

QUAKING THE FOUNDATION: FRACKING-INDUCED EARTHQUAKES AND WHAT TO DO ABOUT THEM

*David Bulgarelli**

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I. INTRODUCTION

The advent of hydraulic fracturing (“fracking”) on a large scale has had a dramatic impact on the United States economy and has greatly contributed to our energy independence.¹ Fracking is an extremely efficient process, and its widespread use has caused a 47% drop in natural gas prices, as well as lower

* J.D., University of Illinois College of Law, May 2017. B.A. Political Science, Michigan State University, May 2013. I would like to thank the entire JLTP staff for their hard work in getting this Note published. I would especially like to thank my Notes Editor, Nisar Qureshi, for his help and feedback during the writing of this Note. I would also like to thank Carmine DiPiero and Daniel Gutt for listening to me shout out ideas randomly down the hall of our apartment. Lastly, a general thank you goes out to all my friends and family for keeping me sane throughout my law school career.

1. Robert Ames et al., *The Arithmetic of Shale Gas* (Yale Graduates in Energy Study Grp., 2012), <http://ssrn.com/abstract=2085027> (discussing the economic benefits of hydraulic fracturing).

gas bills for energy consumers around the country.²

As is natural for a practice of the oil and gas industry, fracking came under the fire of environmentalists for a variety of reasons: from the general worries of pollution of the air due to the use of these minerals, to reasons more specific to fracking, like the massive amount of water the process requires and the alleged contamination of groundwater.³ What has recently been borne out by fact is that deep-water injection wells used in the disposal of waste from fracking operations cause earthquakes.⁴ The science on the issue was long unsettled. It was readily apparent that seismic activity in certain areas of the country had increased dramatically, but only recently could that increase be definitively traced to the fracking boom.⁵

The established connection between fracking and seismic activity will give people whose property has been subject to fracking-related earthquake damage possible recourse against energy companies. One case in Oklahoma has already been allowed to proceed and involves a woman who was injured when an earthquake caused the chimney in her home to collapse on her.⁶ How courts decide cases like these could have a significant impact on the fracking industry, as well as the U.S. energy industry as a whole.⁷ It will also re-open serious national debate about whether this practice should be curtailed, and to what extent.

Part II of this Note will discuss a variety of topics in order to provide a comprehensive background on the current state of fracking in the United States. It will discuss the mechanics behind the process and how the process has evolved over the previous decades. It will also describe the controversies surrounding the practice as they relate to the environment and public health, the effect that fracking has on the nation's economy, and the connection between fracking and a sharp increase in seismic activity in certain areas of the United States. In Part III, this Note will investigate possible claims by private citizens against energy companies based on earthquake damage caused by the practice of using injection ("disposal") wells to dispose of waste generated by fracking. It will also discuss how the practice of fracking is regulated and the

2. Fred Dews, *The Economic Benefits of Fracking*, BROOKINGS INST. (Mar. 23, 2015), <http://www.brookings.edu/blogs/brookings-now/posts/2015/03/economic-benefits-of-fracking>.

3. Mark Fischetti, *Groundwater Contamination May End the Gas-Fracking Boom*, SCI. AM. (Sept. 1, 2013), <http://www.scientificamerican.com/article/groundwater-contamination-may-end-the-gas-fracking-boom/>.

4. Samantha Mathewson, *Fracking Does Not Contaminate Drinking Water, Yale Study Confirms*, NATURE WORLD NEWS (Oct. 14, 2015, 4:33 PM), <http://www.natureworldnews.com/articles/17525/20151014/fracking-contaminate-drinking-water-yale-study-confirms.htm>.

5. Aaron Mamiit, *USGS Finally Confirms Wastewater Fracking Causes Earthquakes*, TECH TIMES (Apr. 26, 2015, 8:25 AM), <http://www.techtimes.com/articles/48828/20150426/usgs-confirms-wastewater-fracking-causes-earthquakes-finally.htm>; Associated Press, *Oil and Gas Drilling Triggers Man-Made Earthquakes in Eight States, USGS Finds*, GUARDIAN (Apr. 23, 2015, 10:36 AM), <http://www.theguardian.com/world/2015/apr/23/oil-gas-drilling-triggers-man-made-earthquakes-usgs>.

6. Heather Smith, *US Government Says Drilling Causes Earthquakes—What Took Them So Long?*, GUARDIAN (Apr. 24, 2015, 12:32 PM), <http://www.theguardian.com/world/2015/apr/24/earthquakes-fracking-drilling-us-geological-survey>.

7. Zahra Hirji, *Oklahoma Case Could Open Doors to More Earthquake-Fracking Lawsuits*, INSIDECLIMATE NEWS (July 2, 2015), <http://insideclimatenews.org/news/02072015/oklahoma-case-could-open-doors-more-earthquake-fracking-lawsuits-oil-gas-drilling>.

potential regulatory measures that may be explored in the wake of new seismological evidence. Part IV will then recommend that courts and regulatory agencies do what they can with this new information to curtail the use of deep injection wells, as well as recommending that the burden of proof in these cases shift to the defendants.

II. BACKGROUND

A. *Process of Hydraulic Fracturing*

Since 2000, the number of natural gas wells in the United States has nearly doubled, which is largely attributable to the emergence of hydraulic fracturing to extract the gas from shale deposits underground.⁸ Hydraulic fracturing, or fracking, is a process where a mixture of water, sand, and other chemicals is pumped down a well at a high pressure to break the rock at the bottom of the well, releasing the natural gas stored in the rock.⁹

This process is necessary because, unlike a traditional well that drills into a pool of oil underground and draws it up like soda from a straw, the natural gas a fracking operation targets is stored in rock, and that rock has to be broken apart to reach the resource.¹⁰ To start the fracking process, a deep well is drilled about one or two miles underground, with steel encasing the hole to keep any leaks that may occur from escaping the well and potentially contaminating the immediate area and any nearby groundwater.¹¹ Where fracking wells differ significantly from traditional wells is that they are horizontal wells, in that once the well is drilled to the target depth, it takes a turn at a roughly ninety-degree angle and continues horizontally for up to thousands of feet.¹² There are perforations in this horizontal portion of the well created by a tool that penetrates through the well to expose the rock outside of it.¹³ The mixture of water, sand, and chemicals, usually comprised of 0.5%–2% additives and 98%–99.5% plain water,¹⁴ is pumped down the wells at a pressure that can exceed 9,000 pounds per square inch.¹⁵ This powerful pressure allows the water to fracture the rock as it escapes from the perforations in the horizontal well.¹⁶ The sand and chemical additives in the water keep the fractures in the rock open long enough for the gas inside to leave the rock and to mix with the water, which is then pumped back up to the

8. *Id.*

9. Marc Lallanilla, *Facts About Fracking*, LIVE SCI. (Jan. 23, 2015, 4:29 PM), <http://www.livescience.com/34464-what-is-fracking.html>.

10. *What Is Fracking and Why Is It Controversial?*, BBC (Dec. 16, 2015), <http://www.bbc.com/news/uk-14432401>.

11. Kate Kershner, *How Hydraulic Fracking Works*, HOWSTUFFWORKS (Nov. 13, 2012), <http://science.howstuffworks.com/environmental/energy/hydraulic-fracking.htm>.

12. Lallanilla, *supra* note 9.

13. Kershner, *supra* note 11.

14. *Id.*

15. Lallanilla, *supra* note 9.

16. *Id.*

surface and later separated into gas and wastewater.¹⁷ The wastewater is then usually either disposed of by being pumped down an injection well, or stored for further use.¹⁸

B. *History of Fracking Practices in the United States*

In order to properly understand the discussion in the United States surrounding the practice of fracking today, it is important to have basic knowledge of its history and how the practice and technology has evolved.

There is a common argument among those in the oil and gas industry—and its proponents—that postulates that since we have been fracking for over six decades, the recent controversies and problems must surely not be attributable to the practice.¹⁹ The reasons for the change in the narrative are largely due to how the process has changed over time. Sixty years ago, fracking was a new process, and it existed in an almost entirely different form than it does today.²⁰ Stanolind—now the Pan American Oil Company—first patented the process of fracking in 1949, and performed the first two successful hydraulic fracturing jobs in that same year.²¹ Early fracking was done on existing wells to increase their production, and on average used about 750 gallons of a fluid mixture with about 400 pounds of sand.²²

Then came massive hydraulic fracturing, which greatly increased the scale of the operations.²³ The 1970s brought awareness of large reserves of natural gas located in sandstone underground; however, at the time, there were no viable economic justifications for recovering them due to the exceptionally low permeability of sandstone.²⁴ The response was to greatly increase the scale of the operation, and now, instead of pumping a mixture of 750 gallons of fluid and 400 pounds of sand, companies are using a mixture of up to eight *billion* gallons of fluid with up to 300,000 pounds of sand.²⁵ This increase

17. *Id.*

18. *Id.*

19. See Robert Rapier, *Fracking Has Been Around Since 1949, Why the Recent Controversy?*, GLOBAL ENERGY INITIATIVE, <https://globalenergyinitiative.org/insights/58-fracking-has-been-around-since-1949-why-the-recent-controversy.html> (last visited Mar. 5, 2017) (“[I]n recent years fracking has become a highly controversial topic. People have strong opinions on the practice, but those opinions are often not based on science and data. Fracking was first commercially introduced in the oil and gas industry in 1949, and application of the technique grew rapidly in the oil and gas fields of Oklahoma and Texas. So if fracking has been around for more than 60 years, why has it only recently become controversial?”).

20. See, e.g., *id.* (“[U]ntil recently, the application of fracking was on conventional, vertical wells. But over the past decade or so, fracking began to be commercially applied to horizontal wells . . . , [and] the marriage of fracking with horizontal drilling enabled economic oil and gas production in the nation’s many shale formations for the first time.”).

21. *About Halliburton: Energy Bill*, HALLIBURTON WATCH, http://www.halliburtonwatch.org/about_hal/energybill.html (last visited Mar. 5, 2017).

22. Michael MacRae, *Fracking: A Look Back*, AM. SOC’Y MECH. ENGINEERS (Dec. 2012), <https://www.asme.org/engineering-topics/articles/fossil-power/fracking-a-look-back>.

23. NAT’L RESEARCH COUNCIL, ENERGY RESEARCH AT DOE: WAS IT WORTH IT? ENERGY EFFICIENCY AND FOSSIL ENERGY RESEARCH 1978 TO 2000, at 201 (2001), <http://www.nap.edu/catalog/10165.html>; cf. Leo A. Schrider & Robert L. Wise, *Potential New Sources of Natural Gas*, 32 J. PETROLEUM TECH. 703, 709 (1980).

24. MacRae, *supra* note 22.

25. *Id.*

coincided with advancements in directional drilling that allowed those drilling the wells to change the direction of their drilling more easily without disrupting their operations, making horizontal wells more prevalent.²⁶ However beneficial extracting these gas reserves from sandstone may have been, the real breakthrough in the field came with the fracking of shale formations.²⁷

In 1997, Mitchell Energy managed to make fracking highly profitable in the Barnett shale formation of northern Texas by using the chemical-laden water described above to break up the shale more efficiently.²⁸ Other energy companies soon began their own operations upon learning that they could economically tap the natural gas reserves of shale formations.²⁹ The Marcellus shale that lies underneath much of West Virginia, Pennsylvania, and New York was pursued with gusto by the mid-2000's, as well, and the fracking boom continued from there.³⁰

C. *Fracking's Effect on Energy and the Economy*

The advent of the fracking boom has greatly aided the United States in becoming more reliant on domestic energy, resulting in economic benefits to consumers in the United States.³¹

Since fracking really began to pick up steam as a wide practice in 2008, the United States has gone from a high of importing 57% of the oil it used that year to importing just 33% of the oil it consumed only five years later.³² This downward trend continued through 2015, when the United States imported just above 24% of its oil from foreign sources, though this trend appears to have leveled off, as there was a slight increase to 25% for 2016.³³

Maintaining reduced dependence on foreign oil could lead to the United States giving less thought to the Organization of Petroleum Exporting Countries (OPEC) in setting its energy policy; especially when there are indicators that OPEC's decisions as a consolidated body might be all but

26. B. CABLE, HORIZONTAL DRILLING SYSTEM (HDS) FIELD TEST REPORT—FY 91 (Oct. 1993), <http://www.dtic.mil/get-tr-doc/pdf?AD=ADA274219>.

27. Gregory Zuckerman, *Breakthrough: The Accidental Discovery that Revolutionized American Energy*, ATLANTIC (Nov. 6, 2013), <https://www.theatlantic.com/business/archive/2013/11/breakthrough-the-accidental-discovery-that-revolutionized-american-energy/281193/>.

28. *Id.* ("Finally, the Mitchell team had discovered the right fluid to fracture rock, the secret sauce for drilling in shale. The water-based liquid seemed to go out in every direction in the rock, creating complex mini-networks of cracks, enabling gas to flow to the surface."); Jon Gertner, *The Lives They Lived: George Mitchell, He Fracked Until It Paid Off*, N.Y. TIMES MAG. (Dec. 21, 2013), <https://www.nytimes.com/news/the-lives-they-lived/2013/12/21/george-mitchell/> ("Mitchell's fracking technique is so far 'the most important, and the biggest, energy innovation of this century.' It is also the most environmentally controversial.")

29. Gertner, *supra* note 28.

30. Rapier, *supra* note 19.

31. Kershner, *supra* note 11.

32. U.S. ENERGY INFO. ADMIN., MONTHLY ENERGY REVIEW 53 tbl.3.3a (Feb. 24, 2017), <https://www.eia.gov/totalenergy/data/monthly/pdf/mer.pdf>; Daniel Yergin, *Congratulations America. You're (Almost) Energy Independent. Now What?*, POLITICO MAG. (Nov. 2013), <http://www.politico.com/magazine/story/2013/11/congratulations-america-youre-almost-energy-independent-now-what-098985>.

33. *Id.*

irrelevant.³⁴ While it cannot be said that the United States has achieved complete energy independence, our decreased dependence on foreign oil, combined with the more globalized economy that exists today, would make the United States far better equipped to handle an embargo from Arab oil producers than it was in the 1970s.³⁵

Fracking today accounts for more than 40% of the United States' oil production, and over half of its natural gas production.³⁶ Producing more of our own oil in the United States as opposed to the costlier method of importing it from other sources, such as Canada or OPEC nations, keeps gas bills more affordable in gas-consuming households, and saves billions of dollars for all types of energy users in general.³⁷ Some have pointed out that the great increase in fracking activity has caused the price of natural gas to be 47% lower than it would have been without it, and caused gas bills between 2007 and 2013 to decrease by a whopping \$13 billion per year, overall.³⁸ In fact, in 2012, the lower energy costs led to a \$1,200 increase in average disposable income in households across the country.³⁹ In addition to lowering the bills for people and businesses no matter what form of energy they consume, it also helps people save money at the gas pump, as more reliance on domestic oil and gas exerts a downward force on the price of gasoline.⁴⁰

As an industry booms, like the energy industry is with fracking, it naturally follows that its proponents will herald it as a job creator and savior of the unemployed worker. But how many jobs does fracking actually create? In 2012, it was estimated that the industry was "supporting" over two million jobs, with that number expected to expand to more than three million by the end of the decade.⁴¹ But what does it mean for an industry to "support" a job? In the case of Pennsylvania, it was claimed in 2014 that the natural gas industry was responsible for over 200,000 jobs, but this figure included jobs that had tenuous ties to the industry, such as truck drivers and construction workers.⁴² Pennsylvania's best estimate for the amount of jobs that are "closely connected" to natural gas production in their fracking operations is 30,000.⁴³ While this is no small amount of employment, when jobs in industries closely connected to Pennsylvania's natural gas production amount

34. Yergin, *supra* note 32.

35. Thanassis Cambanis, *Why It's Time to Stop Fearing OPEC*, BOS. GLOBE (Oct. 26, 2014), <https://www.bostonglobe.com/ideas/2014/10/25/why-time-stop-fearing-opec/v4P5wK8T6axAbXeSCANR90/story.html>.

36. Marcelo Prince, *How Much U.S. Oil and Gas Comes from Fracking?*, WALL ST. J. (Apr. 1, 2015, 3:12 PM), <http://blogs.wsj.com/corporate-intelligence/2015/04/01/how-much-u-s-oil-and-gas-comes-from-fracking/>.

37. Dews, *supra* note 2.

38. *Id.*

39. Yergin, *supra* note 32.

40. Michael Bastasch, *Fracking Boom Continues to Drive Gas Prices Downward*, DAILY CALLER (Aug. 26, 2014, 2:39 PM), <http://dailycaller.com/2014/08/26/fracking-boom-continues-to-drive-gas-prices-downward/>.

41. Yergin, *supra* note 32.

42. Clare Foran, *How Many Jobs Does Fracking Really Create?*, ATLANTIC (Apr. 14, 2014), <https://www.theatlantic.com/politics/archive/2014/04/how-many-jobs-does-fracking-really-create/445227/>.

43. *Id.*

to less than one percent of the state's total jobs,⁴⁴ it does not seem that fracking can be considered the incredible driver of job growth that it is often held out to be, at least not universally.

However, North Dakota, the state that has arguably pursued fracking the most ambitiously, has been the poster child for the industry. The state has ridden the high of fracking to become the nation's second largest producer of oil behind only Texas, with a growing population from jobseekers, and to recently boast the nation's lowest unemployment rate, which sits at a near non-existent 2.8%.⁴⁵ This may suggest that what sets North Dakota apart from states like Pennsylvania is the production of oil instead of natural gas.

D. *Man-Made Earthquakes from Fracking*

States that have engaged fracking operations have been experiencing unexpected seismic activity for quite some time since large-scale operations began. Up until 2008, the State of Oklahoma normally experienced between one and two earthquakes that could be felt (3.0 magnitude or higher) per year, and they steadily became more prevalent up until at least 2015, when there were an average of two such earthquakes each day.⁴⁶ Fracking seems to be the likely cause.⁴⁷ The Dallas-Fort Worth area of Texas had previously had no seismic activity at all, but has had at least fifty noticeable earthquakes since 2008.⁴⁸ The Youngstown area in eastern Ohio experienced at least eleven noteworthy earthquakes in 2011 alone.⁴⁹

A common mistake made when talking about this issue is that the actual process of fracking is not what has been leading to increased seismic activity. What has actually been scientifically linked to earthquakes is the use of deep injection wells that are used to dispose of the wastewater that fracking operations produce.⁵⁰ The link is so strong that scientists at the University of Colorado Boulder and the U.S. Geological Survey found that "the entire increase in the number of earthquakes in the U.S. midcontinent is associated with injection wells."⁵¹

As stated, the act of fracturing the shale is not what causes the earthquake, but rather, the disposal wells, which are the most efficient and cost-effective method of disposing of the wastewater used in the drilling.⁵²

44. *Id.*

45. Travis H. Brown, *Fracking Fuels an Economic Boom in North Dakota*, FORBES (Jan. 29, 2014, 10:44 AM), <http://www.forbes.com/sites/travisbrown/2014/01/29/fracking-fuels-an-economic-boom-in-north-dakota/>.

46. Rivka Galchen, *Weather Underground: The Arrival of Man-Made Earthquakes*, NEW YORKER (Apr. 13, 2015), <http://www.newyorker.com/magazine/2015/04/13/weather-underground>.

47. *Id.*

48. Kelly Connelly et al., *How Oil and Gas Disposal Wells Can Cause Earthquakes*, NPR: STATEIMPACT, <https://stateimpact.npr.org/texas/tag/earthquake/> (last visited Mar. 5, 2017).

49. *Id.*

50. *Id.*

51. Zahra Hirji, *Yes, Those Earthquakes Are Caused by Fracking Boom, Studies Confirm*, INSIDECLIMATE NEWS (June 19, 2015), <http://insideclimatenews.org/news/19062015/yes-those-earthquakes-are-caused-fracking-boom-studies-confirm>.

52. Connelly et al., *supra* note 48.

Disposal wells essentially operate as underground receptacles for the wastewater pulled up from fracking operations. Each injection well typically operates as the disposal site for multiple drilling wells, with about 50,000 injection wells in Texas serving as the means of disposal for over 200,000 drilling sites.⁵³ The disposal wells go thousands of feet underground, and when millions of gallons of wastewater are pumped down, it creates pressure on the fault lines, making them slip, and causing an earthquake.⁵⁴ Cliff Frohlich of the University of Texas compares it to an air hockey table; without the air on, the puck will just sit there, but as soon as you turn the air on, the puck moves, just like when you add water to a fault line.⁵⁵

Scientists with the U.S. Geological Survey recently endeavored to sort injection wells into two categories: wells that were associated with earthquake activity and wells that were not.⁵⁶ A well was labeled an “associated well” if it was within ten miles of a recent earthquake, regardless of whether there were other wells within that same range (and those other wells were also considered to be associated wells).⁵⁷ The scientists found that the wells most commonly associated with earthquakes nearby (about 27,000 out of 106,000 reviewed) had certain attributes in common, such as having higher injection rates of wastewater.⁵⁸ Four such massive injection wells outside of Oklahoma City, owned by the energy company New Dominion, whose founder, David Chernicky, pioneered the use of these larger injection wells, have been speculated to be responsible for 20% of all seismic activity in the central United States from 2008 to 2013.⁵⁹ There are also enhanced oil recovery wells that are used to revitalize production wells that have stopped producing at high rates by injecting the material down into the earth for it to be later pumped up nearby.⁶⁰ The increase in pressure beneath the surface is seemingly marginal, but this process has been found to account for as much as 60% of the wells that are associated with earthquakes.⁶¹ In a study done out of Stanford University, researchers investigated the hottest spots of seismic activity in Oklahoma and found that the areas with the highest rates of injection had the most earthquake activity.⁶²

Evidence suggests that not only do injection wells cause increased seismic activity but also that the earthquakes stemming from them seem to be getting stronger.⁶³ Art McGarr, who works at the U.S. Geological Survey’s Earthquake Science Center, says that the longer a particular injection stays in

53. *Id.*

54. *Id.*

55. *Id.*

56. Hirji, *supra* note 51.

57. *Id.*

58. *Id.*

59. Benjamin Elgin & Matthew Phillips, *Can This Oil Baron’s Company Withstand Another Quake?*, BLOOMBERGBUSINESSWEEK (Apr. 23, 2015, 5:00 AM), <http://www.bloomberg.com/news/articles/2015-04-23/can-this-oklahoma-oilman-s-company-withstand-another-earthquake->.

60. Hirji, *supra* note 51.

61. *Id.*

62. *Id.*

63. Elgin & Phillips, *supra* note 59.

use, the more likely it will be to cause seismic activity of greater magnitude.⁶⁴ The magnitude—not the Richter scale measurement—of each earthquake is measured in the following way:

A network of geological monitoring stations, each with instruments that measure how much the ground shakes over time called seismographs allow scientists to calculate an earthquake's time, location and magnitude. Seismographs record a zigzag trace that shows how the ground shakes beneath the instrument. . . . Based on their magnitude, quakes are assigned to a class, according to the U.S. Geological Survey.⁶⁵

While most earthquakes caused by these injection wells have been about 3.0 on the scale, there have been notably stronger earthquakes linked to these injection wells, such as the multiple 5.0 and higher earthquakes that hit Prague, Oklahoma on November 5, 2011.⁶⁶ Note that the scale at which the magnitude of earthquakes are measured is based on factors of ten, so a 5.0 earthquake is one hundred times more powerful than an earthquake that measures at 3.0.⁶⁷ That day in Prague, two earthquakes hit, measuring at 4.8 and 5.6 respectively, followed by another one centered there two days later that measured at 4.7.⁶⁸

These earthquakes in Prague are the focus of ongoing litigation in Oklahoma that has the chance to set the precedent to offer recourse to property owners who live in states with prevalent fracking-related earthquake activity, and to potentially make energy companies think of alternative methods of wastewater disposal. The Oklahoma Supreme Court is set to hear the case of Sandra Ladra, a resident of Prague, Oklahoma, who suffered a severe injury to her leg when the 5.7-magnitude earthquake—the largest ever recorded in the State of Oklahoma—sent her chimney crashing down into her living room.⁶⁹ For a long time, the official position of the state was that these earthquakes were natural occurrences, though there was no evidence that supported such a position, and many studies and papers concluded that they were caused by injection wells nearby.⁷⁰ The court's decision in this case, as well as how severely it decides to punish the energy companies should it find them responsible, has large implications for the fracking industry and the future of deep wastewater injection wells.

E. Alternative Methods of Disposal

While injection wells are the most cost-effective and efficient method of disposing of wastewater from fracking, and are therefore the most preferred

64. *Id.*

65. Brett Israel, *How Are Earthquakes Measured?*, LIVE SCI. (Aug. 20, 2010, 1:57 PM), <http://www.livescience.com/32779-measuring-earthquake-magnitude-richter-scale.html>.

66. Galchen, *supra* note 46.

67. *Id.*

68. *Id.*

69. Zoë Schlanger, *Oklahoma Court to Decide Whether Fracking Companies Are to Blame for Spate of Earthquakes*, NEWSWEEK (Jan. 28, 2015, 2:03 PM), <http://www.newsweek.com/oklahoma-court-decide-whether-fracking-companies-are-blame-spate-earthquakes-302747>.

70. Hirji, *supra* note 51.

option, they are not the only means available.⁷¹ Pennsylvania, a heavy fracking state due to the shale rock in the Marcellus formation, sometimes treats the waste and stores it in tanks aboveground for future use in other fracking operations.⁷² The less used practice of sending the wastewater to treatment facilities for its eventual discharge into natural bodies of water has also seen an increase in favor, although this carries its own environmental concerns.⁷³ In the event of a mistake made at the treatment site, especially sites that are exempted from the most current water pollution limits, treated water dumped into natural waterways could contaminate the drinking water, posing significant risks to public health.⁷⁴

Along with New York, Pennsylvania has also begun using fracking wastewater, which has a high salt content, to clear icy roads in the winter and suppress road dust in the summer months.⁷⁵ It has many advantages over traditional road salt, such as having a higher salt content and being significantly cheaper.⁷⁶

However, the Natural Resources Defense Council (NRDC) does not support these alternative methods of disposal when it comes to public health and protecting the environment.⁷⁷ The NRDC is especially opposed to the treatment of wastewater in facilities before being discharged into surface waters, as any mistake in the treatment process would result in hazardous chemicals being introduced to waters that provide people with their drinking water.⁷⁸ The seemingly practical solution of using the salty wastewater to deal with ice and dust on roadways also carries the risk of the contaminated wastewater running into nearby waterways as the result of runoff or with the melting snow after winter.⁷⁹ A more viable alternative is needed nationwide. The Marcellus shale region cannot geologically withstand a large amount of injected wastewater.⁸⁰ Moreover, injection wells in other regions of the country pose the geological problem of lubricating and putting pressure on fault lines, causing increasingly large earthquakes.

Some believe it could be possible to find organic and biodegradable products to replace the fracking fluids in the process.⁸¹ There is also the prospect of using waterless processes that use other chemicals such as carbon dioxide (CO₂) or liquefied propane gas as a substitute for the water component

71. Connelly et al., *supra* note 48.

72. Press Release, Nat. Res. Def. Council, Report: Five Primary Disposal Methods for Fracking Wastewater All Fail to Protect Public Health and Environment (May 9, 2012), <https://www.nrdc.org/media/2012/120509>.

73. *Id.*

74. *Id.*

75. Zoë Schlanger, *Gas Industry's Solution to Toxic Wastewater: Spray It on Roads*, NEWSWEEK (Mar. 2, 2015, 2:52 PM), <http://www.newsweek.com/oil-and-gas-wastewater-used-de-ice-roads-new-york-and-pennsylvania-little-310684>.

76. *Id.*

77. Nat. Res. Def. Council, *supra* note 70.

78. *Id.*

79. *Id.*

80. *Id.*

81. *Hydraulic Fracturing (Fracking) in the U.S.: Issues, Problems, and Opportunities*, in 64 OIL, GAS & ENERGY Q. ch. 4 (D. Larry Crumley & Linda M. Nichols eds., 2015) [hereinafter *Fracking in the U.S.*].

of the fracking fluid.⁸² While water used in fracking becomes saturated with chemicals after one frack and therefore cannot be used again, CO₂ could possibly be recycled and re-used in multiple fracks if the oil and gas company could collect it at the surface once it comes back up the well.⁸³ A problem with this technology, however, when it was used in Canada, was that the CO₂ mixed too much with the natural gas being mined from the operation, and a process called “flaring” had to be used to separate the two, which caused the release of greenhouse gasses.⁸⁴ However, a company in Oklahoma called Praxair has been developing a liquid CO₂ for fracking and is optimistic about the results.⁸⁵ The product—the very aptly named—DryFrac, uses a liquid form of CO₂, and Praxair claims they can safely separate the CO₂ from the natural gas as it returns up the well,⁸⁶ which would eliminate the greenhouse gas concern from having to undergo the flaring process in order to separate them. While it would still be more expensive than water, it could end up being more profitable to use, as it allows for a freer flow of natural gas through the well than the water,⁸⁷ making the well more productive.

This process would inject liquefied propane gas down the well instead of water, where due to the immense pressure and heat, the propane would vaporize into a gaseous form, which would return up the well for collection with the gas obtained, and then be available for re-use.⁸⁸ This carries the advantage of removing the issue of finding a way to store or dispose of massive amounts of wastewater, which would eliminate many of the environmental concerns of fracking, especially by putting a halt to any increase in the severity of the seismic activity stemming from deep injection wells. However, energy companies have been hesitant and slow to adopt this method due to propane gel being much more expensive than water, as well as additional concerns over its flammability.⁸⁹ Thus, while people attempting to innovate are exploring alternative options, the use of disposal wells is still widespread, and they will likely not be going anywhere anytime soon.

III. ANALYSIS

Now that the science behind the rise in earthquakes is essentially settled—being caused by fracking operations’ disposal of wastewater into injection wells underground—those who sustained injuries from these quakes, and those who will in the future, can make solid cases against energy companies and recover damages in court. An avenue could also open up for

82. Andrew Topf, *Water-Less Fracking Could Be Industry Game Changer*, OILPRICE.COM (Nov. 6, 2014, 5:41 PM), <http://oilprice.com/Energy/Energy-General/Water-less-Fracking-Could-Be-Industry-Game-Changer.html>; *Fracking in the U.S.*, *supra* note 81.

83. *Fracking in the U.S.*, *supra* note 81.

84. Nelson Bennett, *Gas in, Gas out: The Waterless Fracking Alternative*, BUS. VANCOUVER (Oct. 13, 2015, 12:00 AM), <https://www.biv.com/article/2015/10/gas-gas-out-waterless-fracking-alternative/>.

85. Topf, *supra* note 82.

86. *Id.*

87. *Id.*

88. *Fracking in the U.S.*, *supra* note 81.

89. Bennett, *supra* note 84.

special interest groups interested in stopping the practice of fracking for the sake of the environment to adopt aggrieved parties and convince them to take their cases to court without settling, in order to establish more case law that is beneficial for the environment.

A. *Legal Causes of Action for Earthquake Victims*

1. *The Ladra Case and Personal Injury Claims Related to Injection Well Earthquakes*

Once scientists found links between oil and gas activities and earthquakes, Sandra Ladra sued multiple energy companies for compensatory and punitive damages on the basis that their wastewater disposal methods were the proximate cause of her injuries.⁹⁰ The case is pending, but the Supreme Court authorized it to be heard in state court instead of by the Oklahoma Corporation Commission, which normally has jurisdiction over oil and gas matters.⁹¹

In injury cases such as Ladra's, plaintiffs will need to prove not only that the earthquake was the cause of their injury, but also that the earthquake was caused by the defendant's injection well.⁹² The difficulty here is proving that the particular earthquake in question was man-made as opposed to naturally occurring. To be sure, the increase from an average of two 3.0-plus-magnitude quakes per year in Oklahoma to an average of over two *per day* make it a virtual certainty that any earthquake in that region strong enough to cause damage is the product of an injection well.⁹³ Nonetheless, the fact that there was small activity in the region prior to the fracking boom produces some wariness over imposing liability when even a small chance exists that the earthquake was naturally occurring.⁹⁴ Another potential difficulty arises if there are wells owned by multiple companies in the proximity of where the earthquake occurred.

Filing a suit based on a tort claim opens the door for punitive damages in addition to compensatory damages.⁹⁵ The amount in these cases could get quite high because, given the great wealth of energy companies, it would take a large amount to deter the conduct in which they are engaged.⁹⁶ A jury might also take umbrage to the act of causing thousands of earthquakes a year, and hold that behavior to be especially reprehensible and deserving of heavy monetary punishment. Oil and gas industry leaders are fearful of such a result, as it might transform their efficient and cost-effective injection wells into huge

90. Ladra v. New Dominion, LLC, 353 P.3d 529, 530 (Okla. 2015).

91. Bennett, *supra* note 84.

92. Steven M. Sellers, *Earthquakes, Fracking, Disposal Wells . . . and Litigation*, 31 TOXICS L. REP. 398 (Apr. 28, 2016).

93. Galchen, *supra* note 46.

94. *Id.*

95. BLAKE WATSON, HYDRAULIC FRACTURING TORT LITIGATION SUMMARY (Jan. 1, 2017), https://udayton.edu/directory/law/documents/watson/blake_watson_hydraulic_fracturing_primer.pdf.

96. Joseph W. Cotchett & Mark C. Molumphy, *Punitive Damages: How Much Is Enough?*, 20 CIV. LITIG. REP. (1998).

legal and economic liabilities.⁹⁷ They would have to transition to using much more costly methods of disposal in order to keep their operations running, and there is a belief among some experts that the rise in these earthquake cases has the potential to cripple the industry.⁹⁸

This becomes even more worrisome as lawsuits based on earthquake damages from fracking have been occurring for a few years now, though oil companies have mostly been able to avoid public scrutiny, seemingly due to plausible deniability over the causation of earthquakes.⁹⁹ A notable class-action lawsuit in Arkansas in which five residents sued two oil and gas companies, Chesapeake Energy and BHP Billiton, saw the parties settle for an undisclosed amount, indicating that the companies may not have liked their chances in court or the negative exposure from such a case.¹⁰⁰ That settlement occurred in 2013, when most seismologists believed that fracking could only rarely cause earthquakes that could be felt.¹⁰¹ Now that earthquakes can be definitively tied to the wastewater disposal wells operated by oil and gas companies,¹⁰² plaintiffs and special interest groups may start to become more ambitious with what they want out of the case. Similar to how opponents of affirmative action in education seek out parties to act as plaintiffs in order to try and obtain judicial action on an issue,¹⁰³ environmental special interest groups could do the same. After seeking out and finding potential plaintiffs such as Ms. Ladra in areas like Oklahoma, Texas, and Arkansas that have been personally affected by a specific earthquake, these groups could encourage these individuals to carry their cases to trial in order to establish judicial precedent and obtain injunctions on the use of certain disposal wells.

2. *Earthquakes as Nuisance and Trespass to Property*

Property owners could bring suit against energy companies that operate injection wells near where they live, claiming them to be private nuisances. A private nuisance interferes with the enjoyment of one's land, and the law governing them recognizes that there is a right of property owners not to have an entity impair the quality of their land, as well as the right to be comfortable in the occupation of their land.¹⁰⁴ Being the cause of a major earthquake that causes the destruction of one's home, especially in an area that was never known for heavy activity beforehand, could reasonably be seen to be a private

97. Ziva Branstetter, *Prague Earthquake Suit Before Supreme Court Could Set Precedent*, TULSA WORLD (Jan. 27, 2015, 9:39 AM), http://www.tulsaworld.com/news/local/prague-earthquake-suit-before-supreme-court-could-set-precedent/article_4eed1eff-bb39-5b1f-af3b-1f18ba933d37.html.

98. *Id.*

99. *Id.*

100. Mica Rosenberg, *Arkansas Homeowners Settle Suit Charging Fracking Wastewater Caused Quakes*, REUTERS (Aug. 28, 2013, 4:25 PM), <http://www.reuters.com/article/us-usa-fracking-quakes-idUSBRE97R16320130828>.

101. *Id.*

102. Hirji, *supra* note 51.

103. Joan Biskupic, *Special Report: Behind U.S. Race Cases, a Little-Known Recruiter*, REUTERS (Dec. 4, 2012, 1:50 PM), <http://www.reuters.com/article/us-usa-court-casemaker-idUSBRE8B30V220121204>.

104. Nat'l Tel. Coop. Ass'n v. Exxon Corp., 38 F. Supp. 2d 1, 14 (D.D.C. 1998); RESTATEMENT (SECOND) OF TORTS § 821D (AM. LAW INST. 1979).

nuisance to a property owner. A manufacturer who pollutes a stream or river would be assessed a fine, be forced to cease the polluting activity, and be required to pay for the costs of environmental cleanup.¹⁰⁵ In turn, an energy company could be ordered to cease the use of its well if it is proven to be the cause of earthquakes.

In addition to private nuisances, public nuisances can be any number of things that threaten the general welfare of the community.¹⁰⁶ As they affect the community, public nuisances are those that inconvenience the public as a whole, not just a single, individual person. Public nuisances can include anything from causing environmental harm to an area or shooting off fireworks in the street to operating a brothel or engaging in behavior that somehow makes travel unsafe.¹⁰⁷

It is possible for a nuisance to walk the line and be both a private and public nuisance—also known as a mixed nuisance.¹⁰⁸ A common example of a mixed nuisance is the polluted river just mentioned, which inconveniences the public as a whole while also interfering with the enjoyment of a landowner's property that the river runs through.¹⁰⁹ Similarly, a man-made earthquake also meets the criteria for being a mixed nuisance.

Energy companies could raise a defense stating that because their fracking operation, which includes the drilling and disposal of waste, is a legal enterprise, they are exempt from liability under a claim for nuisance.¹¹⁰ While this is technically true, laws that enable fracking operations and the methods of their waste disposal were not made with the foresight that man-made earthquakes would erupt from them, and courts will probably not be sympathetic to this defense.

Remedies in these types of cases are usually monetary damages, though courts will grant injunctive relief when appropriate.¹¹¹ Injunction is a remedy that requires the defendant to stop or remove their nuisance, and is usually only reserved for cases where the damage caused by the nuisance is irreparable or where the plaintiff finds the monetary damages to be unsatisfactory as a remedy.¹¹² Courts tend to weigh the hardships placed upon the parties and the value to the public of the enterprise causing the nuisance to continue.¹¹³

105. 33 U.S.C. § 1319 (2012).

106. *Nat'l Tel. Coop. Ass'n*, 38 F. Supp. 2d at 13; RESTATEMENT (SECOND) OF TORTS § 821B(1) (AM. LAW INST. 1979).

107. See RESTATEMENT (SECOND) OF TORTS § 821B(1) cmt. c (AM. LAW INST. 1979) (listing common public nuisances).

108. *Armory Park Neighborhood Ass'n v. Episcopal Cmty. Servs.*, 712 P.2d 914 (Ariz. 1985).

109. See, e.g., *Gail v. New Eng. Gas Co.*, 460 F. Supp. 2d 314, 324–25 (D.R.I. 2006) (citing the “polluted stream” example of W. PAGE KEETON ET AL., PROSSER AND KEETON ON THE LAW OF TORTS § 90, at 645 (5th ed.1984)).

110. See, e.g., *Tuscaloosa v. Fitts*, 96 So. 771, 773 (1923) (holding that a governmental entity engaged in the collection or disposal of waste is not liable for associated torts). *But see, e.g., Sherfey v. City of Brazil*, 13 N.E.2d 568, 572 (1938) (suggesting that some functions of waste management are corporate and not governmental, and thus do not give rise to immunity from suit).

111. *Janvey v. Alguire*, 647 F.3d 585, 600 (5th Cir. 2011).

112. *Id.* at 595.

113. *Id.*

In 2014, a homeowner in Arkansas successfully sued XTO Energy for damages incurred from the vibrations caused by XTO Energy's nearby drilling operations.¹¹⁴ After the defendant energy company began fracking operations on land adjacent to the plaintiff's, she began feeling vibrations that eventually caused structural damage to her house, which an inspector determined to be the fault of the vibrations and not of any preexisting structural defect.¹¹⁵ The homeowner based her suit on claims of negligence, nuisance, and trespass.¹¹⁶ The jury awarded her \$300,000 in both compensatory and punitive damages after finding in her favor on every aspect of her claim.¹¹⁷ While a lawsuit based on feeling vibrations on one's property from adjacent drilling operations is not the same as a lawsuit based on a fracking-induced earthquake, the circumstances are similar enough where it is not unreasonable to say that such claims could be extended to the similar instances of earthquakes and tremors affecting homeowners near injection wells.

3. *Diminished Value of Property*

Property owners in areas that experience earthquakes caused by the fracking boom who bought their property before the area became known as being very seismically active could claim injury from diminished value to their property.¹¹⁸ While diminished value claims are typically associated with cars, the action is applicable to other property.¹¹⁹ A homeowner in Oklahoma might find that the value of his or her house on the market has decreased due to the state and the specific area now being afflicted by the highest earthquake occurrence in the United States, recently passing California as the most seismically active state.

B. Regulatory Response

There is spirited debate as to precisely who is better for the job of regulating fracking—the federal government or the states? On the whole, it is somewhat difficult for the government to regulate fracking due to how the oil and gas industry has been excluded or exempted from many important federal environmental laws. The Clean Water Act (CWA) had its original intent and language amended to exempt runoff from the exploration, production, processing, and treatment of oil and gas.¹²⁰ Congress also amended the Safe

114. *Hiser v. XTO Energy Inc.*, No. 4:11CV00517 KGB, 2013 WL 5467186, at *1 (E.D. Ark. Sept. 30, 2013), *aff'd*, 768 F.3d 773 (8th Cir. 2014).

115. John Chapman, *Arkansas Homeowner Wins Verdict for Damages Caused by Vibrations from Nearby Oil Drilling Operations*, HEYGOOD, ORR & PEARSON (Oct. 25, 2014), <https://www.hop-law.com/arkansas-homeowner-wins-verdict-for-damages-caused-by-vibrations-from-nearby-oil-drilling-operations/>.

116. *Hiser*, 768 F.3d. at 773.

117. *Id.*

118. R. Tyler Bryant et al., *Recovery of Diminished Value in First Party Property Insurance Claims* (Ins. Coverage Litig. Comm. CLE Seminar, 2013), http://www.americanbar.org/content/dam/aba/administrative/litigation/materials/2013_insurance_coveragelitigationcommittee/b_10_recovery_diminished_value_first.authcheckdam.pdf.

119. *Id.*

120. Energy Policy Act of 2005, Pub. L. No. 109-58, 119 Stat. 594 (2005).

Drinking Water Act (SDWA) in 2005 to exclude hydraulic fracking from the Environmental Protection Agency's ability to regulate injection wells.¹²¹ Several exceptions were carved out to exempt oil and gas activities under the National Environmental Policy Act, which would normally require the government to issue a statement on the impact of an activity on the environment.¹²² The Resource Conservation and Recovery Act defers the regulation and management of waste from oil and gas activities from the federal government to the states.¹²³ An exemption was made from the Emergency Planning and Community Right-to-Know Act—designed to help communities prepare for spills or releases of hazardous materials—whereby the oil and gas industry is exempt from reporting releases or transfers of their materials.¹²⁴ The Comprehensive Environmental Response, Compensation, and Liability Act (Superfund), which can hold parties responsible for the cleanup and costs of hazardous substances being dumped into the environment, does not apply to crude petroleum or refined petroleum unless they are released from underground.¹²⁵

As illustrated in the above examples, whether for genuine economic reasons or just by the influence of special interests, the Environmental Protection Agency—and federal government in general—have their hands tied from regulating the activities of the oil and gas industry. The George W. Bush Administration was incredibly damaging to federal regulation of the energy industry. The Energy Policy Act passed in 2005 is what carved out and/or widened the exceptions for the oil and gas industry within the CWA and the SDWA (that Vice President Cheney was the former CEO of Halliburton is surely no coincidence).¹²⁶

Proponents of a need for more wide-reaching federal regulation argue that fracking has evolved to a point where it no longer only affects states on an individual level, and that more comprehensive regulation is now necessary.¹²⁷ Setting aside whether the states are equipped to handle the regulation of wide-reaching environmental issues such as air pollution, wastewater disposal, effects on wildlife, and seismic activity, they inevitably become national issues, as they are not problems that can necessarily be confined to state borders.¹²⁸ There is wide variation among the states as to the standards they hold oil and gas companies to, and there is reason to believe that even states that are well experienced with oil and gas production are finding it difficult to

121. *Id.*

122. National Environmental Policy Act of 1969, Pub. L. No. 91-190, 83 Stat. 852 (1970) (codified as amended at 42 U.S.C. §§ 4321–70 (2012)).

123. Resource Conservation and Recovery Act, Pub. L. No. 94-580, 90 Stat 2795 (1976) (codified as amended at 42 U.S.C. §§ 6901–92 (2012)).

124. Emergency Planning and Community Right-to-Know Act, Pub. L. No. 99-499, tit. III, 100 Stat. 1613, 1728–58 (1986) (codified as amended at 42 U.S.C. §§ 11,001–50 (2012)).

125. Comprehensive Environmental Response, Compensation, and Liability Act of 1980, Pub. L. No. 96-510, 94 Stat. 2767 (1980) (codified as amended at 42 U.S.C. §§ 9601–75 (2012)).

126. Justin Miller, *Why It's So Hard to Regulate Fracking*, AM. PROSPECT (June 24, 2015), <http://prospect.org/article/why-its-so-hard-regulate-fracking>.

127. Jody Freeman & David Spence, *Should the Federal Government Regulate Fracking?*, WALL ST. J. (Apr. 14, 2013, 4:16 PM), <http://www.wsj.com/articles/SB10001424127887323495104578314302738867078>.

128. *Id.*

keep their regulations in pace with the speed of drilling.¹²⁹ State regulation of fracking activity becomes even more problematic as they take away the ability from local governments to regulate fracking on a smaller level. In May 2015, the governor of Texas signed into law legislation that prohibits local governments in the state from placing prohibitions on fracking.¹³⁰ At one point, Oklahoma was set to discuss banning the practice of fracking statewide amid the rash of earthquakes plaguing the state, then turned in the opposite direction and followed Texas by banning local governments from prohibiting the practice.¹³¹

On the other hand, there is still a decent argument that states are still better equipped to handle the regulation of fracking themselves. The benefits and downfalls of fracking fall, for the most part, on the localities that they are in,¹³² and there is something to be said for the idea that the level of government that is closest to the problem and subsumes most of the costs and benefits of the activity should be the one that is responsible for its regulation.

It is an undisputed fact that the regulation of fracking falls under the authority of the federal government due to the ever-expansive Interstate Commerce Clause.¹³³ So, while the federal government *can* step in to regulate fracking, the debate continues over whether the federal government *should* be the one to regulate this activity.

IV. RECOMMENDATION

Courts that hear cases arising from earthquakes linked to injection wells should strongly consider issuing injunctions as a form of relief. There should also be hefty punitive damages levied against energy companies that have caused earthquakes that personally injured people living near the injection wells. That any business is engaged in activities that cause natural disasters speaks to such hubris that it should not be allowed to continue. We do not want to cripple the fracking industry, given the obvious boon it is to the nation's economy, but shutting down these wells will not have that effect. There are perfectly safe injection wells in use today that do not have these issues,¹³⁴ proof that it is within the realm of reality to operate these mechanisms in a safe way.

While oil and gas producers have been reluctant to adopt these alternative fracking methods in a widespread fashion,¹³⁵ it would be wise for them—and

129. *Id.*

130. Miller, *supra* note 126.

131. Emily Atkin, *Fracking Bans Are No Longer Allowed in Oklahoma*, THINKPROGRESS (June 1, 2015), <http://thinkprogress.org/climate/2015/06/01/3664586/oklahoma-ban-on-fracking-bans/>.

132. Freeman & Spence, *supra* note 127.

133. David Spence, *Is It Time for Federal Regulation of Shale Gas Production?*, ENERGY MGMT. & INNOVATION CTR., <https://www.mcombs.utexas.edu/~media/Files/MSB/Centers/EMIC/Briefs/Energy-Brief-Is-It-Time-for-Federal-Regulation-of-Shale-Gas-Production.pdf> (last visited Mar. 5, 2017).

134. James Conca, *The Fracking Solution Is a Good Cement Job*, FORBES (Sept. 10, 2012, 1:12 AM), <http://www.forbes.com/sites/jamesconca/2012/09/10/the-fracking-solution-is-a-good-cement-job/>.

135. Topf, *supra* note 82; *see also* Bennett, *supra* note 84 (stating that most companies use hydraulic fracking because it is inexpensive).

for the rest of the world—to substantially invest in research to find ways to wean themselves off of water for fracking. Doing so would solve one of the biggest problems for the industry, which is the disposal of wastewater.¹³⁶ If the practice of fracking is going to continue as robustly as it does now, the transition from water to waterless fracking needs to be made sooner rather than later, for the sake of the environment and the people who live near these operations. As a quick aside, it is also increasingly becoming more unacceptable to use countless gallons of water on oil and gas operations when large areas of the country are currently experiencing a serious drought, which promises to continue for some time.¹³⁷

The obvious solution, as the situation currently dictates, is to shut down all disposal of wastewater into the disposal wells that are most strongly linked to atypical seismic activity in that region, in terms of both frequency and magnitude. As stated above, there are a relatively small number of disposal wells—when compared to the total amount—responsible for much of the increase in the incidents of earthquakes in places like Oklahoma.¹³⁸ Ceasing all use of those disposal wells in particular would provide a stopgap on the frequency and magnitudes of earthquakes already occurring in the area from increasing, hopefully leading also to a decrease in the frequency. Companies should invest in more sophisticated geological testing in areas where they place their disposal wells, so they can avoid drilling disposal wells that share the same characteristics as those that are most directly tied to the causes of seismic activity.

The government should invoke its regulatory powers under the Interstate Commerce Clause¹³⁹ to properly ensure that energy companies are not taking short cuts when it comes to fracking procedures and the management of their wells. The exemptions under the statutes listed above make sense as a way to encourage the exploration of oil and gas for the purpose of the United States' growing independence from foreign oil; however, they have failed in protecting the American people and their land from unchecked, unsafe practices from the oil and gas industry. Thus, the exceptions carved out for the oil and gas industry in environmental statutes such as those listed above must be eliminated, so that the proper level of oversight can be administered to their activities. Recent events have made this highly unlikely, as the Trump Administration's "America First Energy Plan" is unsurprisingly extremely friendly to the oil and gas industry, in addition to the Administration loathing the idea of "burdensome" regulations.¹⁴⁰ Unless President Trump decides to go after natural gas in an attempt to keep his pledge to restore the coal industry,¹⁴¹ it is unlikely the government will do anything in the near future,

136. Topf, *supra* note 82.

137. Bennett, *supra* note 84.

138. Elgin & Philips, *supra* note 59.

139. See U.S. CONST. art. I, § 8, cl. 3 ("[The Congress shall have power] [t]o regulate Commerce with foreign Nations, and among the several States, and with the Indian tribes . . .").

140. *An America First Energy Plan*, WHITE HOUSE, <https://www.whitehouse.gov/america-first-energy> (last visited Mar. 5, 2017).

141. *Id.*

especially with a Congress controlled by the Republican Party that is unlikely to pass any such legislation in the first place.

Given the lack of especially viable methods of disposal, and the lack of desire by the government to do anything in a regulatory capacity, we will likely continue to see an increase in seismic activity in the already affected areas of the country. Because of this, the lawsuits brought by citizens who have suffered damages from these industry-caused earthquakes will logically only increase in the near future. Plaintiffs are bound to bring these cases before courts in a variety of jurisdictions across the country. It is highly likely, and likely inevitable, that courts will apply the law in these relatively new kinds of cases in a variety of ways, arriving at wildly different outcomes. It is important to establish consistent standards and rulings early on to avoid confusion in this area moving forward. The issue of proving that the earthquake in question was caused by the defendant's operating injection well is obviously going to be the crux of many of these cases.

In these kinds of cases, courts should take an unorthodox approach and shift the burden of proof from the plaintiffs and onto the defendants. The plaintiffs would be required to prove the following: that they sustained damages, that those damages were the result of an earthquake, and that the defendants owned and operated a disposal well nearby. It would then fall on the defendant(s) to prove by a preponderance of the evidence that it was not their operation that caused the earthquake giving rise to the plaintiff's complaint. The most prescient factors to consider would be, in no particular order: the area's record of seismic activity pre- and post-fracking, the number of disposal wells in the area, the proportion of wells in the area owned and operated by the defendant(s), the specific location in the area of said wells, and how responsibly they are operated.

V. CONCLUSION

Earthquakes caused by the disposal of wastewater down injection wells have been plaguing the central United States with unprecedented seismic activity for almost a decade.¹⁴² The advent of the discovery that definitively links the earthquakes to fracking operations gives rise to an opportunity for injured persons to seek relief in the form of damages and injunctions. This would pave the way to getting rid of the wells that are known to account for earthquakes. The oil and gas industry should take advantage of emerging technology to stop using water in its injecting fluid altogether, as that alone mitigates all of the risk posed by the problem of disposing massive amounts of wastewater from fracking operations. Fracking is an enormous boon to the United States economy and a great help in the push towards energy independence, but we cannot arrive at that goal at the expense of the safety of the public.

142. Alexandra Witze, *Wastewater Disposal Causes Sharp Rise in Central US Earthquakes*, NATURE: NEWS (June 18, 2015), <http://www.nature.com/news/wastewater-disposal-causes-sharp-rise-in-central-us-earthquakes-1.17795>.

These are not typical occurrences; however, where it does occur, the industry-wide practice is literally shifting the landscape of the communities in which it operates. While this may put the defendants in the unenviable position of having to prove that it was not their well that caused the earthquake in question, it is their fault that they find themselves in such a position. By engaging in the use of these disposal wells, these potential defendants are actively and directly causing earthquakes to occur at unprecedented rates. It is impossible to overstate the seriousness of that fact. They are turning a great profit at the expense of innocent people whose bodies and property are directly harmed by the potential defendants' actions. In areas that had no seismic activity prior to the operation of these wells, it is the fracking energy companies that created the problem—a shifting burden just forces them to lie in a bed of their own making.