Induced Seismicity and Oil and Gas Operations

Houston Bar Association
Oil, Gas & Mineral Law Section
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Headlines

• "Quakes in North Texas city blamed on energy sector" (USA Today, Dec. 24, 2015)
• "Earthquakes in Oklahoma Raise Fears of a Big One" (N.Y. Times, Jan. 7, 2016)
• "New research for the first time is linking oil and gas activity in California to earthquakes" (U.S. News, Feb. 4, 2016)
Processes at issue

• Hydraulic fracturing
  – Chemicals
  – Injection of fluid into formation

• Wastewater disposal
  – Injection of flowback water or produced water
  – Operator-owned or third-party facilities
Earthquake science

- Two blocks of the earth suddenly slip past one another. Surface where they slip is called the “fault” or “fault plane”
- Location below the earth’s surface where earthquake starts called “hypocenter” and location directly above it on surface of earth called “epicenter”
Earthquake science

• Richter scale, officially called the “Richter Magnitude Scale,” provides numerical value used to measure power of earthquakes

• Logarithmic scale based on wave amplitude recorded by seismograph. Means that each whole number increase on scale corresponds to an absolute increase by a factor of ten
Earthquake science

• Richter scale does not provide accurate estimates for large magnitude earthquakes
• Moment magnitude scale (M) preferred because works over wider range of earthquake magnitudes and applicable globally
• Moment = Distance a fault moves * force required to move it
History of induced seismicity

- Mining seismicity
- Water impoundment
- Geothermal energy
- Waste disposal
Seismic events

- Earthquakes can occur when shockwaves or fluids release strain on a preexisting fault
- Induced seismicity cannot be assessed same as natural seismicity
- Studies by USGS, National Research Council, universities, and other agencies
- High public concern in AR, CO, KS, OH, OK, TX (areas of shale development)
Seismic events

- Oklahoma
  - Prague [5.6 magnitude in 11/2011]
  - Cushing [4.4 magnitude in 10/2014]
  - Fairview [5.1 magnitude in 02/2016]
- Kansas
  - Anthony [3.2 magnitude in 11/2014]
- Texas
  - Snyder [4.4 magnitude in 09/2011]
  - Arlington [2.4 magnitude in 09/2014]
  - Venus [4.0 magnitude in 05/2015]
Theories of induced seismicity

- Geologist from OGS stated in 2012 that 2% of OK oil and gas wells fractured in past 2.5 years were followed within 21 days by quake within 5 miles of well
  - USGS Earthquake Science Center and UT Austin’s Institute for Geophysics disagreed
  - Injection wells, not fracturing, likely trigger
- More recent studies (early results) indicate that hydraulic fracturing and waste water injection may cause earthquakes
Damages

• Property damage or structural damage
• Personal injury caused by property damage or stress
• Diminution of property values or inability to sell property
• Contamination of groundwater (perhaps?)
Statutes and regulations

• California: Approved Well Stimulation Treatment Regulations (SB 4) [Ch. 313]
  – May require reporting of seismic activity greater than magnitude of 2.7. If magnitude-2.7 earthquake occurs, State will examine past, lesser quakes to determine if there is pattern associated with well operations
  – May require hydraulic fracturing permitting
Statutes and regulations

• California: *Introduced* Well Stimulation Treatments: Seismic Activities(AB 1490)
  – A.B. 1490 puts moratorium on nearby fracturing operations if earthquake > 2.0. Operations cannot resume until determination by California Division of Oil, Gas and Geothermal Resources
  – Also prohibits wastewater disposal wells and all well-stimulation activity within 10 miles of a fault active at any point in the past two centuries
Statutes and regulations

  - Mandating State and ILSGS adopt rules to regulate disposal; defining “induced seismicity” as “an earthquake event that is felt, recorded by the national seismic network, and attributable to a Class II injection well used for disposal of flow-back and produced fluid from hydraulic fracturing operations”
  - Requiring hydraulic fracturing permitting
Statutes and regulations

• Oklahoma: Oklahoma Corporation Commission
  – Large-scale regional reduction in oil and gas wastewater disposal for ~5,000 square mile area in western Oklahoma
  – 200+ Arbuckle disposal wells affected (researchers agree that disposal wells injecting into Arbuckle formation pose highest potential risk for causing damaging earthquakes in Oklahoma)
Statutes and regulations

• Oklahoma: Oklahoma Corporation Commission
  – Ordered some injection well operators to reduce wastewater disposal volumes on five wells operating within 10 miles of the center of earthquake activity near Edmond (Jan. 2016)
  – Some operators refusing to shut down injection wells, resulting in Commission action
Studies and developments

Oklahoma

• Governor Fallin approved $1.38 million in transfer of emergency funds to support earthquake research by Oklahoma Geological Survey and Oklahoma Corporation Commission (Jan. 28, 2016)

• OGS will install addition seismic monitoring devices
Studies and developments

We know that Oklahoma experienced 907 magnitude 3+ earthquakes in 2015, 985 magnitude 3+ earthquakes in 2014 and 119 in 2013. This rise in seismic events has the attention of independent scientists, citizen, policymakers, media and industry. See what information and research state officials and regulators are relying on as the situation unfolds.

In September 2014, Governor Fallin directed the Oklahoma Secretary of Energy and Environment to assemble the Coordinating Council on Seismic Activity. The body’s primary responsibility is to work cooperatively to develop solutions, identify gaps in resources and coordinate efforts among state agencies, researchers and the state’s oil and gas industry.

Click below for a map that shows wastewater disposal wells and recent earthquakes in Oklahoma.
Statutes and regulations

• Texas: *Adopted* 16 Tex. Admin. Code §§ 3.9, 3.46
  – After rash of low-magnitude earthquakes, purportedly linked to oil & gas development and disposal wells, RRC hired seismologist Dr. David Pearson in 03/14
  – In 08/14, Pearson proposed 4 new rules to House subcommittee concerning disposal wells
  – Beginning 11/17/14, new rules go into effect for disposal wells. Adopted disposal well rule amendments designed to address disposal well operations in areas of historical or future seismic activity
Studies and developments

Oklahoma

• Formed Coordinating Council on Seismic Activity, which is charged with organizing state resources and related activities related to Oklahoma’s recent increase in seismic activity

• Variety of stakeholders: regulators, industry, academics, environmental groups
Studies and developments

Texas

• TexNet Seismic Monitoring Program, overseen by The University of Texas and approved last year with $4.5 million by the Texas Legislature (with advisory committee to review Dec. 1)

• Integrated Seismicity Research center created at UT Bureau of Economic Geology

• 22 permanent seismograph stations to be installed
Texas

• SMU seismologists studied the Azle-Reno earthquakes, concluding that SWD “represent the most likely cause of recent seismicity.”

• Currently collecting data to determine cause of Irving earthquakes
Studies and new developments

Texas

- RRC hired seismologist, Craig Pearson, to investigate source of earthquakes in Texas, but has not yet established clear link to oil and gas activity
- Commission Ryan Sitton said it is “virtually impossible” for waste-water wells to be causing earthquakes in Irving and questioned the SMU study, saying it lacked conclusive data
Litigation

  
  – Two families claimed “swarms and mini-clusters” of quakes in 2010 and 2011 damaged property values
  
  – Case along with three others filed in the Eastern District of Arkansas were settled or closed March 20, 2014. The terms of the settlements are unknown
Litigation

  - Class action against BHP and Chesapeake, alleging public nuisance, private nuisance, absolute liability, negligence, trespass, economic loss, emotional distress
  - Voluntarily dismissed after expert testimony showed seismicity not a result of hydraulic fracturing
Litigation

  - Sandra J. Ladra injured in November 2011 during an earthquake when walls of her house shook and chimney toppled. Ladra claims earthquake caused by wastewater injections and is suing 25+ energy companies, including New Dominion and Spess Oil Company
  - Dismissed 10/16/14 based upon exclusive jurisdiction of the OCC; Reversed 06/30/15
Litigation

  – OKC and Edmond residents filed suit against 12 energy companies, alleging defendants caused Dec. 29, 2015 earthquake (4.3 magnitude)
  – Negligence, strict liability, property damage, pain and suffering, punitive damages, injunction
Litigation

  - Class action against Chesapeake, SandRidge, New Dominion, and Devon, alleging claims for wastewater injection "at an alarming rate"
  - Private nuisance, ultra-hazardous activities, negligence, trespass
Litigation

  – Alleges wastewater disposal operations caused hundreds of earthquakes and that Resource Conservation and Recovery Act (RCRA) violated
    • RCRA governs disposal of solid and hazardous wastes
Litigation

  – Nevada landowners trying to halt fracturing in the state, claiming the U.S. government decided to sell oil and gas leases without fully studying all environmental risks, including an increased threat of earthquakes
  – Dismissed 09/08/14 for lack of subject matter jurisdiction
Litigation

  - Class action alleging property damage caused by earthquakes
  - Claimed negligence and strict liability
  - Settled
§ 53.50. Complaint, petition, or declaration—Allegation—Operation of hydraulic fracturing injection wells resulting...

American Jurisprudence Pleading and Practice Forms Annotated
Database updated October 2014

III. Drilling and Maintenance
B. Negligence in Operation

Topic Summary References Correlation Table

§ 53.50. Complaint, petition, or declaration—Allegation—Operation of hydraulic fracturing injection wells resulting in seismic activity as public nuisance

PUBLIC NUISANCE

1. The Defendants, in connection with their hydraulic fracturing operations in [name of county], [name of state], regularly disposed of the consequent wastewater by injecting it into multiple wastewater disposal injection wells in [name of county].
Potential litigation issues

Oklahoma Homeowner Earthquake Damage
If your property has been damaged by an earthquake in Oklahoma contact us now.

Fracking earthquakes are causing damage to Oklahoma property owners.
Potential litigation issues

• Earthquakes causing possible subsurface fractures that allow fracturing fluids to migrate from the wellbore to the water supply. See Warren Drilling Co. v. Equitable Prod. Co., 2014 WL 1512699 (S.D. Ohio 2014) (indemnification lawsuit between drilling company and operator over tort action brought by property owners against both parties for alleged contamination of their water supply)
Other litigation ramifications

• Affect of “earthquakes” on juror perceptions in other trials. *See Hiser v. XTO Energy, Inc.*, 768 F.3d 773 (8th Cir. 2014) (oil and gas producer not entitled to new trial in homeowner action for damages caused by drilling vibrations even though jurors discussed earthquakes because content precluded any possibility of prejudice)
Other litigation ramifications

• Hydraulic fracturing’s potential to be classified as a ultra-hazardous activity, which gives rise to strict tort liability. See Ely v. Cabot Oil & Gas Corp., 2014 WL 4071640 (M.D. Pa. 2014) (adopting Magistrate report and recommendation, which held “natural gas drilling activities, including hydraulic fracturing, were not abnormally dangerous”)

Future trends in litigation

- Enhanced oil recovery and CO₂ injection
- Geothermal energy projects
- Carbon capture and sequestration
Operator strategies

• All stakeholders want to be informed and to mitigate risks and hazards:
  – Operators
  – Land owners
  – Regulators
  – Investors
Operator strategies

- Keep abreast of regulations (even proposed and pending – comment)
- Develop plan with asset team with regards to well/field development that mitigates seismic risk
- Hire or consult with seismologist
- Enter into surface use agreements with owners that include damage from seismic events (not an admission)
Operator strategies

- Record current state of structures within certain radius or perimeter of well or operation
- Use of seismic devices to monitor activity
- Company regulatory contact should be providing required information to agency
- Stop activity if seismic event recorded and notify agency (establish threshold)
Operator strategies

- Treat and reuse flowback and produced water to avoid reinjection
- Invest in new technologies, R&D, fluid treatment plants to reduce need for disposal
- Establish a response plan
Surface owner strategies

• Negotiate purchase of seismicity insurance if not covered in homeowner policy
• Involvement at local and state levels for information and disclosure
• Document damage, time, etc., in addition to nearby disposal facilities
Contact information

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