

EXPERT ANALYSIS

Science and Law: Another Collision at A Difficult Intersection

By Patricia McGarvey Rosendahl, Esq.
Greenberg Traurig LLP

On Feb. 16 the Sierra Club filed a lawsuit in the U.S. District Court for the Western District of Oklahoma against oil and gas drillers Chesapeake Operating LLC, Devon Energy Production Co. and New Dominion LLC.¹

The Sierra Club claims that wastewater injection wells have contributed to cause increased earthquake activity in Oklahoma and alleges that, because “no government body is currently taking a holistic or proactive view of waste injection and its potential to induce earthquakes,” a court order is needed to require the establishment of an independent earthquake monitoring and prediction center to determine the amount of production waste that can be injected into specific wells before seismic activity occurs.

The suit also seeks an injunction ordering the three defendants to reduce the amounts of production waste being injected underground “to levels that seismologists believe will not cause or contribute to increased earthquake activity.”

The Sierra Club action followed an earlier lawsuit filed by 14 residents of Edmond, Oklahoma, against a dozen oil and gas companies. The plaintiffs in that suit claimed that saltwater disposal wells were in part to blame for the 4.3 and 4.2 magnitude earthquakes that struck near Edmond on Dec. 20 and Jan. 1.² Two other cases involving a personal injury and a property damage claim are also making their way through the Oklahoma state courts. Those cases stem from a 5.6 magnitude quake in 2011 near the town of Prague.

As these lawsuits demonstrate, the question of whether particular earthquakes have been caused by natural geologic forces or by man-made activity — or a combination of both — is no longer simply a matter of academic interest. The legal implications of new earthquake studies in areas of increased drilling activities are just now beginning to emerge. These implications could reshape the limits of legal liability in ways that are hard to predict.

Until now, earthquakes, although causing significant property damage and personal injuries, have generally been outside the scope of civil litigation since they have been traditionally viewed as acts of God or force majeure events.

If causation of earthquakes, in some cases and in some areas, can now plausibly be attributed to man-made activities — specifically underground wastewater injection — then potential liability for quake damage could arguably arise. Such a development would have profound consequences not just for the oil and gas industry, the insurance industry, and other sectors of the economy, but for large areas of existing law.

A bill that would make it easier to sue oil and gas companies for damage caused by earthquakes is currently raising concern in Colorado. The bill amends an oil and gas accommodation statute to



As these lawsuits demonstrate, the question of whether particular earthquakes have been caused by natural geologic forces or by man-made activity — or a combination of both — is no longer simply a matter of academic interest.

address any claim of damage caused by an oil and gas operator. It specifically applies a strict liability legal standard when claims are made regarding damage caused by earthquakes that are presumably caused by oil and gas operations.

HB 1310 passed the Colorado House of Representatives and is headed for the Senate, even though seismic activity associated with oil and gas production is relatively rare in Colorado. A spokesperson for Colorado's governor has characterized the bill as "a solution in search of a problem."³

The legal implications of linking increased quake activity with wastewater injection wells are undeniably broad in scope but fairly recent in origin. In April 2015 the U.S. Geological Survey unveiled a map of earthquakes thought to be triggered by human activity in the eastern and central United States.⁴ The map showed earthquake activity from 1960-2012, 2013 and 2014, with most of the activity occurring in 2014. It also highlighted areas that were located near deep fluid injection wells or other industrial activities believed to be capable of inducing earthquakes.

The release of the map came as officials in a number of states were already investigating whether wastewater disposal, following oil and gas extraction by means of hydraulic fracturing, or fracking, could cause more earthquakes.

Fracking involves injecting a high-pressure mix of water, sand and chemicals deep underground to extract oil and natural gas from oil shale formations. The resulting wastewater is often injected underground. These wastewater injection wells are now suspected of triggering earthquakes on otherwise inactive fault lines.

On March 28, the U.S. Geological Survey issued a report that cited the oil and gas drilling process as triggering the quakes.⁵ The report notes that most quakes appear to be triggered by wastewater disposal from oil drilling, with far fewer being triggered by fracking itself.

Oklahoma appears to be the state most heavily hit by recent earthquake activity. In 2014 Oklahoma had more earthquakes at magnitude 3 or higher than California. It is also the subject of a number of recent studies undertaken to explore the perceived link between seismic tremors and hydraulic fracturing during oil and gas production.

In June 2015 Stanford geophysicists published a study indicating that the primary source of the problem was not the flowback water generated by fracking but "produced water" — saltwater that naturally coexists with oil and gas within the earth, which drilling companies typically reinject into deeper disposal wells as oil and gas is extracted.⁶

The volume of produced water entering disposal wells generally exceeds the volume of flowback water from fracking by a significant factor. In the areas where the greatest seismic activity occurred in Oklahoma, over 95 percent of the wastewater disposal was produced water. The study also attempted to explain the time delay that has been noted between the peak wastewater injection rate and the onset of seismic activity, which raised questions about causation.

According to the study, shear stress builds up slowly along fault lines until it finally overcomes the frictional strength that keeps the two sides of a fault clamped together. While an earthquake may have been inevitable along the fault line over time, injecting water into the faults effectively pressurized them and "advanced the clock."

Following this study, the Oklahoma Geological Survey concluded that the sharp rise of earthquakes in that state was "very unlikely to represent a naturally occurring process," since the quakes had occurred in the same areas that had a sharp rise in wastewater disposal wells in recent years.

The link between injection wells used to dispose of hydraulic fracturing wastewater and seismic tremors is largely based on circumstantial evidence, however, and direct causation has not been fully established.

State regulatory agencies find themselves in the difficult position of trying to formulate policy concerning underground wastewater disposal in response to public concern while investigation

continues and scientific studies remain suggestive but ultimately inconclusive. Without sufficient data and long-term studies, the effectiveness of any new regulations would be difficult to measure.

Whether a reduction in wastewater injections in areas with known fault lines would be followed by a reduction in seismic activity is not yet clear, and how much of a reduction would be needed to minimize the risk of quakes is currently a matter of speculation.

In other words, the Sierra Club's demand for a court order to reduce the amounts of production waste being injected underground "to levels that seismologists believe will not cause or contribute to increased earthquake activity" is assuming a fact not in evidence yet. Complicating matters even further is the reality that many small geologic fault lines in oil-rich areas have been inactive for eons and are not just unmapped but largely unknown.

Nevertheless, state regulatory agencies have begun to take steps to both increase scrutiny of seismic activity in areas where a large number of wastewater injection wells are located and to regulate wastewater injection wells in areas with known seismic activity.

In response to increased concern about earthquakes, both in terms of frequency and magnitude, Oklahoma, Texas and Kansas have all imposed new regulations and requirements for wastewater injection wells. Because the body of scientific knowledge about these events is at an early stage of development and hard data concerning critical issues remains sketchy, the three states have independently begun to tackle the problem — albeit with somewhat different approaches.

While many of the new regulations involve closer monitoring and new requirements for recording volumes of injected wastewater, other regulations are moving toward limiting or prohibiting new injection wells in seismically sensitive areas.

On March 7 the Oklahoma Corporation Commission asked well operators in central Oklahoma to reduce by 40 percent the amount of oil and gas wastes being injected underground.⁷ The directive covers 411 injection wells in a rough circle that includes Oklahoma City and points northeast.

This directive followed a February request that imposed a 40 percent cutback on injection wells in a similar-size region of northwest Oklahoma. The 40 percent cutbacks are based on the amount of waste injected into the wells in 2014, a peak year, and should result in a reduction of more than 300,000 barrels a day from the 2015 average injection volumes.

The directives were phrased as requests because the commission's legal authority to order cutbacks over such broad areas is unclear. However, the commission has pledged to take to court any operator that refuses to implement the reductions.

In a separate action, the Oklahoma Corporation Commission announced the expansion of the size of its "area of interest," bringing more restrictions to disposal well operations in areas that have not yet seen major earthquake activity.⁸ An additional 118 disposal wells will be covered by so-called "yellow light" earthquake precautions. These include having to prove the well has not been drilled too deep as well as daily and weekly volume recording and reporting requirements.

Gov. Mary Fallin has also allotted \$1.4 million in state funds to the state geological survey and to the Corporation Commission to allow the state to enhance its earthquake monitoring network, to hire a geophysicist and other staff members, and to better monitor quakes.⁹

Additionally, the Oklahoma Legislature is considering a bill that would allow the state insurance commissioner to create an earthquake reinsurance program. Residents of quake-prone areas of the state have complained that private insurance was either impossible to obtain or that it included prohibitively high deductibles.

Kansas had only 31 quakes between 1981 and 2010, but it experienced 127 earthquakes in 2014. After more than 50 quakes were recorded by mid-March 2015, the Kansas Corporation Commission cited an immediate danger to public safety on March 19, 2015, as the reason for limiting the pressure that could be used to inject wastewater into disposal wells and limiting the volumes that could be injected.

The legal implications of linking increased quake activity with wastewater injection wells are undeniably broad in scope but fairly recent in origin.

"Because individual earthquakes cannot be linked to individual injection wells, this order reduces injection volumes in areas experiencing increased seismic activity," commission officials stated in the order.¹⁰ The order also required well operators to measure and report the true vertical depth of each well and to plug all wells that penetrated formations lying beneath the base of the Arbuckle formation.

Drilling areas in north, south, and west Texas have also seen more earthquake activity as the number of disposal wells has surged amid Texas' fracking bonanza. However, Texas has thus far avoided making any sweeping new regulations. Instead, it has focused on seismology investigation of specific areas and regulatory "show cause" evidentiary hearings that require companies to rebut researchers' findings and show why they should keep their permits. The state's unique geology and geography have created a need for its own specific data.

A study by researchers at Southern Methodist University concluded that wastewater injection wells most likely triggered more than two dozen small earthquakes that shook two north Texas towns in late 2013 and early 2014.¹¹ Using modeling techniques, the study showed that a pressure differential developed along one of the faults as a combined result of high fluid injection rates to the west and high water removal rates from production wells to the east.

The study also indicated that some ancient faults in the region were already critically stressed, which meant that surprisingly small changes in stress could cause earthquakes in the area. While the SMU study has been quite influential in focusing attention on injection wells in Texas, its findings and conclusions remain site specific.

As early as 2014, Texas' oil and gas regulatory agency, the Railroad Commission, tightened rules for wells that dispose of oil field waste by requiring companies to submit additional information, including historic records of earthquakes in the region, when applying to drill a disposal well and clarified that the commission could, at its discretion, halt injections of fracking waste and require companies to disclose volume and pressure of injections.¹²

While these powers are intended to be used on an "as needed" basis for problematic well operations, the commission has increased its scrutiny of wastewater injection well activity and hired its own seismologist.

After the SMU study linked earthquakes in the north Texas area to wells operated by XTO Energy and EnerVest, the Texas Railroad Commission ordered hearings.¹³ "Show cause" hearings in June 2015 required the two companies to offer evidence rebutting the researchers' findings and showing why the operators should keep their permits.

In two rulings, however, commission examiners ultimately agreed with the energy companies that natural tectonic processes had surprised North Texans "unaccustomed to shaky ground."

The commissioners found that the SMU study was a "commendable first-order investigation" of the issue, but "presents data indicating a weak temporal correlation between injection and seismic activities — too small to imply a causal relationship without further corroborating evidence."

Texas, perhaps because of its variable geology, appears to be addressing these issues on a case-by-case basis while retaining a full arsenal of regulatory powers to use as needed.

In sum, the Sierra Club is arguably incorrect in its contention that no government bodies are taking proactive measures to address wastewater injection wells and their potential to cause seismic activity.

A number of regulatory agencies in multiple states have been taking action to investigate and address this issue, using a variety of different approaches. However, regulatory agencies are also exercising caution by choosing not to react too quickly to too little information.

Litigants, on the other hand, are moving ahead with earthquake damage claims that seek to impose liability on operators of wastewater injection wells based upon these early studies. Science and law appear headed for another collision at a difficult intersection.

In 2014 Oklahoma had more earthquakes at magnitude 3 or higher than California.

NOTES

- ¹ *Sierra Club v. Chesapeake Operating LLC*, No. 16-134, complaint filed, 2016 WL 618869 (W.D. Okla. Feb. 16, 2016).
- ² Joe Wertz, *Edmond Residents Latest to Sue Oil and Gas Companies Over Earthquake*, STATEIMPACT (Jan. 12, 2016, 11:22 AM), <http://n.pr/1SUQ57h>.
- ³ Cathy Proctor, *Hickenlooper Concerned About Earthquake Bill Aimed at Colorado's Oil and Gas Sector*, DENVER BUS. J. (Mar. 17, 2016, 2:45 PM), <http://bit.ly/1RpuZwC>.
- ⁴ Rong-Gong Lin II, John Schleuss & Thomas Suh Lauder, *Man-Made Earthquakes Increasing in Central and Eastern U.S., Study Finds*, L.A. TIMES (Apr. 23, 2015, 6:00 AM), <http://bit.ly/1RpuZwC>.
- ⁵ Doyle Rice, *Man-Made Earthquakes Put Millions at Risk, Report Says*, USA TODAY (Mar. 28, 2016, 4:40 PM), <http://usat.ly/1pFz9KB>.
- ⁶ Ker Than, *Oklahoma Earthquakes Linked to Oil and Gas Wastewater Disposal Wells, Say Stanford Researchers*, STANFORD NEWS (June 18, 2015), <http://stanford.io/1dO6eOq>.
- ⁷ Michael Wines, *Oklahoma Puts Limits on Oil and Gas Wells to Fight Quakes*, N.Y. TIMES (Mar. 7, 2016), <http://nyti.ms/1Qhz1pT>.
- ⁸ Press Release, Okla. Corp. Comm'n, Oil & Gas Div., *Regional Earthquake Response Plan for Central Oklahoma and Expansion of the Area of Interest* (Mar. 7, 2016), <http://bit.ly/23Sr6cl>.
- ⁹ Wines, *supra* note 7.
- ¹⁰ Order Reducing Saltwater Injection Rates, In the Matter of an Order Reducing Saltwater Injection Rates Into the Arbuckle Formation, Applicable to Wells in Defined Areas of Increased Seismic Activity in Harper and Sumner Counties, Docket No. 15-CONS-770-CMSC (Okla. Corp. Comm'n Mar 19, 2015), <http://1.usa.gov/1VxPDCu>.
- ¹¹ SMU-Led Seismology Team Reveals Azle Findings: Combination of Gas Field Fluid Injection and Removal Is Most Likely Cause of 2013-14 Earthquakes, S. METHODIST UNIV. (Apr. 21, 2015), <http://bit.ly/1TeLRKm>.
- ¹² Jim Malewitz, *Responding to Quakes, Texas Passes Disposal Well Rules*, TEX. TRIBUNE (Oct. 28, 2014), <http://bit.ly/1tfV0FH>.
- ¹³ Jim Malewitz, *On Quakes, Regulator Sides With Energy Companies*, TEX. TRIBUNE (Nov. 3, 2015), <http://bit.ly/1TeLZJU>.



Patricia McGarvey Rosendahl is of counsel with **Greenberg Traurig** in Houston. She focuses her practice on commercial litigation and contract review, construction litigation, environmental matters and international dispute resolution. This analysis is presented for informational purposes only. It is not intended to be construed or used as general legal advice or as a solicitation.