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BUSINESS // OIL & ENERGY

Researchers deepen link between oilfield activity, earthquakes

Research creates framework to help mitigate seismicity risks



Mella McEwen, [MRT.com/Midland Reporter-Telegram](#)

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Hydraulic fracturing wells span the Yates Oil Field in the Delaware Basin. Researchers from the University of Texas at Austin are deepening the link between water disposal and hydraulic fracturing operations and seismic activity. This helps design a framework for operators and regulators to mitigate the risk of earthquakes.
Jan Buchholz UT Austin

Researchers are increasingly linking oilfield activity and seismic activity, with a new report from the University of Texas at Austin connecting the two in the Delaware Basin.

Researchers investigating the rise in seismic activity in the Delaware since 2009 studied data that tracked seismicity and oil and gas production in the basin from 2017 to 2020. They found 68 percent of earthquakes above magnitude 1.5 were highly associated with hydraulic fracturing and/or disposal of produced water into shallow or deep geologic formations.

“They’re identifying a definitive link between wastewater injection and the frequency of quakes.” Jason Jennaro, chief executive officer of Breakwater Energy

Partners, told the Reporter-Telegram by email. “But interestingly they are also identifying a strong statistical relationship between wastewater injection and earthquake intensity, which is particularly concerning to population centers.”

Jennaro noted that the report identified wastewater injection into both shallow and deep geological formations as the principal cause of more than 5,000 earthquakes in West Texas and New Mexico. The largest of those quakes, like a 5-magnitude tremor near Mentone in 2020, were strongly linked to deep disposal, he added.

As a result, Jennaro added, operators have focused their 2022 water management programs on the recycling and movement of wastewater out of seismically active areas, especially Seismic Response Areas.



“These data validate those efforts and the need for improved stewardship over the water supply chain,” he wrote.

Alexandra G. ... research at the UTRP Division of Economic Geology and

Alexandros Savvaidis, a researcher at the U T Bureau of Economic Geology and the principal investigator of Texas' state seismic monitoring network and seismicity research TexNet, told the Reporter-Telegram by email that the work presents a framework that can assess the causal link between industry operations and seismicity.

The paper shows researchers know a lot about how oil and gas activities and seismic activity are related, Savvaidis said, and the modeling techniques can help producers and regulators identify potential risks and adjust production and disposal activity to decrease those risks.

“By using current information, we provide a model that connects operations with seismicity and this model can be used for hazard mitigation,” he wrote. “Also, when we have the expected subsurface fluid injection data – projection of the subsurface fluids based on planned production – we can use the model to hindcast seismicity. In this way, we can proactively take measures to protect the environment and the industry investment.”

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The paper's lead author Iason Grigoratos developed the model as a postdoctoral researcher at the UT Jackson School of Geosciences, where the bureau is a research unit. The model was first applied in a 2020 study that found a connection between produced water disposal and seismicity in Oklahoma.

The model was developed using a combination of statistical analysis and physics-based modeling to determine which activities have a connection to past earthquakes.

More importantly, Savvaidis noted, this framework can be used in other areas of the state and worldwide.

The plan, he continued, is to apply the developed methodology to other areas and transform the methodology into a tool that can be accessible from stakeholders. By improving earthquake, oil and gas data, he said researchers plan to use the methodology at a smaller scale – less than 5 kilometers – and also develop additional methods for seismicity causal assessment and enabling hazard mitigation.

The researchers analyzed about 5,000 earthquakes, selecting the above magnitude 1.5 threshold. Forty-three percent of the earthquakes above magnitude 1.5 were linked with injection into shallow sedimentary formations

magnitude 1.5 were linked with injection into shallow sedimentary formations, above the hydraulic fracturing depth; 12% were linked with injection into deep sedimentary formations above the basement rock and below the hydraulic fracturing depth. The 2020 magnitude 5.0 earthquake that occurred in Mentone happened in a region where seismicity was strongly associated with deep produced water injection. Hydraulic fracturing was linked to only 13% of earthquakes. However, this was higher than previously expected.



Written By
Mella McEwen

Mella McEwen is the Oil Editor for the Midland Reporter-Telegram.

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