SCIENCE AND MEDICINE 4 DAYS AGO

Wastewater injection can make faults twice as likely to fail, quake study says

Anna Kuchment, Science writer

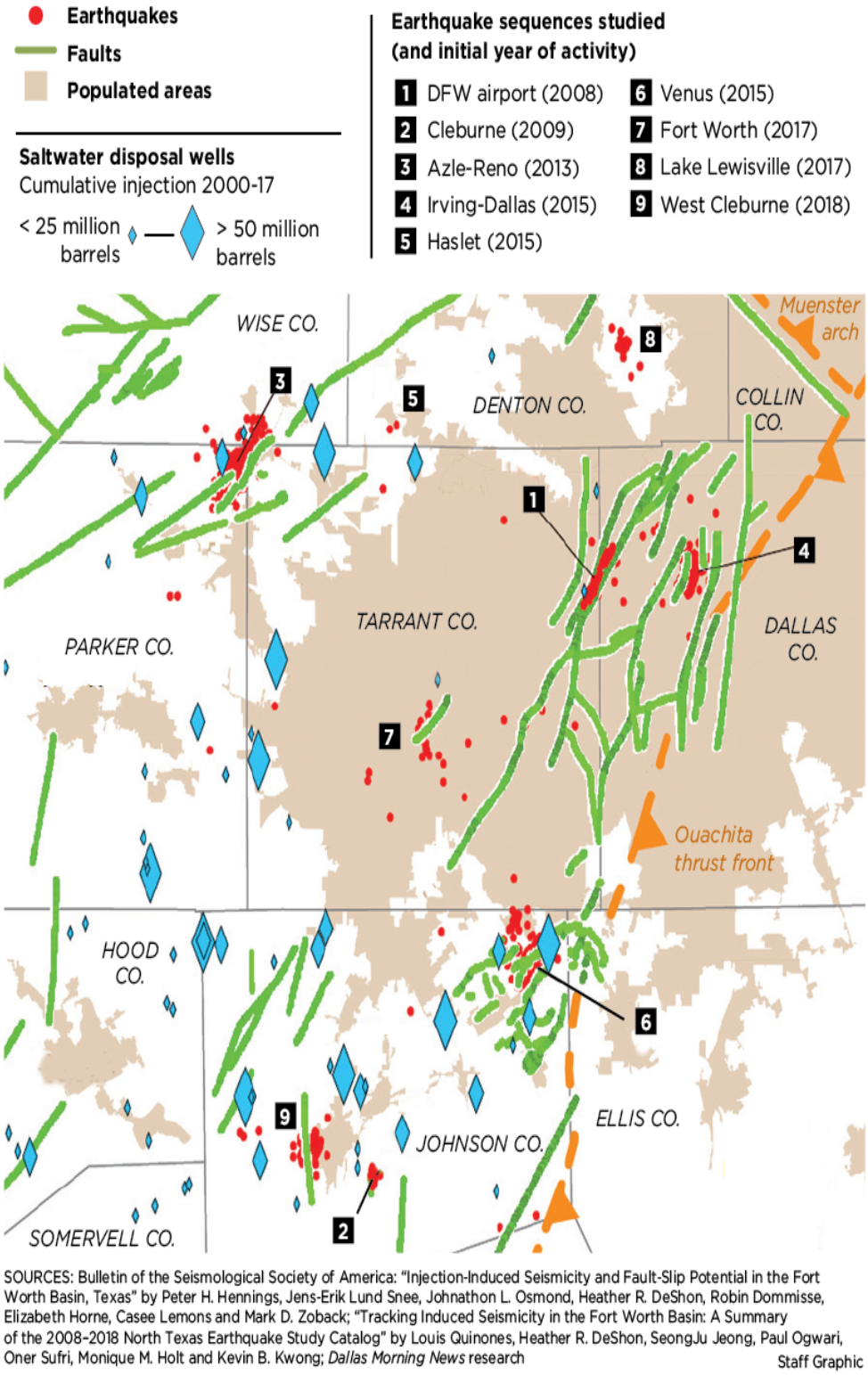
UPDATED at 2:40 p.m. July 25 *to include a statement from the Railroad Commission of Texas' seismologist.*

When earthquakes first jolted Dallas-Fort Worth residents in the fall of 2008, academic researchers knew little about the dense network of faults that run through our region. Now, two newly published studies offer the most complete picture yet of the fissures beneath North Texas and the thousands of small earthquakes they have hosted.

The new research also shows that wastewater injection from oil and gas operations makes faults much more likely to slip. When scientists modeled fault behavior before and after wastewater disposal, they found that disposal pressures could double the chance of earthquakes. The findings solidify the conclusion that North Texas quakes have been triggered by humans and not by Mother Nature.

“These papers are really useful for trying to understand what’s going on in the Fort Worth basin,” the geological formation that underlies much of North Texas, said Michael Brudzinski, a seismologist at Miami University in Ohio who studies human-induced earthquakes but was not involved in the new publications.

In the fault study, researchers at the University of Texas at Austin, Stanford University and Southern Methodist University mapped and analyzed 251 fissures in North Texas with a total length of more than 1,800 miles.



They found that short segments of a majority of these faults can rupture if they're

affected by pressure changes from the disposal of wastewater into deep wells. “That leads us to the conclusion that most of the faults in the entire area are sensitive,” said Peter Hennings, the paper’s lead author and a research scientist at UT-Austin’s Bureau of Economic Geology.

North Texas sits atop one of the world’s richest deposits of natural gas. Since the early 2000s, operators have used hydraulic fracturing to tap into the Barnett Shale and free the natural gas from surrounding rock.

As the natural gas flows up wells toward the surface, it mixes with fracking fluids and natural but toxic saltwater from the ground. Operators separate that water from the gas and pump the waste fluids down a separate set of deep wells meant to lock the hazardous material away from soil, rivers, plants and drinking water.

In 2008, as oil and gas development boomed across the U.S., scientists started connecting the growing volumes of fluid being pumped underground with a surprising surge of earthquakes in areas that had previously been still.

The sun sets behind a wastewater disposal well just outside the city limits of Reno, Texas. In 2015, scientists tied earthquakes in Reno and neighboring Azle to the disposal of wastewater from oil and gas production. (File Photo/Staff Photographer)

While Texas regulators have never formally acknowledged that North Texas earthquakes are tied to industry practices, researchers now agree that pressures from wastewater disposal can unlock ancient faults that might have otherwise not stirred for thousands of years, if ever.

A second paper, led by researchers at SMU and published in June, shows that small earthquakes, most too tiny to feel, continue to rumble beneath North Texas. It also reports for the first time three recent earthquake sequences: tremors in Fort Worth and beneath Lake Lewisville that started in 2017 and a brief sequence of shocks and aftershocks that rustled West Cleburne in 2018.

These events bring the total number of earthquake sequences that have struck North Texas in the last decade to nine and the total number of earthquakes recorded on local

seismic stations to 2,352. Of these, fewer than 200 have been strong enough for residents to feel.

The largest earthquake recorded in the Fort Worth basin is a 4 magnitude tremor that shook the Johnson County town of Venus in 2015 but caused little damage.

“As long as we have earthquakes, people who live in the Dallas-Fort Worth metropolitan areas should be aware that there remains a low level of earthquake hazard and we should be prepared for that,” said Heather DeShon, a seismologist at SMU and co-author of the June paper. Both studies were published in the journal *Bulletin of the Seismological Society of America*.

The new findings will help researchers and regulators assess where quakes are most likely to strike. “For us, both of these papers are very significant and important,” said Mark Petersen, an expert on earthquake hazard at the U.S. Geological Survey in Golden, Colo. In 2016, he and his colleagues released a national earthquake hazard map that showed the Dallas-Fort Worth area had a tenfold higher risk of experiencing earthquakes than it did in 2008.

Since then, earthquake rates in North Texas have fallen sharply along with rates of wastewater disposal. The UT-led paper, which was partly funded by oil and gas companies, incorporated proprietary fault data from ExxonMobil and its subsidiary XTO Energy, ConocoPhillips, Pioneer and others. Researchers combined the industry information with their own new mapping, previously published geologic studies and SMU and TexNet earthquake locations to create the most detailed fault map ever drawn up for the Fort Worth basin.

Alexandros Savvaidis, program manager for TexNet, checks his laptop as he and an associate install a portable seismometer behind a fire station on Sept. 29, 2016, in Farmers Branch, Texas. TexNet is an earthquake monitoring program run by the Bureau of Economic Geology, at the University of Texas at Austin, to help locate and determine the origins of earthquakes in Texas. (Smiley N. Pool/Staff Photographer)

The longest fault the researchers traced is the DFW Airport Fault, which stretches for 22 miles beneath one of the country's busiest transportation hubs. A small portion of it ruptured in 2008, causing loud booming noises and some ground shaking in Irving. After seismologists tied the earthquakes to a nearby disposal well, the well was shut down. The rest of the faults are shorter than 5 miles long, suggesting that North Texas is not in store for California-sized earthquakes, said Hennings.

After tracing the faults, researchers used a tool developed at Stanford University and Exxon to predict which faults would be most likely to rupture in the event of pressure changes from wastewater injection.

The findings suggest that wastewater disposal wells in North Texas should be closely

monitored, said Hennings.

“Operations near population centers need to be strongly justified,” said Hennings. “Future saltwater disposal should be spread out as broadly as possible, because it’s the concentration of fluid pressure which is the most hazardous thing.”

Jacob Walter, the state seismologist for Oklahoma, which has experienced more induced earthquakes than any other state, praised the UT-led paper as an important contribution to the understanding of regional faults.

He said he hoped to see such collaboration extend beyond North Texas. “It would be exciting to see the same type of data-sharing occur in other areas with active induced seismicity,” he wrote in an email.

The Railroad Commission of Texas, which regulates oil and gas wells in the state, declined a request to interview its staff seismologist Aaron Velasco about the new studies. Instead, he issued a statement that said, "The Commission considers research studies, such as this one, to be an important element to making regulatory decisions based on solid science in our mission to protect public safety and the environment."

In a second written statement, a spokesperson said that the agency's highest priority is the protection of public safety and the environment, and that it grants permits for wastewater wells in areas of historic seismicity selectively and with special conditions. The conditions can include requirements to reduce maximum daily injection volumes and pressure, and to record volumes and pressures daily instead of monthly.

MORE IN NEWS

NEWS

Dallas police ask for help finding who shot 8-year-old dog, Beethoven, in the back

NEWS

Republican lawmaker on alleged target list demands answers from caucus chairman Dustin Burrows

BUSINESS

Chuck E. Cheese parent company cancels deal to bring Irving chain public

NEWS

Man accused of setting fires at Fort Worth home with woman, children inside

BUSINESS

Retail Therapy: CBD-infused products land in Texas, and Swappa wants to sell your electronics

ARTS

'Struggle does not defeat you': How music helped save this young Arlington composer's life

TRENDING ARTICLES

Elderly couple found fatally shot in murder-suicide in White Rock area, Dallas police say...

Beto O'Rourke's mother has this to say about her son's White House ambitions...

For Uptown Dallas' sleepy Routh Street, it's high-rise and shine on the horizon...

Red states are surging past blue states in growth and business. It isn't hard to see why...

Rescue crews recover body after man went missing in Lewisville Lake...

Authorities identify 2 people killed in fiery twin-engine plane crash in Gainesville...

Why a Dallas judge made the rare decision to have a 16-year-old tried as an adult in rape, murder...

NEWS

BUSINESS

LIFE

SPORTS

ENTERTAINMENT

ARTS

OPINION