Fault That Produced North Texas' Largest Quake Could Produce an Even Bigger One, Study Says

The report also concluded there was “substantial evidence” that the quake was triggered by the underground disposal of wastewater from oil and gas operations.

BY ANNA KUCHMENT, THE DALLAS MORNING NEWS / SEPTEMBER 25, 2017



In this Feb. 2, 2017 photo, scientists from the University of Texas and a contractor, Nanometrics, install a seismometer on a hillside owned by Sul Ross University in Alpine, Texas. Scientists say it's clear there's a connection between the rise in earthquakes: Oil and gas operations pump billions of barrels of water deep into the earth every year, pressuring faults underground. Politicians, industry leaders and officials of the Texas Railroad Commission, which regulates the oil and gas industry, have steadfastly argued that there is little proof, if any, of such a tie.

AP/LYDIA DEPILI



(TNS) - The town that experienced a 4-magnitude earthquake in May 2015 — the strongest quake ever recorded in North Texas — sits on a fault with the potential to produce an event 10 times larger, suggests a new study led by scientists at Southern Methodist University.

The report also concluded there was “substantial evidence” that the quake, near the Johnson County town of Venus, was triggered by the underground disposal of wastewater from oil and gas operations.

The study was the latest to investigate North Texas’ earthquake surge, which began in 2008 and has generated more than 200 tremors. The most recent widely felt event was a 3.1-magnitude quake that struck near the border of Irving and Dallas on Aug. 25.

The U.S. Geological Survey, backed by peer-reviewed studies, has categorized the post-2008 earthquakes as human-induced. But the Railroad Commission of Texas, an agency that both regulates and promotes the oil and gas industry, has not accepted the USGS findings.

In response to the new study, published Sept. 4 in the journal *Solid Earth*, the Railroad Commission said through a spokesperson only that its seismologist, Aaron Velasco, had not had the chance to thoroughly review the paper.

The team of seismologists identified two previously unpublished faults near Venus and Mansfield, about 30 miles southwest of Dallas. The researchers found that the fault responsible for the 2015 quake is at least 4 miles long and holds the potential to produce

a 5-magnitude or greater earthquake if the fault ruptured along its full length.

“This is not meant to be taken as, ‘a magnitude 5 will happen on this fault,’” said SMU’s Heather DeShon, a who led the new study. Until now, the fault has ruptured only in smaller sections, and it may never produce a bigger event, she said.

Quakes of that size are considered moderate and don’t typically cause serious property damage. But a 5-magnitude earthquake that struck Cushing, Okla. in November caused several brick buildings, which are especially vulnerable to earthquake damage, to be condemned. At least one of those buildings later collapsed, and others were torn down, said Jacob Walter, Oklahoma’s state seismologist who contributed to the paper while he was at the University of Texas at Austin’s Institute for Geophysics.

Because earthquakes in North Texas and Oklahoma are shallower than typical natural quakes, they can be felt more strongly near the epicenter.

DeShon, Walter and their colleagues also found that the 4-magnitude event marked the culmination of a series of increasingly large earthquakes along the same fault that began decade ago, shortly after companies began disposing wastewater in northeast Johnson County. Until May 2015, earthquake magnitudes increased in step with injection volumes.

To DeShon, that means turning off individual wells is not likely to affect earthquake size or rates.

“From a mitigation standpoint, you need to start thinking in terms of the cumulative history of injection in regions,” she said.

Johnson County Emergency Management Director Jamie Moore said that the county had factored earthquakes into its plans but that tornadoes and floods took priority because of limited resources. “We focus on what are the most likely scenarios, not necessarily the most damaging ones,” he said. He is concerned about the possibility of an earthquake shifting gas pipelines and causing a leak. But, because Johnson County is home to a dense network of wells and pipelines, first responders are prepared for those situations, he

said.

Moore suggested that the earthquakes are more of a political issue than one of emergency management. "It's a completely separate issue whether we as a society want to live with minor earthquakes that are very odd and certainly very noticeable," he said.

The 4-magnitude earthquake that shook Venus on May 7, 2015, generated a flood of phone calls to Moore's office but only one report of relatively minor damage: a block holding up a mobile home cracked.

A 5-magnitude earthquake would be 10 times bigger than a magnitude 4 and would release 30 times more energy.

The new study suggests that pressure from wastewater injections in Johnson County triggered the May 2015 4-magnitude earthquake. Energy companies rely on wastewater wells to dispose of fluid left over from hydraulic fracturing and other oil and gas production techniques. Johnson County, which sits atop the gas-rich Barnett Shale, is one of the densest regions in the U.S. for wastewater disposal wells, with more than five for every 2 square miles. Disposal and gas production wells dot the landscape, sometimes hidden behind trees but often rising amid new housing developments and alongside roads.

To extract gas, companies force millions of gallons of water, sand and chemicals down a well to fracture the shale. As the gas travels from the rock back up the well, fracking fluid and natural groundwater travel up with it. Companies then separate the oil and gas from the wastewater, then truck the wastewater to a disposal well that injects the fluid deep underground, where it is less likely to contaminate soil and drinking water.

Studies going back to the 1960s have shown that pressure from wastewater injections can cause faults to slip and produce earthquakes. More recently, scientists have learned that only a small percentage of faults — those oriented in just the right direction relative to natural stresses in the earth — are likely to slip in such cases.

That rare set of circumstances converged in Venus on May 7, 2015. In response, the

Railroad Commission sent inspectors to the area to check wells and pipelines for damage and asked operators of the five wells closest to the epicenter to temporarily shut down and perform pressure tests. The commission then issued a statement saying there was “no conclusive evidence” tying the wells to the earthquake.

SMU scientists analyzed data from those tests and found that pressures around the wells were elevated significantly enough to trigger an earthquake. Despite publicly playing down links between wastewater injection and the earthquake, the Railroad Commission privately asked one of the well operators, Metro Saltwater Disposal, to plug back its well to a shallower depth. Another operator, EOG Resources, stopped injecting into one of its wells after May 2015, according to public data available on the Railroad Commission website. It has since plugged that well and sold its natural gas assets in Johnson County, according to a company spokesperson.

In November, Railroad Commissioner Ryan Sitton came close to publicly accepting the wastewater disposal-earthquake link. He said the connection was especially plausible in Johnson County. “I have seen credible data and science from operators that lead me to believe that [Johnson County] has elevated risks of seismicity related to disposal activities, and therefore warrants additional investigation,” he said in a prepared statement.

That investigation, he suggested, would come from UT-Austin’s Bureau of Economic Geology, which operates TexNet, Texas’s new state-funded seismic network, and hosts the industry-sponsored Center for Integrated Seismicity Research, or CISR.

Peter Hennings, principal investigator of CISR, called the new study “a valuable contribution for understanding earthquakes in Johnson County” and said the link between the earthquake and the wells was “reasonable” but incomplete pending more definitive studies. His group is also investigating faults in the Dallas-Fort Worth area and their potential to produce earthquakes and will begin releasing those findings in December.

He added that the reduction in wastewater volumes in Johnson County since 2012 suggests that a stronger earthquake would be less likely now but cannot be ruled out.

Since Oklahoma began reducing its wastewater injections, it has seen several larger quakes, even as its overall earthquake rate has decreased.

For that reason, wrote DeShon and her colleagues, the May 7, 2015 earthquake “may be neither the final nor the largest earthquake in this sequence.”

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