

Gas drilling and earthquakes in Texas

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Throughout Cleburne's 142-year history, people have known it as a quiet, rural town where residents live happily away from the hubbub of neighboring Dallas-Fort Worth. That changed this summer when a series of small earthquakes jolted Cleburne. Though no serious injuries or damage was reported, the quakes upset nerves, stirred controversy, and drew media attention from far corners of the country.

"It shook my chair and rattled things on the wall," City Council member Gayle White says of the first earthquake, on June 2—a 2.8 magnitude tremor she said lasted only seconds.

As quakes continued, calls rolled into the city's 911 emergency operators, and longtime residents tried to make sense of brief shaking sensations they had never before felt.

"I thought somebody had run into the house with a tractor," says Sharla Harwell, 48, of Cleburne, recalling a booming sound accompanying one of the quakes.

What caused the booms? Nearly everyone has a theory, and the prevailing one around here seems to be that "the boom" caused the booms. (See "Quaking in Cleburne," Aug. 7)

"The boom" has been in natural gas wells. N.R. Powell, 74, who has lived in Cleburne his entire life, says, "All you do is walk 100 yards in any direction, and you'll find one."

A town of about 30,000 in Johnson County, Cleburne is situated over the Barnett Shale gas field, where hydraulic fracturing is used to extract natural gas. The process involves injecting gas wells with high-pressure water, along with chemicals and sand, to crack open the rock and release the gas.

Earthquake graph

Over the past six years, Cleburne's natural gas boom has produced numerous millionaires and filled city coffers with sizable royalties. The Johnson County area isn't the only one rolling in gas royalties. Adjacent Tarrant County, another of the 19 counties in the Barnett Shale, has experienced at least as big a boom. It felt the first of several earthquakes on Oct. 31 last year. Since then, at least 20 more quakes have occurred in the two counties. The quakes are the first recorded in their histories. A WORLDWIDE WEB

Might the recent earthquakes in North Texas have anything to do with Google and Basel, Switzerland? Depends on whom you ask.

In Basel, a geothermal project involving hydraulic fracturing was shut down in December 2006 after scientists concluded that the operation had triggered earthquakes—more than 3,500 over the following year. That was reported by The New York Times in June, in the wake of five earthquakes that rocked Cleburne earlier that month, and raised the question of whether hydraulic fracturing might be the cause.

According to the article, Google is one of the main investors in a proposed geothermal project in California that would be similar to the one tried in Basel, and the first such project in the United States.

Asked if he is familiar with the Times article, Cleburne spokesman Charlie Hodges says, "No, because it has nothing to do with Cleburne, Texas."

According to the article, the Basel project injected high-pressure water into drilled holes more than two miles deep to create a network of fractures. The goal in Basel was circulating water through the heated earth and extracting it as steam. But project leaders, concerned about the sudden incidence of earthquakes in the city, released well pressure in an attempt to halt the fracturing. As they did, a 3.4 quake occurred, accompanied by a loud noise that sounded to one project leader like a sonic boom. That man told the Times, "It took me maybe half a minute to realize, hey, this is not a supersonic plane, this is my well."

Natural gas industry officials in Texas have been less quick to assume responsibility for quakes, which have continued this spring and summer. Oklahoma City-based Chesapeake Energy Corp. is the largest gas producer in Johnson County and the third-largest operator in the Barnett Shale, according to the most current information from the Texas Railroad Commission.

Chesapeake officials declined to comment for this article.

The Basel and North Texas scenarios are not entirely analogous. For one thing, hydraulic fracturing in the Barnett Shale extracts natural gas rather than circulating water, and wells here are shallower, averaging 1.4 miles, according to the commission. The consequences of hydraulic fracturing at any depth have yet to be established.

Still, earthquakes in both cases have been of similarly small magnitudes, and though coincidence doesn't equal cause, the chronology is suggestive. THE DECIDERS

Local concern over the possibility that fracturing might be causing the earthquakes "is directly related to the amount of mailbox money they receive," says Chester Nolen, Cleburne's city manager.

About half of Cleburne's residents get "mailbox money"—royalty checks from \$300 to tens of thousands of dollars a month—for leasing their land for natural gas wells, Nolen says. Landowners also received handsome signing fees that reached \$16,000 an acre, though those have decreased in recent years to about \$2,500, he says.

The city of Cleburne has received more than \$25 million for allowing drilling on municipal land.

After multiple earthquakes hit Cleburne, city leaders hired a geologist to find out why. Then they learned that Southern Methodist University geologists were conducting their own six-month study with 10 loaned seismic monitoring stations, funded mainly by the National Science Foundation. So Cleburne's council decided to save the expense and piggyback on SMU's study. Most of Cleburne's earthquakes had already occurred when the 10 stations were put in place this summer.

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Fractured The hydraulic fracturing technique was pioneered by Halliburton Co. Former Vice President Dick Cheney was chief executive officer of the company from 1995 to 2000 and served as an SMU trustee from 1996 to 2000. Some critics of SMU's coziness with the company have referred to the school as "Southern Halliburton University."

The Bush-Cheney administration's 2005 Energy Policy Act exempted hydraulic fracturing from regulation under the federal Safe Drinking Water Act. As a result, gas operators don't have to divulge what chemicals they inject when they fracture a well.

Concerned about the risks of groundwater contamination from fracturing, some members of Congress have been working on a bill to reverse that decision and require companies such as Halliburton to reveal the chemicals in their fracturing fluids.

SMU renamed its geology department the Roy M. Huffington Department of Earth Sciences last year after receiving a \$10 million endowment from Huffington, the late oil and gas man who in 1990 was appointed ambassador to Austria by former President George H.W. Bush. Huffington, an SMU alumnus, has given the university more than \$31 million through the years, according to SMU Magazine. SMU has also received substantial gifts from other oil and gas industry figures.

Last August, SMU was among three entities sharing an investment of more than \$10 million by Google.org (Google's philanthropic arm) in "enhanced geothermal systems," technology that relies on hydraulic fracturing. SMU's portion was a nearly half-million-dollar grant for the earth sciences department to update its geothermal energy map of North America, which will help interested parties locate geothermal resources. AltaRock Energy Inc. and Potter Drilling Inc. received the rest of the Google investment. Google is a primary investor in a proposed AltaRock Energy geothermal project in California similar to the one tried in Basel, and the first such project in the United States.

David Blackwell is the SMU geophysics professor spearheading the geothermal energy map project funded by the Google grant. He expresses irritation with the Times story on Basel, which discussed the proposed AltaRock project in California.

"There was one mistake that was made where people didn't know what they were doing, and it's been blown completely out of proportion," he says, declining to comment further.

On the morning he made that brief remark, the Times had published a follow-up story saying Energy and Interior Department officials had shelved the California AltaRock project indefinitely because of its unknown potential to cause earthquakes. Officials previously had told the Times that AltaRock failed to fully disclose what happened in Basel.

INDEPENDENCE

SMU's ties to the energy industry notwithstanding, the two SMU scientists monitoring the North Texas earthquakes appear to be free of direct conflicts of interest and are not involved in the Google mapping project. They are Brian Stump, professor of earth sciences, and Chris Hayward, Geophysics Research Projects Director. Their primary research at SMU involves seismic monitoring of nuclear explosions, a study funded by the Department of Defense.

Chesapeake's only contribution to SMU was \$5,000 for an oil and gas symposium held at the university in 2005, an SMU spokesman says. Aside from the loan of seismic equipment, funded mainly by the National Science Foundation, Stump and Hayward have received no funding for the seismic study, they say.

"We want to get to the bottom of this as much as anybody else does," Stump says, insisting that SMU's ties to the energy industry have no bearing on their research.

This summer isn't the first time Stump and Hayward have studied area earthquakes. Last November, after the fall earthquakes, they deployed six seismic sensors around the Dallas-Fort Worth International Airport. Those sensors were removed in January. Stump and Hayward are analyzing the data and hope to have something to share in the next few months.

Likewise, data from this summer's Cleburne quakes will take time for analysis and peer review to ensure accuracy and objectivity, Stump says. The scientists say their data will be available to the public and will be analyzed in collaboration with Cliff Frohlich, associate director of the University of Texas Institute for Geophysics and co-author of Texas Earthquakes. **SCIENTISTS PUZZLED**

SMU scientists hope to glean from their research how deep the quakes are originating. Some geologists believe the earthquakes come from deeper than drilling has reached and are thus unrelated, but seismologists have had difficulty determining the exact depths of the area's quakes.

Nailing down what the industry is doing presents another challenge. "The difficulty is knowing when people are actually doing the fracturing," says John Nichols, an associate professor at Texas A&M University who studies death statistics from earthquakes around the world.

Nichols says data from area gas operators showing when and where they have fractured could help SMU scientists ascertain whether there's a relationship between that activity and the earthquakes. As of mid-July, Chesapeake had not shared that data with SMU scientists, but Stump says he's "cautiously optimistic" that Chesapeake will cooperate.

Gas well activities such as injecting or extracting fluids into or from the earth's crust can cause earthquakes, Stump said, but many other areas of the state have drilling and fracturing without earthquakes.

"There's something peculiar going on here [in the DFW area] that's not going on elsewhere," Hayward says.

The earthquakes near the DFW airport were close to gas wells set up just last year, Frohlich says, noting, "It's certainly a likely candidate as being related to the earthquakes."

Though scientists have had less time to study data from this summer's Cleburne quakes, "it certainly is suspicious," Frohlich says.

Similarly, some geophysicists with the United States Geological Survey are intrigued by the prevalence of natural gas drilling near the North Texas earthquakes. USGS research geologist Russell Wheeler recalled a situation in the 1960s when the U.S. Army was trying to get rid of some liquid toxic waste on the north side of Denver. The Army drilled a couple miles into the earth and began pumping the fluid in, but the process was halted when earthquakes resulted, he says.

Paul Caruso, a geophysicist with the agency's National Earthquake Information Center in Golden, Colo., wanted to know when natural gas drilling started in the DFW area.

Told the boom began in 2001 and has accelerated in the past two years, Caruso said, "That's all I'm going to say about that."

Is it related to the earthquakes?

"I'm not going there," he said, and suggested looking up "induced seismicity."

MYSTERY BOOMS

Induced seismicity refers to earthquakes and tremors triggered by human activity, which tend to be of low magnitude. Triggered quakes often make a loud tearing or roaring noise, according to the June Times story on Basel's quakes.

"Triggered quakes tend to be shallower than natural ones, and residents generally describe them as a single, explosive bang or jolt—often out of proportion to the magnitude—rather than a rumble," the article reports.

A person involved in the Basel project who experienced a quake there described hearing a noise like a supersonic aircraft. A woman quoted in the story said she thought a bomb had gone off.

Witnesses in DFW and Cleburne have used much the same language to describe earthquakes there.

"It's just like a boom," says Garland Bishop, 48, of two earthquakes he felt in June at his home just outside of Cleburne. "... It feels like a bomb went off, like an explosion."

White, the Cleburne councilwoman, felt the June 2 quake while at home on the southwest side of town.

"I was at my desk going over my stuff, and there was just a boom," she says. "It was like a sonic boom or something. I thought the house had blown up."

Staci Semrad is an Austin-based freelance journalist.