

Speakers detail research, data gathering involved in addressing seismicity

[Midland Reporter-Telegram - Powered by Dow Jones](#) Mella McEwen

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Seismic events have rattled the Permian Basin, beginning with a rash of quakes in Culberson and Reeves counties and heading northeast to the Midland-Odessa area.

According to Earthquake.com, more than 255 have been reported in the area around Midland since last February. Seismicity around Midland-Odessa have been growing not only in frequency but in intensity. In late December, a 4.5 magnitude earthquake was reported north of Stanton. Culberson County has experienced more earthquakes than the rest of Texas combined, according to Cody Comiskey, earth science advisor at Chevron.

The rise in seismic activity has been linked to water disposal and, in some areas, to hydraulic fracturing as well, according to those at the Permian Basin Water in Energy Conference.

"How are we sure disposal wells trigger seismicity?" asked Heather DeShon, seismologist and professor and chair of the Department of Earth Sciences at Southern Methodist University as she updated attendees at the conference on response to the earthquakes.

To answer, she cited the experience of the Rocky Mountain Arsenal in Colorado in the 1960s. Investigating a series of earthquakes, the arsenal found the pressures of the fluids lowered frictional resistance along established fault lines. But, she added, the largest earthquakes occurred two years after injection stopped.

She currently serves as project lead for induced earthquake studies focused on understanding the causal factors and physical mechanisms leading to increased seismicity rates in North and West Texas. Her presentation focused on lessons learned from the spate of earthquakes in the Fort Worth Basin amid drilling activity in the Barnett Shale.

"There were early indicators of induced earthquakes near wells. Those quakes now occur at greater distances."

There is no clear, easy solution that is predictive of what fault will generate an earthquake and under what pressures, she said. "But we learned a lot about the size and orientation of faults."

One takeaway is that very small changes in stress to the rocks can trigger an event. "The numbers are very small," she said, noting that now-retired quarterback Tom Brady put more pressure on a football than it could take to trigger an event.

Mapping fault hazards and understanding their orientation is underway in the Midland Basin, she said. For best data, she advised that there should be a monitoring station within 10 kilometers of an active fault paired with a regional seismicity monitor.

Higher-quality data and a willingness to communicate that data to other operators and to regulators is key to addressing seismicity, said Comisky.

In counties experiencing seismic activity, potential causes differ, he told the audience.

In Culberson County, seismic activity has been consistent with deep disposal wells, whereas activity in Reeves County appears linked to shallower disposal wells.

There has been a rapid increase in seismic events in the Midland Basin, which appear linked to deep disposal wells.

As the Railroad Commission established three seismic response areas – Gardendale, Stanton and North Culberson-Reeves County in response to activity, they have requested information from operators on injection volumes and pressures. Hydraulic fracturing start and end times have also been requested in the Culberson SRA.

Operators in the Culberson SRA have been meeting over the last three months to develop a response plan. The plan recently submitted includes a two-tiered approach of shallow disposal wells and deep disposal well response. The plan also contains significant reductions in deep well injections over the next 12 to 15 months.

In the Stanton MSA, operators are still crafting a response plan.

"There is strong recognition of industry collaboration on response," said Comiskey. He noted that CISR – the Center for Integrated Seismicity Research – at the Bureau of Economic Geology has 20 industry sponsors. In addition, he said more public seismic monitors have been deployed to provide higher-quality data and in late 2019 the industry provided the Railroad Commission with its recommendations for best practices to mitigate or avoid seismicity.

That increased reporting is being leveraged in the Culberson and Stanton SRAs, he said, and the industry is also leveraging that data and understanding to address the seismic activity around Midland and Odessa.

The rise in seismic activity and resulting reduction in injection volumes, rates and pressures by the Railroad Commission in response have serviced to heighten the focus on the need to expand water optionality, recycling and beneficial use, Comiskey concluded.