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# We Need a Fracking Baseline

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## INTRODUCTION

In more than 3,000 locations across Louisiana,[1] a pressurized concoction of water and select toxic and nontoxic chemicals has been, or will be, injected into the earth at up to 100 barrels per minute, with a pressure as high as 15,000 pounds per square inch ("psi").[2] A mere 10 psi of pressure applied on the human body is equivalent to 294 mile-per-hour winds, exerting a force sufficient to demolish reinforced concrete buildings.[3] The Plutonium bomb detonated over Nagasaki created pressures nearing 15 psi at 0.5 miles from ground zero and caused total destruction within the radius.[4] Pressures nearly 1,000 times greater than that blast pressure are required to crack rock formations lying deep beneath Louisiana's farms, communities, and cities.[5]

Hydraulic fracturing, more commonly referred to as "fracking," is a polarizing subject in politics,[6] the environmental debate,[7] and the media.[8]

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1. Abraham Lustgarten & Krista Kjellerman Schmidt, *State-by-State: Underground Injection Wells*, PROPUBLICA (Sept. 20, 2012 12:00 PM), http://projects.propublica.org/graphics/underground-injection-wells [https://perma.cc/M2DP-FEX4] (select the state of Louisiana).

2. *See A Look at the Hydraulic Fracturing Process and How it Works*, STI GROUP, http://setxind.com/upstream/the-hydraulic-fracking-process-and-how-it-works [https://perma.cc/5CA8-3XWA] (last visited Nov. 8, 2015).

3. R. KARL ZIPF, JR. & KENNETH L. CASHDOLLAR, NAT'L INST. FOR OCCUPATIONAL SAFETY AND HEALTH, EFFECTS OF BLAST PRESSURE ON STRUCTURES AND THE HUMAN BODY, http://www.cdc.gov/niosh/docket/archive/pdfs/NIOSH-125/125-ExplosionsandRefugeChambers.pdf [https://perma.cc/CVR7-MSHP].

4. Frank von Hippel, *The Myths of Edward Teller*, BULL. ATOMIC SCI., Mar. 1983, at 6, 10.

5. *See infra* Part I.B.

6. President Barack Obama, Remarks on America's Energy Security at Georgetown University (Mar. 30, 2011), https://www.whitehouse.gov/the-press-office/2011/03/30/remarks-president-americas-energy-security [https://perma.cc/J7AN-Q4U5] ("Recent innovations have given us the opportunity to tap large reserves—perhaps a century's worth of reserves, a hundred years [sic] worth of reserves—in the shale under our feet. But just as is true in terms of us extracting oil from the ground, we've got to make sure that we're extracting natural gas safely, without polluting our water supply.").

7. GASLAND (HBO Documentary Films 2010).

8. *Late Show with David Letterman* (CBS television broadcast July 18, 2012) (host claiming that a number of states have been ruined by the "greedy oil and gas companies of this country" and the practice of fracking).

Although experimental fracking was first used in 1947,[9] its use expanded significantly during the shale boom of the 2000s.[10] Hydraulic fracturing involves pumping numerous chemicals diluted by water, including some that are toxic,[11] into the ground at a pressure high enough to crack deep rock formations and increase oil and gas production. The use of fracturing has grown exponentially over the past decade;[12] accordingly, the number of lawsuits claiming contamination by hydraulic fracturing has increased.[13] Often, landowners can prove that oil and gas production chemicals have contaminated their water source; given the evidentiary requirements, however, they are routinely unable to prove that the fracturing operations on the land caused the contamination.[14] These landowners are required to demonstrate a causal link between the source of the contaminant and the

9. Carl T. Montgomery & Michael B. Smith, *Hydraulic Fracturing: History of an Enduring Technology*, J. PETROLEUM TECH., Dec. 2010, at 26, 27 (noting that the first successful commercial fracturing treatment was not performed until 1949).

10. *See* U.S. ENERGY INFO. ADMIN., DOE/EIA-038320, ANNUAL ENERGY OUTLOOK 2015, at 20 (2015) ("[T]otal dry natural gas production in the United States increased by 35% from 2005 to 2013 . . . .").

11. U.S. ENVTL. PROT. AGENCY, EPA/600/R-15/047a, ASSESSMENT OF THE POTENTIAL IMPACTS OF HYDRAULIC FRACTURING FOR OIL AND GAS ON DRINKING WATER RESOURCES [Draft] 5-72 (2015). As indicated, this report is a draft, and expert commentary during the comment period may alter the contents of the original.

12. AM. PETROLEUM INST., HYDRAULIC FRACTURING: UNLOCKING AMERICA'S NATURAL GAS RESOURCES 1 (2014), http://www.api.org/~/media/Files/Policy/Exploration/HYDRAULIC_FRACTURING_PRIMER.ashx [https://perma.cc/AU2A-ZJEJ] (before the shale boom, natural gas production from shale constituted roughly 2% of the United States output; by the end of 2015 it will reach 37%, and by 2035 it is projected to reach 75%); *see also* MOHSEN BONAKDARPOUR ET AL., IHS GLOBAL INSIGHT, INC., THE ECONOMIC AND EMPLOYMENT CONTRIBUTIONS OF SHALE GAS IN THE UNITED STATES 5 (2011), http://anga.us/media/content/F7D1750E-9C1E-E786-674372E5D5E98A40/files/shale-gas-economic-impact-dec-2011.pdf [https://perma.cc/VXC4-4F6C].

13. *See* BARCLAY NICHOLSON, NORTON ROSE FULBRIGHT ANALYSIS OF LITIGATION INVOLVING SHALE & HYDRAULIC FRACTURING 1 (2014), http://www.nortonrosefulbright.com/files/20140101-analysis-of-litigation-involving-shale-hydraulic-fracturing-104256.pdf [https://perma.cc/959K-7XKG]; *see also* Blake Watson, *Hydraulic Fracturing Tort Litigation Summary*, UNIV. OF DAYTON SCH. OF L., http://www.udayton.edu/directory/law/documents/watson/blake_watson_hydraulic_fracturing_primer.pdf [https://perma.cc/9K5R-4CG9] (last updated July 23, 2016) (noting that the majority of the 99 contamination cases listed were filed within the past five years).

14. *See* Ely v. Cabot Oil & Gas Corp., 38 F. Supp. 3d 518 (M.D. Pa. 2014); Anthony v. Chevron USA, Inc., 284 F.3d 578, 586–87 (5th Cir. 2002).

actual contamination.[15] Unfortunately, both are usually thousands of feet or miles beneath the earth's surface, rendering the procurement of this evidence impossible.[16] Furthermore, years may pass before the contamination actually occurs.[17] Consequently, obtaining equitable relief in cases in which contamination has already been proven is highly improbable, if not impossible.[18]

Hydraulic fracturing has not been proven to be inherently dangerous; this factor should be considered prior to the implementation of any new regulations, as the utility of the practice exceeds its proven risk.[19] However, until the impact on finite groundwater resources is conclusively determined, the acquisition of information and evidence should be improved to develop a full record on the subject matter, while simultaneously promoting the industry and protecting landowners. The federal government remains detached from the issue, as Congress has permitted exemptions for the practice in both of the major pieces of legislation intended to regulate the industry and protect the nations water, the Clean Water Act and the Safe Drinking Water Act.[20] The Environmental Protection Agency ("EPA") conducted a five-year study that resulted in inconclusive outcomes, partially because of the lack of a requirement for operators to perform baseline testing.[21]

Due to the lack of federal guidance and sufficient data acquisition, Louisiana must take steps to protect its landowners, drinking water resources, and the industries essential to its economy. The first step should be requiring hydraulic fracturing operators to perform baseline water testing prior to any hydraulic injections. This data will aid injured plaintiffs in their pursuit for a factual link to contamination. It will aid the industry by possibly providing evidence that fracturing is not the cause of contamination. Finally, it will aid the state's economy by promoting best practices and easing public concern. Additionally, once a comprehensive

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15. *See Anthony*, 284 F.3d 578.
16. AM. PETROLEUM INST., *supra* note 12, at 7.
17. U.S. ENVTL. PROT. AGENCY, *supra* note 11, at 6-56–6-57.
18. *See infra* Part II.A.1.
19. *See infra* Part I.C. *But see infra* Part I.B; U.S. ENVTL. PROT. AGENCY, *supra* note 11, at 10–20 (finding that contamination has occurred through multiple avenues in a relatively small number of cases, but noting that the number of cases might be understated because of insufficient pre- and post-fracturing data of the groundwater resources).
20. *See infra* Part III.A.
21. U.S. ENVTL. PROT. AGENCY, *supra* note 11, at ES-22 (noting that one of the limitations of the reported data was the lack of pre-fracturing local water quality data).

data set is established, the industry and regulatory agencies will be better able to determine when and where contamination is or is not occurring. Agencies can then implement or remove regulations to make the process safer and more efficient.

This Comment does not argue that hydraulic fracturing is inherently dangerous, nor that its use should be restricted, but instead discusses several issues that have arisen from the practice, including the potential for increased risk as the shale boom continues. It argues that Louisiana should apply a mixed regulatory strategy beginning with requiring baseline water testing and promoting best-practices regulations as standards develop or when issues arise, which will protect both the industry and the landowners. Part I explains hydraulic fracturing and contamination while also demonstrating that hydraulic fracturing is essential to Louisiana and the United States. Part II discusses the theories of liability available to injured landowners and the evidentiary requirements' prevention of an equitable resolution, regardless of whether strict liability is imposed. Part III illustrates Congress's refusal to regulate the industry and demonstrates several states' compensation for this lack of regulation, whereby states enact their own regulations. Part IV examines the issues from the perspectives of the landowner, the operator, and the State to develop a solution beneficial to all. This Comment concludes by proposing that Louisiana should require baseline water testing before hydraulic fracturing operations and use the data collected over time to establish best-practices regulations for the industry.

## I. THE NECESSITY OF HYDRAULIC FRACTURING

Hydraulic fracturing has transformed the Louisiana[22] and national economies over the past decade.[23] Since its inception, the industry has also improved its own procedures to attain higher production at a lower risk.[24] Although the practice is the subject of much controversy and debate, the benefits of cheap energy are indisputable.[25] Over the next decade, Louisiana expects nearly $100 billion in investments from an industrial renaissance largely attributed to low natural gas prices,[26] and the nation as a whole

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22. *See infra* Part I.C.1.

23. *See infra* Part I.C.1.

24. In the 1950s, hydraulic fracturing became prevalent over the more hazardous nitroglycerin fracturing. The first fracturing fluids were petroleum-based until the industry moved to the water-based gel fluids in the 1970s. Montgomery & Smith, *supra* note 9, at 27–28.

25. *See infra* Part I.C.

26. LOREN C. SCOTT & JAMES A. RICHARDSON, THE LOUISIANA ECONOMIC OUTLOOK: 2015 AND 2016, at iii (2014) (In 2014, "Louisiana [was] in the midst

stands to gain if the production of shale energy sources[27] remains safe and efficient.

### *A. Understanding Hydraulic Fracturing and its Development*

Hydraulic fracturing is a method for stimulating underground rock formations to increase oil and gas production.[28] It is commonly used in conjunction with horizontal drilling to maximize formation stimulation and overall production of oil and gas.[29] The wellbore can penetrate the earth a mile or more vertically before gradually turning horizontal and continuing for up to an additional 6,000 feet.[30] Once the desired terminal location is reached and the well is prepared, fracking fluid, called "mud," is injected into the well at a pressure that exceeds the breakdown pressure of the formation.[31] The high-pressure fluid causes the formation to crack, creating a fracture that generally runs vertically in both directions through the formation.[32] The operator pumps the fluid into the fracture, expanding the crack until it is wide enough to accept the chosen propping agent, or "proppant."[33] Operators then add propping agents such as sand or ceramic beads[34] to the fluid after the fracture is formed to fill the fracture, thereby "propping open" the fracture and permitting the flow of oil or gas to the well.[35] The final step is to pump the fracking fluid back to the surface,

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of an industrial boom unlike any other in our history, with over $100 billion in industrial projects either under construction or at the front-end engineering and design phase."); *id*. at 104 (projecting Louisiana to have more than 2 million non-farm employees for the first time in history in 2015).

27. Shale energy is natural gas and oil produced from a fine-grained sedimentary rock known as shale. Hydraulic fracturing and horizontal drilling have made the production of shale energy much more efficient. *See Shale 101: An Overview of Shale Energy*, INST. FOR 21ST CENTURY ENERGY, http://www.energyxxi.org/sites/default /files/shale_101.pdf [https://perma.cc/J6DW-TVFL] (last visited Sept. 11, 2016).

28. U.S. ENVTL. PROT. AGENCY, *supra* note 11, at ES-1.

29. *Id.*

30. AM. PETROLEUM INST., *supra* note 12, at 7.

31. U.S. ENVTL. PROT. AGENCY, EPA 816-R-04-003, EVALUATION OF IMPACTS TO UNDERGROUND SOURCES OF DRINKING WATER BY HYDRAULIC FRACTURING OF COALBED METHANE RESERVOIRS, at App. A-1 (2004) (fracturing fluid may also be referred to as "pad").

32. *Id.*

33. *Id.*; *see* Montgomery & Smith, *supra* note 9, at 28.

34. *Id.* at App. A-13.

35. *Id.*

where it is collected; the proppant is left behind to hold the crack open.[36] The amount of fracking fluid left in the well is termed "leakoff"; the amount of leakoff depends on the formation being fractured.[37] In some formations, 90% or more of the fracturing fluid might be left in the well.[38]

The fracking fluid injected into the well is designed with a specific chemical composition to serve a particular function.[39] The fluids often vary by company, location, and well.[40] The primary functions of the fluid are to create and expand the fracture, transport the proppant to the fracture, and abandon the proppant in the fracture, thus propping the fracture open.[41] The fear of groundwater contamination is due in large part to the chemical additives necessary to perform these tasks. On average, roughly 1.5 million gallons of water are used in the hydraulic fracturing of each well,[42] with some formations requiring up to 15 million gallons.[43] Chemical additives typically constitute 2% or less of the mixture.[44] The EPA estimates the total volume of chemicals injected into each well ranges from 2,600 gallons to 18,000 gallons.[45] More information has been introduced in recent years regarding the chemical composition of the fracking chemicals through voluntary and mandatory disclosures.[46]

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36. Joe Schremmer, *Avoidable "Fraccident": An Argument Against Strict Liability for Hydraulic Fracturing*, 60 U. KAN. L. REV. 1215, 1220 (2012).

37. The amount of fluid remaining in the well is determined by the amount of fluid injected into the well, the reservoir's hydraulic properties, the capillary pressure near the fracture faces, and the length of time between the well being shut in and production. U.S. ENVTL. PROT. AGENCY, *supra* note 11, at 6-35.

38. *Id*. Other studies have shown 85% or more fracturing fluid remaining in some Marcellus Shale wells. Additionally, a study of 271 wells in West Virginia revealed that more than 85% of the total volume of fracturing fluid remained in more than 80 of the Marcellus Shale wells. *Id.* at 7-9.

39. For example, acids are added to dissolve cement, minerals, and clays; biocides control or eliminate bacteria; and corrosion inhibitor protects the iron and steel components of the well. *Id.* at 5-10–5-11.

40. *Id.* at ES-12.

41. *Id.* at ES-10.

42. *Id.*

43. Jean-Philippe Nicot & Bridget R. Scanlon, *Water Use for Shale-Gas Production in Texas, U.S.*, 46 ENVTL. SCI. & TECH. 3580, 3582 (2012) (Haynesville Shale averages 5.7 million gallons per well and Eagle-Ford averages 4.3 million gallons per well).

44. U.S. ENVTL. PROT. AGENCY, *supra* note 11, at ES-10.

45. *Id.* at ES-12.

46. *About Us*, FRACFOCUS, http://www.fracfocus.org [https://perma.cc/674W-RG4B] (last visited Sept. 11, 2016). Fracfocus is an online registry that

However, the majority of companies refuse to disclose any proprietary or trade-secret additives when not required by state law.[47] No federal regulation regarding the disclosure of fracturing chemicals currently exists; consequently, the states' requirements vary significantly.[48] Some of the variance in state requirements may be attributed to the type of chemicals required for the state's specific geologic conditions and which avenue for contamination is most likely.[49]

The current method of hydraulic fracturing traces its roots to the 19th century practice of "shooting" the well.[50] Originally, the fracturing operator dropped liquid or solidified nitroglycerine into the well and detonated it to fragment the oil-bearing formation and increase the flow of oil to the well.[51] Operators attempted different fracturing methods over the years before a viable hydraulic fracturing commercial application was performed in 1949.[52] This original method involved pumping crude oil mixed with gasoline and sand into the formation.[53] In the first year, operators treated 332 wells, with an average increase in well production of 75%.[54] The use of hydraulic fracturing continued to increase with an estimated 25,000 to 30,000 wells fractured annually in the U.S. between 2011 and 2014.[55] Overall, an estimated two million wells have been

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collects data from mandatory disclosures and allows operators to voluntarily disclose the chemical composition of their hydraulic fracturing treatments.

47. *See infra* Part III.B.2.

48. Wyoming requires companies to make disclosures of the contents of the fluid to the state, and the information is made public after any proprietary information is redacted. Arkansas does not require the chemical composition to be disclosed, but it does require the additives to be categorized by type. *See* Jeffrey C. King, *Factual Causation: The Missing Link in Hydraulic Fracture – Groundwater Contamination Litigation*, 22 DUKE ENVTL. L. & POL'Y F. 341, 358–59 (2012).

49. Oil and Gas; Hydraulic Fracturing on Federal and Indian Lands, 80 Fed. Reg. 16,183 (proposed Mar. 26, 2015) (codified at BLM Onshore Oil and Gas Operations, 43 C.F.R. § 3160 (2016)) (deciding against a national requirement for baseline testing partially because local authorities are better informed of their specific geologic conditions).

50. Montgomery & Smith, *supra* note 9, at 27.

51. *Id.*

52. *Id.*

53. *Id.*

54. *Id.*

55. U.S. ENVTL. PROT. AGENCY, *supra* note 11, at ES-5.

hydraulically fractured over the past 60 years.[56] With 95% of new wells requiring hydraulic fracturing to reach their designed production potential,[57] the industry's growth is expected to continue.[58]

*B. Sources of Hydraulic Fracturing Contamination*

Although fracturing chemicals are intended to serve a specific purpose in the production of oil and gas, debate continues over the possibility of the chemicals migrating into drinking water resources.[59] Currently, barring a local ordinance prohibiting the activity, the practice of hydraulic fracturing is permitted to occur near residences[60] and drinking water resources.[61] In 2013, approximately 6,800 public drinking water sources serving more than 8.6 million Americans had at least one hydraulically fractured well located a mile or less from the source.[62] The three primary sources of concern over drinking water contamination are due to accidents or spills occurring at the surface, migration of the fluid from the production zone through the formation into drinking water resources, and movement of fluid out of the production well because of deficiencies in the well casing.[63]

The first source of contamination is a surface spill, which can occur during the shipment of materials to the fracturing site, during operations at the drill site, or even after the fluid is collected as produced water or

56. *Natural Gas from Shale: Questions and Answers*, U.S. DEP'T OF ENERGY, http://energy.gov/sites/prod/files/2013/04/f0/how_is_shale_gas_produced.pdf [https://perma.cc/8SWM-BMSD] (last visited Sept. 11, 2016).

57. *Id.*

58. *See* 3 IHS GLOBAL INSIGHT, AMERICA'S NEW ENERGY FUTURE: THE UNCONVENTIONAL OIL AND GAS REVOLUTION AND THE US ECONOMY 47 (2013), http://www.energyxxi.org/sites/default/files/Americas_New_Energy_Future_Phase3.pdf [https://perma.cc/3QJ4-PL8C]. The value added for the entire unconventional energy-value chain and energy-related chemicals is expected to increase to $533 billion in 2025, from $284 billion in 2012. *Id.* Jobs that the shale gas industry created are expected to increase from 600,000 in 2012 to over 1.6 million by 2035. *Id.* at v.

59. *See* GASLAND, *supra* note 7; *Late Show*, *supra* note 8 (host claiming that the "greedy oil and gas companies of this country" and the practice of fracking have ruined a number of states).

60. U.S. ENVTL. PROT. AGENCY, *supra* note 11, at ES-5–ES-6 (noting that between 2000 and 2013 approximately 9.4 million Americans resided a mile or less from a hydraulically fractured well).

61. *Id.* at 3-11.

62. *Id.*

63. *Id.* at ES-13–ES-14.

flowback.[64] The fluid collected at the well site is collectively referred to as "produced water" and includes the fracturing fluid and any water extracted from the formation.[65] Wells in close proximity have shown a higher incident rate of "well communication events" that lead to surface spills caused by well-component failures.[66] These well communications occur when either the wellbore or fractures of the well being hydraulically fractured intersect the wellbore or fractures of a nearby well, permitting the pressurized fluid of the first well to invade the second well.[67] If the second well is properly sealed and abandoned, the invasion should not occur or cause problems.[68] However, many older wells were not designed to contain the high pressures associated with hydraulic fracturing.[69] In the EPA's study of 225 surface spills of produced water, the average volume of released fluid in each spill was 990 gallons, with 8% of the studied spills reaching surface or groundwater.[70]

The second source of contamination occurs through the migration of gas or chemicals from the production zone through the rock formation into groundwater.[71] This migration likely occurs during either the pressurized fracturing or through natural fluid activities over years or even decades.[72] Impermeable formations and formations significantly deeper than the groundwater are much less likely to permit this sort of migration because more obstacles lie between the contamination source and the groundwater.[73] Several formations such as the Marcellus Shale in Pennsylvania and West Virginia and the Haynesville Shale in Louisiana and Texas lie very deep and might have a mile or more between the top of the formation and the base of the groundwater.[74] However, an EPA study of 23,000 wells concluded that 20% of the wells had fewer than 2,000 feet between the shallowest point of fracturing and the base of the groundwater resource.[75]

The third source of contamination involves migration within the wellbore through the casing of the wellbore being fractured or through a nearby well experiencing well communication.[76] The well casing is a steel pipe that

64. *See id.* at ES-17, 7-30.
65. *Id.* at ES-16.
66. *Id.*
67. *Id.* at 6-42–6-45.
68. *Id.* at 6-45.
69. *Id.* at 6-51–6-52.
70. *Id.* at ES-17, ES-19.
71. *Id*. at 6-48.
72. *Id.* at 6-56–6-57.
73. *Id.* at ES-15.
74. *Id.*
75. *Id*.
76. *Id.* at ES-14.

encircles the well, provides support, and prevents fluid migration.[77] The surface casing typically extends from the wellhead through any groundwater zones and is commonly encircled by cement.[78] Many older wells were constructed with insufficient casing and were not designed for the high-pressure injections associated with hydraulic fracturing;[79] these wells are commonly reopened and hydraulically fractured. These wells may also be infiltrated with pressurized fracturing fluid through well communication with nearby wells being hydraulically fractured.[80] Additionally, even modern wells that were designed for hydraulic fracturing are susceptible to design or construction imperfections[81] and prove to be a source of contamination.[82]

### *C. The Beneficial Impacts of Hydraulic Fracturing*

Despite the risk associated with the practice, hydraulic fracturing is a vital element of the United States's energy and economic portfolios. The shale boom provides a tremendous source of economic benefit for not only the hydraulic fracturing operators, but also for the government and the average American household. In 2012, unconventional oil and gas operations were estimated to contribute $1,200 in real disposable income to each household in America.[83] The conventional oil and gas value chain and energy-related chemical sector are expected to provide 2.9 million U.S. jobs in 2015.[84] Americans benefit directly from hydraulic fracturing through increased employment opportunities and decreased energy costs, and indirectly through manufacturers' ability to produce chemicals and products more profitably because of access to cheaper energy.

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77. *Id.* at 6-4.
78. *Id.*
79. *Id.* at ES-15 (estimating that 6% of the 23,000 wells studied were drilled ten years before being hydraulically fractured and suggesting that these wells may not have been designed to withstand the stresses associated with hydraulic fracturing).
80. Many wells were improperly plugged in the 1950s by using little to no cement. *Id.* at ES-16.
81. *Id.* at ES-14 (estimating that 3% of the 23,000 wells studied between 2009 and 2010 did not have cement across a portion of the casing within groundwater depths).
82. *Id.* at ES-14–ES-15 (arguing that natural gas was able to migrate into Bainbridge, Ohio drinking water resources because of inadequately cemented casing).
83. IHS GLOBAL INSIGHT, *supra* note 58, at 55 (stating that by 2025 this number is expected to reach more than $3,500).
84. *Id.* at 42 (stating that by 2025 the sector is projected to provide 3.9 million US jobs).

### *1. Industrial Economic Impact*

Many manufacturing industries of raw goods, such as bulk chemicals and primary metals, are expanding and converting to the use of dry natural gas and gas plant liquids ("NGPL") feedstocks instead of petroleum-based feedstocks because of the economic benefits.[85] Natural gas has initiated a "manufacturing renaissance" in Louisiana that will be responsible for $100 billion in planned project investments over the next several years.[86] These manufacturers use natural gas "like a baker uses flour"; it is their "daily bread."[87] Nationally, the value added in 2012 for the entire unconventional energy-value chain and energy-related chain was more than $284 billion and is projected to reach $533 billion by 2025.[88] These increases will lead to increased government revenues, from more than $74 billion in 2012 to a projected $138 billion in 2025, with a total collection of more than $1.6 trillion over this time period.[89]

### *2. Energy Independence*

Hydraulic fracturing is instrumental in the United States's mission to become energy independent. Although the first attempt at the initiative under the Nixon administration failed,[90] the United States has resurrected this ideal because of technological improvements making previously inaccessible oil and gas accessible[91] and the ability to avoid the risk and uncertainties

85. U.S. ENERGY INFO. ADMIN., *supra* note 10, at ES-1.

86. SCOTT & RICHARDSON, *supra* note 26, at iii (noting in 2014 that "Louisiana is in the midst of an industrial boom unlike any other in our history, with over $100 billion in industrial projects either under construction or at the front-end engineering and design phase"); *id.* at 104 (projecting Louisiana to have more than 2 million non-farm employees for the first time in history in 2015).

87. *The Benefits of Offshore Oil and Gas Development: Oversight Field Hearing before the Subcomm. On Energy and Mineral Resources*, 109th Cong. 66 (2006) (statement of Dan Borne, President, Louisiana Chemical Association).

88. IHS GLOBAL INSIGHT, *supra* note 58, at 47.

89. *Id.* at 50.

90. *Project Independence: Hearing Before the House Comm. of the Interior & Insular Affairs*, 93d Cong. 1 (1975); *see generally DOE Timeline: 1971-1980*, DEP'T OF ENERGY, http://web.archive.org/web/20060927141408/ http://www.mbe.doe.gov/me70/history/1971-1980.htm [https://perma.cc/YFC7-27E9] (last visited Oct. 14, 2016).

91. *See* Joseph S. Nye, *Shale Gas is America's Geopolitical Trump Card*, WALL ST. J. (June 8, 2014, 6:26 PM), http://online.wsj.com/articles/joseph-nye-shale-gas-is-americas-geopolitical-trump-card-1402266357 [https://perma.cc/A3CL-7NXF] ("The U.S. was regarded as increasingly dependent on energy imports and was building terminals to import high-priced liquefied natural gas. Instead, North

associated with foreign producers.[92] Since the inception of the shale boom, the United States has steadily reduced its dependency on foreign energy resources.[93] By 2017, the United States is projected to be a net exporter of natural gas,[94] and by 2028, the United States is projected to be energy neutral.[95]

*3. Transition from Fossil Fuels to Renewables*

Using natural gas to produce energy has played a tremendous role in the United States's effort to reduce greenhouse gas emissions.[96] As an energy producer, natural gas is considered a clean fuel alternative when compared to other viable alternatives.[97] On average, natural gas-fired power plants in the

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America is now building terminals to export its low-cost LNG, and the continent is expected to be self-sufficient in energy in the 2020s, according to a broad consensus of energy experts. The Energy Department estimates that the country has 25 trillion cubic meters of technically recoverable resources of shale gas, which when combined with other oil-and-gas resources could last for two centuries."); Bob Abeshouse, *American Power And The Fracking Boom*, HUSSEINI ENERGY (Oct. 2, 2014), http://www.husseinienergy.com/media-center/in-the-press/american-power-and-the-fracking-boom/ [https://perma.cc/E3BD-26U4] ("After decades of fuel dependency on the Middle East and elsewhere, fracking—the high pressure extraction of oil and gas from shale—promises to make the United States energy self-sufficient by 2030.").

92. Tom Gjelten, *Energy Independence For U.S.? Try Energy Security*, NAT'L PUB. RADIO (Oct. 25, 2012, 4:37 AM), http://www.npr.org/2012/10/25/163573768/energy-independence-for-u-s-try-energy-security [https://perma.cc/WZK5-AR98] (discussing the importance of "energy security" to prevent events similar to the oil boycott that several Arab countries imposed on the U.S. in 1973).

93. U.S. ENERGY INFO. ADMIN., *supra* note 10, at 17 (2015) (arguing that net imports of energy have declined from 30% of total consumption in 2005 to 13% in 2013 because of strong growth in domestic oil and gas production from tight formations).

94. *Id.* at ES-1 (projecting natural gas exports to continue growth after 2017 with projected net natural gas exports ranging from 3.0 trillion cubic feet ("tcf") and 13.1 tcf in 2040).

95. *See id.* at ES-3. A country that is energy neutral has equal amounts of energy imports and exports.

96. Mike Orcutt, *How and Why U.S. Greenhouse Gas Emissions Are Falling*, MIT TECH. REV. (May 6, 2014), http://www.technologyreview.com/news/527106/how-and-why-us-greenhouse-gas-emissions-are-falling/ [https://perma.cc/EP4J-N7RC].

97. U.S. ENVTL. PROT. AGENCY, NATURAL GAS: AIR EMISSIONS, https://web.archive.org/web/20150905095003/http://www.epa.gov/cleanenergy/ener

United States emit half the carbon dioxide, less than a third of the nitrogen oxides, and about 1% of the sulfur oxides that their coal-powered counterparts emit for the same quantity of energy production.[98] In 2013, the U.S. energy sector emissions reached their lowest level since 1994.[99] Cheap natural gas prices and the industry's willingness to convert to a cheaper and cleaner fuel largely attributed to this reduction.[100] In 2013, total emissions in the United States were only 4.7% higher than they were in 1994, while total emissions in 2007 were 17.5% above the 1994 levels.[101] This reduction correlates with an increase in coal prices and a significant decrease in the price of natural gas in 2009.[102] In April 2012, energy production from natural gas reached the same level as coal for the first time in recorded history.[103] As methods to increase energy production from renewable resources, such as water, wind, and solar sources, are made more efficient, natural gas is a clean "transition fuel" that might bridge the gap between coal and renewables.[104] Renewable electricity generation is expected to increase 72% by 2040;[105] moreover, between 2025 and 2040, projections show that natural gas will

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gy-and-you/affect/natural-gas.html#footnotes [https://perma.cc/SVW7-XDFY] (last visited Oct. 4, 2016).

98. *Id.*

99. CTR. FOR CLIMATE AND ENERGY SOLUTIONS, LEVERAGING NATURAL GAS TO REDUCE GREENHOUSE GAS EMISSIONS, at v (2013), https://www.c2es.org/docUploads/leveraging-natural-gas-reduce-ghg-emissions-summary.pdf [https://perma.cc/RZK5-GHQX].

100. *See* Orcutt, *supra* note 96.

101. *Id.*

102. U.S. ENVTL. PROT. AGENCY, TRENDS IN GREENHOUSE GAS EMISSIONS 2–3 (2014), http://www3.epa.gov/climatechange/Downloads/ghgemissions/US-GHG-Inventory-2014-Chapter-2-Trends.pdf [https://perma.cc/M556-MVEN] (stating that other factors include the economic downturn and less energy-intensive weather conditions).

103. *Monthly Coal-and Natural Gas-Fired Generation Equal for First Time in April 2012*, U.S. ENERGY INFO. ADMIN., (July 6, 2012), http://www.eia.gov/todayinenergy/detail.cfm?id=6990 [https://perma.cc/B9DM-LTGD].

104. Interview with Gina McCarthy, Administrator, US Envtl. Prot. Agency, in Washington D.C. (Sept. 25, 2014), http://www.rff.org/files/sharepoint/Documents/Events/RFF-Sept25-GinaMcCarthyPLF.pdf [https://perma.cc/8GYL-N2DD] ("Let me start off by saying that natural gas in the US has been a game changer. The abundance of low-cost natural gas has really started an energy transition that we are really taking advantage of and hoping to follow through our 111(d) process, so it's been a significant benefit to the United States. It's been a significant benefit to air quality, because it's allowed us some room to address pollution, pollutants like mercury in a way that maintains reliability because it's accessible and it's affordable.").

105. U.S. ENERGY INFO. ADMIN., *supra* note 10, at ES-6.

be the fuel source for 60% of all new electricity generation, with renewable fuels supplementing the remaining generation.[106] Consequently, energy-related carbon dioxide emissions are projected to remain below 2007 levels through 2040.[107]

Natural gas benefits the average citizen both directly and indirectly and has become an essential part of the American economy. As the industry transitions from fossil fuels to renewable resources, cheap natural gas provides a cleaner energy source than coal and leads to more jobs in the U.S. because of increased manufacturing. Natural gas as an industry has grown exponentially in the past decade with the increased use of hydraulic fracturing, and the projected benefits of increased natural gas production are inconceivable without the continued use of hydraulic fracturing.[108]

## II. HYDRAULIC FRACTURING LITIGATION

Natural gas is and will likely continue to be a valuable asset to the current U.S. economy. However, because of the industry's rapid growth, it is unclear whether the technology and increased use of hydraulic fracturing will outpace the regulatory framework that keeps other similar industries in check.[109] Some argue that the solution to the lapse in regulation is imposing strict liability to encourage companies engaged in hydraulic fracturing to apply the highest standards of safety and alleviate some of the evidentiary burden for plaintiffs injured by groundwater contamination.[110] However, imposing strict liability will still leave injured parties without a means of equitable relief because the most difficult burden, that of proving causation, remains.

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106. *Id.* at 24.

107. *Id.* at 27 ("The main factors influencing CO2 emissions include substitution of natural gas for coal in electricity generation, increases in the use of renewable energy, improvements in vehicle fuel economy, and increases in the efficiencies of appliances and industrial processes."); *see id.* at 26 fig.36.

108. *Natural Gas from Shale*, *supra* note 56.

109. *See* Jason T. Gerken, Comment, *What the Frack Shale We Do? A Proposed Environmental Regulatory Scheme for Hydraulic Fracturing*, 41 CAP. U.L. REV. 81 (2013); Alexander T. Maur, Note, *Let's Not Frack This Up: State-based Solutions for the Regulation of Hydraulic Fracturing and the Disposal of Flowback Water*, 48 SUFFOLK U. L. REV. 151 (2015).

110. *See* Hannah Coman, Note, *Balancing the Need for Clean Energy and Clean Water: The Case for Applying Strict Liability in Hydraulic Fracturing Suits*, 39 B.C. ENVTL. AFF. L. REV. 131, 154–59 (2012).

The most common claims brought in hydraulic fracturing suits are trespass, negligence, nuisance, and strict liability for ultra-hazardous activities.[111] Causation is an essential element to each of these theories of liability[112] and is often the element that plaintiffs are incapable of proving. To survive a motion for directed verdict, plaintiffs must provide sufficient evidence that hydraulic fracturing activities caused the contamination of the groundwater,[113] in addition to the other elements that the specific theory of liability being pursued requires.[114]

### *A. Alleging Contamination*

Given the circumstances of the hydraulic fracturing process and the numerous potential sources of contamination, proving causation in groundwater contamination cases places a nearly insurmountable burden on plaintiffs. Although groundwater contamination does not occur in a widespread or systemic manner,[115] it has occurred.[116] As natural gas becomes the primary source of energy in the United States,[117] the use of hydraulic fracturing will continue to increase at an expansive rate. Expanded use of the activity consequently escalates the likelihood of increased occurrences of contamination, whether due to operator error or an unforeseeable circumstance.

The standard of evidence required to prove groundwater contamination is nearly impossible to reach because baseline water composition data is lacking,[118] the source of the contamination is located miles beneath the surface,[119] and the contamination might take years to infiltrate the groundwater.[120] In cases in which groundwater pollution in fracking areas is

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111. *See, e.g.*, King, *supra* note 48, at 344, n.17 (citing multiple sources).

112. *See, e.g.*, *id.* at 345 n.21; Ely v. Cabot Oil & Gas Corp., 38 F. Supp. 3d 518 (M.D. Pa. 2014).

113. Anthony v. Chevron USA, Inc., 284 F.3d 578, 586–87 (5th Cir. 2002).

114. King, *supra* note 48, at 346.

115. U.S. ENVTL. PROT. AGENCY, *supra* note 11, at ES-6.

116. *See id.* at 10-20.

117. U.S. ENERGY INFO. ADMIN., *supra* note 10, at 27.

118. *See generally* U.S. ENVTL. PROT. AGENCY, *supra* note 11.

119. AM. PETROLEUM INST., *supra* note 12, at 7.

120. U.S. ENVTL PROT. AGENCY, *supra* note 11, at 6-56–6-57. ("Given the surge in the number of modern high-pressure hydraulic fracturing operations dating from the early 2000s, evidence of any fracturing-related fluid migration affecting a drinking water resource (as well as the information necessary to connect specific well operation practices to a drinking water impact) could take years to discover."); Gerken, *supra* note 109, at 99 (proposing that an "enhanced regulatory framework could give a landowner the tools to make a case in state

confirmed, but insufficient evidence exists to establish the required factual link between the fracturing and water contamination, common law remedies are incapable of providing equitable relief for injured plaintiffs.[121]

*B. Liability for Negligence*

In jurisdictions that do not recognize strict liability tort actions for abnormally dangerous or ultra-hazardous activities, plaintiffs often turn to alternative theories such as negligence.[122] The burden of proving causation remains a barrier for plaintiffs, however, because of the inability to obtain evidence of the defendant's breach of duty and evidence establishing that breach caused the injury. The following elements are those most commonly required for a finding of liability stemming from negligence: first, the existence of a duty owed by the defendant to the plaintiff; second, the defendant's breach of that duty; third, that the breach caused the injury; and fourth, that the plaintiff suffered injury because of the breach.[123]

In *Anthony v. Chevron USA, Inc.*, the Anthony family brought claims for the negligent contamination of groundwater and soil on the family ranch caused by the hydraulic fracturing of two separate wells.[124] The family had baseline water test data from 1973 to 1975 showing that the water chloride level was roughly 60 parts per million ("ppm"), a suitable level for human consumption, but by 1988, the level had increased and far exceeded a level safe for human consumption.[125] The family claimed the contamination was due to hydraulic fracturing operations that Chevron performed from 1979 to 1989 to increase production.[126] To succeed, the plaintiffs had to prove the four elements of negligence liability, and predictably, the plaintiffs had difficulty proving causation.

To meet the evidentiary burden of causation, the plaintiffs provided the testimony of two expert witnesses.[127] Through one expert's testimony, the plaintiffs established that one of the Chevron wells was leaking

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court in the distant future, if not create alternative causes of action to be brought immediately in federal court under existing environmental statutes").

121. Gerken, *supra* note 109.

122. *See* King, *supra* note 48, at 344. The terms "abnormally dangerous" and "ultra-hazardous" are used interchangeably in this Comment.

123. Anthony v. Chevron USA, Inc., 284 F.3d 578, 583 (5th Cir. 2002) (citing Mosley v. Excel Corp., 109 F.3d 1006, 1009 (5th Cir. 1997)).

124. *Id.* at 582.

125. *Id.* at 581 (explaining that the chloride level reached 980 ppm by 1988).

126. *Id.* at 582.

127. *Id.* at 584.

through the casing in multiple areas.[128] Additionally, the expert established that Chevron had initiated a fracture that extended vertically from the production zone and theorized that the continued use of high-pressure saltwater injections over several years had caused the fracture to continue upward, which caused contamination of the groundwater aquifer.[129] Although the plaintiffs established the water was contaminated and proposed several fact-based theories for how Chevron could have caused the contamination, the court determined that the experts had not established a sufficient factual link between Chevron's operations and the contamination of the groundwater.[130]

The court offered advice for bridging this evidentiary gap in stating, "[t]he well could have presumably been tested or a separate well could have been dug in the vicinity of these point sources to search for higher pollution."[131] These recommendations would have imposed additional costs on the plaintiffs, aside from the cost of the two experts who were already hired. Additionally, the court noted that the plaintiffs failed to address the possibility that other subsequent operators caused the contamination, implying an additional burden of requiring a plaintiff to prove not only that the defendant contaminated the groundwater, but also that other operators did not contaminate it.[132]

The evidence presented in *Anthony* was more extensive than that submitted by most plaintiffs in similar suits because the plaintiffs in *Anthony* were able to prove that contamination occurred with baseline water data as well as factually plausible sources of fluid migration from the defendant's fracturing wells.[133] However, the evidence was insufficient to establish the factual nexus between the contaminant source and the contaminated water.[134] This scenario demonstrates the significant burden

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128. *Id.* at 584–86 (relying on the temperature log, which revealed that the well was leaking through numerous holes in its casing from 2,016 feet to 1,924 feet, and at 1,390 feet below the surface, roughly 1,300 feet below the contaminated aquifer).

129. *Id.* at 586–87 (establishing that Chevron initiated a fracture that extended vertically from the production zone 166 feet towards the aquifer and theorizing that Chevron's continued use of high-pressure saltwater injections over several years after the initial fracture had caused the fracture to continue upward, thus causing contamination of the aquifer, which was roughly 1,500 feet above).

130. The experts provided proof that the fracturing fluids had ventured farther than Chevron might have intended, but the plaintiff could not factually prove that the fluid had migrated an additional 1,300 to 1,500 feet to the groundwater and caused the contamination. *Id.*

131. *Id.* at 586.

132. *Id.* at 587.

133. *Id.* at 586–87.

134. *Id.* at 590.

injured plaintiffs face when bringing contamination suits under a negligence theory.

### *C. Strict Liability*

The elements required to find that hydraulic fracturing is an ultra-hazardous activity subject to strict liability vary among the states. The cause of action is intended to impose liability for actions that are abnormally dangerous regardless of whether the utmost care is exercised during the operation.[135] The activity is continued because the utility derived from the activity justifies the risk of proceeding.[136] The essential question is not whether the defendant acted negligently, but rather whether the activity itself presents an abnormal degree of risk that cannot be alleviated by operating with the utmost care.[137] Some argue that strict liability is the best means to permit equitable relief to plaintiffs injured by hydraulic fracturing activities.[138]

Pennsylvania has adopted the analysis set forth in The Restatement (Second) of Torts section 519 and section 520 for determining whether an activity is abnormally dangerous.[139] Section 519 states that "[o]ne who carries on an abnormally dangerous activity is subject to liability for harm . . . of another resulting from the activity, although he exercised the utmost care to prevent the harm."[140] To determine whether the activity is "abnormally dangerous," section 520 enumerates a six-factor test. These factors are as follows: first, the existence of a high degree of risk of some harm to the person, land, or chattels of others; second, the likelihood that the resulting harm will be great; third, the inability to eliminate the risk by the exercise of reasonable care; fourth, the extent to which the activity is not a matter of common usage; fifth, the inappropriateness of the activity to the place where it is carried on; and sixth, the extent to which its value to the community is outweighed by its dangerous attributes.[141] Pennsylvania plaintiffs have not yet been able to present the required evidence to establish hydraulic fracturing and other

135. RESTATEMENT (SECOND) OF TORTS § 519 (AM. LAW INST. 1977).

136. *Id.* § 520 cmt. b.

137. *See* Ely v. Cabot Oil & Gas Corp., 38 F. Supp. 3d 518, 529 (M.D. Pa. 2014).

138. Coman, *supra* note 110, at 154–59.

139. *See, e.g.*, *Ely*, 38 F. Supp. 3d at 529 (adopting §§ 519 and 520 of the Restatement (Second) of Torts); Diffenderfer v. Staner, 722 A.2d 1103, 1107 (Pa. Super. Ct. 1998) (same); Melso v. Sun Pipe Line Co., 576 A.2d 999, 1002–03 (Pa. Super. Ct. 1990) (same); Smith v. Weaver, 665 A.2d 1215, 1219–20 (1995) (same); Albig v. Municipal Auth. of Westmoreland Cnty., 502 A.2d 658, 662–63 (Pa. Super. Ct. 1985) (same).

140. RESTATEMENT (SECOND) OF TORTS § 519 (AM. LAW INST. 1977).

141. *Id.* § 520.

similar injection activities[142] as abnormally dangerous or ultra-hazardous activities.[143] These plaintiffs generally revert to other theories of liability such as negligence, which make recovery more difficult because of the additional case-specific evidentiary burdens.[144]

Arkansas has developed a simplified two-part test to determine whether an activity is ultra-hazardous. If the gas production activity "necessarily involves a risk of serious harm . . . which cannot be eliminated by the exercise of the utmost care and is not a matter of common usage," the activity is ultra-hazardous.[145] Arkansas courts have implemented a standard similar to Pennsylvania's by permitting a full record to be established and withholding judgment until discovery is complete.[146] In contrast, Texas does not recognize a cause of action of strict liability for "abnormally dangerous" or "ultra-hazardous" activities for oil and gas operations.[147] Instead, Texas plaintiffs generally bring negligence claims,[148] in which the evidentiary showing is more cumbersome.

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142. *See Melso*, 576 A.2d at 1003 (finding that operating a pipeline in an urban area was not abnormally dangerous); *Smith*, 665 A.2d at 1220 (finding that underground gasoline storage tanks are not ultra-hazardous or abnormally dangerous because they are common, can be dealt with safely, and are valuable to society); *Diffenderfer*, 722 A.2d at 1107 (holding that the storage of toxic insecticide in a barn was not abnormally dangerous).

143. *See Ely*, 38 F. Supp. 3d 518.

144. Kleinknecht v. Gettysburg College, 989 F.2d 1360, 1366 (3d Cir. 1993)

> In order to prevail on a cause of action in negligence under Pennsylvania law, a plaintiff must establish: (1) a duty or obligation recognized by the law, requiring the actor to conform to a certain standard of conduct; (2) a failure to conform to the standard required; (3) a causal connection between the conduct and the resulting injury; and (4) actual loss or damage resulting to the interests of another.

(citing WILLIAM PROSSER, LAW OF TORTS § 30, at 143 (4th ed. 1971)). These other claims are more burdensome for plaintiffs because they have to prove the injuring party's actions fall below the required standard of duty, which is not required for strict liability claims.

145. Zero Wholesale Gas Co. v. Stroud, 571 S.W.2d 74, 76 (Ark. 1978) (emphasis omitted).

146. Tucker v. Sw. Energy Co., 2012 U.S. Dist. LEXIS 20697, *10 (E.D. Ark. Feb. 17, 2012) (first citing Fiorentino v. Cabot Oil & Gas Corp., 750 F. Supp. 2d 506, 511–12 (M.D. Pa. 2010); and then citing Berish v. Sw. Energy Prod. Co., 763 F. Supp. 2d 702, 705 (M.D. Pa. 2011)).

147. *See* Turner v. Big Lake Oil Co., 96 S.W.2d 221, 226 (Tex. 1936) (declining to apply a strict liability standard in oil and gas operations); Harris v. Devon Energy Prod. Co., No. 4:10-CV-708, 2012 WL 220212 (E.D. Tex. Jan. 25, 2012), *aff'd as modified* 500 Fed. App'x. 267 (5th Cir. 2012).

148. *See Harris*, 2012 WL 220212.

Prior to 1996, article 667 of the Louisiana Civil Code imposed absolute liability for damage that the proprietor of an estate caused on his neighbor's property by ultra-hazardous activities.[149] In 1996, however, the legislature amended article 667 and limited its application to pile driving and blasting activities.[150] Before the amendment, Louisiana required four elements to be met to impose strict liability related to an ultra-hazardous activity: first, the activity had to be related to the immovable; second, the activity itself must have caused the injury; third, the defendant must have directly engaged in the activity; and fourth, the activity must have had the ability to cause injury, regardless of a party's substandard conduct.[151] Numerous methods have been used to determine the standard for "substandard conduct" that the third element requires,[152] but substandard conduct is generally deemed to require the activity to be capable of causing injury "even when conducted with the greatest prudence and care."[153] Although Louisiana does not currently recognize a cause of action for hydraulic fracturing as an ultra-hazardous activity, modifying article 667 to permit these claims would not alleviate the burden of causation.

The theories of liability currently available to injured plaintiffs do not promote equitable relief for groundwater contaminations that have already occurred. Both legislators[154] and scholars[155] have debated whether hydraulic fracturing should be considered an ultra-hazardous activity and, consequently,

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149. *See* Craig v. Montelepre Realty Co., 211 So. 2d 627 (La. 1968) (pile driving); Fontenot v. Magnolia Petroleum Co., 80 So. 2d 845 (La. 1955) (blasting); Gotreaux v. Gary, 94 So. 2d 293 (La. 1957) (herbicide crop dusting); Updike v. Browning-Farris, 808 F. Supp. 538, 542–43 (W.D. La. 1992) (storing hazardous waste); Hampton v. Rubicon Chems., Inc., 458 So. 2d 1260, 1268 (La. 1984); Langlois v. Allied Chem. Corp., 249 So. 2d 133 (La. 1971) (storage of poisonous gas).

150. LA. CIV. CODE art. 667 (1996); *see also* Suire v. Lafayette City-Parish Gov't., 907 So. 2d 37 (La. 2005) (affirming the amended code article).

151. Perkins v. F.I.E. Corp., 762 F.2d 1250, 1267–68 (5th Cir. 1985).

152. *Updike*, 808 F. Supp. at 542–43 (denying defendant's motion to dismiss to permit a factual inquiry based on a fully developed record, but also noting that if the ultra-hazardous determination can be based on an analogy to other cases, the court would conclude that the storage of hazardous waste in pits is an ultra-hazardous activity).

153. Triplette v. Exxon Corp., 554 So. 2d 1361, 1362 (La. Ct. App. 1989).

154. Timothy Wheeler, *Lawmakers Wade Into Debate Over Fracking in Western Maryland*, BALTIMORE SUN (Mar. 3, 2015), http://www.baltimoresun.com/features/green/blog/bal-lawmakers-wade-into-debate-over-fracking-in-western-maryland-20150303-story.html [https://perma.cc/3DGM-CQF9].

155. *See generally* Coman, *supra* note 110; King, *supra* note 48; Schremmer, *supra* note 36.

subject to strict liability. Regardless of whether strict liability or negligence liability applies, the primary evidentiary burden of causation remains the same. Plaintiffs lack the information to prove the factual link required by courts to prove the defendant caused the contamination;[156] thus, taken in the aggregate, this same lack of a factual link over time prevents a finding that hydraulic fracturing is an abnormally dangerous activity.[157] And, regardless of whether hydraulic fracturing is considered abnormally dangerous, the risk factor will not weigh heavily against the overall utility of the activity until sufficient evidence from multiple contamination claims provides a factual link between hydraulic fracturing and groundwater contamination.

Ultimately, the lack of causation evidence in contamination cases has two possible explanations: either hydraulic fracturing does not cause groundwater contamination, or it occasionally does cause contamination but the practice is not sufficiently studied and monitored to establish a record of the contamination. An EPA study[158] and several plaintiffs[159] have established that oil and gas activities have contaminated groundwater resources, which proves the latter scenario more plausible. In instances where equitable relief is not available to injured parties through *ex post*[160] tort liability, a robust *ex ante*[161] regulatory strategy might be necessary to reduce the occurrence of harm by establishing safe standards and best practices.

## III. CURRENT REGULATIONS

A number of reasons exist as to why the controversy over the long-term detrimental effects of hydraulic fracturing has reached considerable proportions. Clean water is a finite resource, in some locations more than others, that is usually found underground.[162] Pumping large quantities of

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156. King, *supra* note 48, at 344.

157. *See* RESTATEMENT (SECOND) OF TORTS § 520(a) (AM. LAW INST. 1977) (requiring the "existence of a high degree of risk of some harm to the person, land or chattels of others").

158. *See* U.S. ENVTL. PROT. AGENCY, *supra* note 11, at 6-57.

159. *See, e.g.*, Anthony v. Chevron USA, Inc., 284 F.3d 578 (5th Cir. 2002); Ely v. Cabot Oil & Gas Corp., 38 F. Supp. 3d 518 (M.D. Pa. 2014).

160. *Ex post* regulation, such as tort liability, imposes monetary damages on injuring parties after the injury has occurred. *See* Thomas Merrill & David Schizer, *The Shale Oil and Gas Revolution, Hydraulic Fracturing, and Water Contamination: A Regulatory Strategy*, 98 MINN. L. REV. 145, 212 (2013).

161. *Ex ante* regulations attempt to reduce the risk of injury before their occurrence by imposing industry standards and requirements. *Id.* at 215.

162. U.S. ENVTL. PROT. AGENCY, EPA/601/R-12/004, SAFE AND SUSTAINABLE WATER RESOURCES: STRATEGIC RESEARCH ACTION PLAN 2012–2016, at 7 (2012).

pressurized blends of toxic chemicals into the ground over several years will likely have a detrimental effect. However, as long as industries with similar risks, such as nuclear power plants and chemical manufacturing plants, are regulated to alleviate the risk involved, the general public is more likely to accept this risk.[163] When activities perceived to impose a high risk of harm are left largely unregulated, such as hydraulic fracturing, the talking points align and the ensuing controversy leads to a largely misinformed debate.

*A. Federal Regulations*

Hydraulic fracturing and other oil and gas activities are exempted from several of the major federal environmental regulations that similar industries are required to follow, which removes any reassurances of regulatory oversight from the public opinion. The Clean Water Act ("CWA") is intended to maintain and restore the biological integrity of surface water by preventing pollution sources in navigable waterways.[164] The objective of the CWA is to protect surface water as opposed to groundwater, both of which are currently being used as sources of drinking water.[165] Contamination of surface waters by hydraulic fracturing activities, however, would not activate the CWA regulations because of several exemptions. The operators of oil and gas exploration and production facilities are not required to obtain CWA permits for the storm-water runoff from these facilities, which effectively exempts these activities.[166] The Energy Policy Act of 2005 expanded this exemption to exempt pollution caused by activities necessary for the preparation of the site and for movement and placement of the drilling equipment at these facilities.[167]

The Safe Drinking Water Act ("SDWA") required all "underground injection" activities to obtain a permit and be regulated by an approved Underground Injection Control ("UIC") program before 2005.[168] UIC programs required the applicant to show that the underground injection would not endanger drinking water and required inspection, monitoring,

163. Ayesha Rascoe, *Fracking Regulations Could Ease Public Concerns: White House*, REUTERS (Apr. 26, 2011, 3:57 PM), http://www.reuters.com/article/us-natgas-fracking-regulation-idUSTRE73P6DV20110426 [https://perma.cc/CSE9-QURE].

164. 33 U.S.C. § 1251(a) (2012).

165. U.S. ENVTL. PROT. AGENCY, *supra* note 11, at ES-3.

166. 33 U.S.C. § 1342(l)(2).

167. *Id.* § 1362(24).

168. 42 U.S.C. § 300h(b) (2012).

and recordkeeping of the well activities.[169] Despite the Eleventh Circuit's ruling that hydraulic fracturing "fit[s] squarely" within the defined class of "underground injections,"[170] Congress exempted hydraulic fracturing from the SDWA[171] in a controversial act colloquially known as the "Halliburton Loophole."[172] This exemption was controversial because many viewed it as an endorsement of oil and gas companies' continued operations, even though the effects of hydraulic fracturing could not be conclusively stated.[173]

Additionally, the Comprehensive Environmental Response, Compensation, and Liability Act ("CERCLA") exempts oil and natural gas from the definition of "hazardous waste."[174] The Resource Conservation and Recovery Act subsection C regulates the disposal of hazardous waste products but, similar to CERCLA, contains a provision exempting "drilling fluids, produced waters, and other wastes associated with the exploration, development, or production of crude oil or natural gas."[175] The Clean Air Act ("CAA") grants direct control to the EPA over areas satisfying the "major source" criteria.[176] When sources of air pollution like drilling and pumping equipment are within a contiguous area, such as a fracking site, the pollution of all sources are aggregated to establish the total pollution aggregate for the area.[177] If the total pollution aggregate surpasses the CAA

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169. *Id.*

170. Legal Envtl. Assistance Found. (LEAF), Inc. v. EPA, 276 F.3d 1253, 1263 (11th Cir. 2001). The Eleventh Circuit rejected the EPA's interpretation that "underground injection" did not include hydraulic fracturing activities. The EPA's interpretation included only wells "whose 'principal function' is the underground emplacement of fluids," and hydraulic fracturing would be excluded because its primary function is the production of product. *Id.* at 1471.

171. The exemption was part of the Energy Policy Act of 2005 and is not applicable when the fracturing fluid contains diesel. 42 U.S.C. § 300h(d)(1)(B)(ii).

172. *See The Halliburton Loophole*, EARTHWORKS, http://www.earthworksaction.org/issues/detail/inadequate_regulation_of_hydraulic_fracturing#.VRMaZClN3zI [https://perma.cc/6KBW-UPF9] (last visited Sept. 11, 2016). The 1997 *LEAF* decision happened while the EPA was under the Clinton Administration and the "Halliburton Loophole" occurred during a Republican majority in Congress. This distinction supports the notion that the lack of federal regulation is largely based on economic concerns and not on partisan issues.

173. Adam Garmezy, *Balancing Hydraulic Fracturing's Environmental and Economic Impacts: The Need for a Comprehensive Federal Baseline and the Provision of Local Rights*, 22 DUKE ENVTL. L. & POL'Y F. 405, 407–10 (2013).

174. 42 U.S.C. § 300h(d)(1)(B)(ii).

175. *Id.* § 6921(b)(2)(A).

176. *Id.* § 7412(a)(1).

177. *Id.*

threshold, the EPA will issue regulations to achieve the maximum reduction of these emissions.[178] However, the statute later declares that emissions from "any oil or gas exploration or production well . . . [are not] aggregated for any purpose under this section."[179] It was not until April of 2012 that the EPA finally issued the first federal air standards for qualifying hydraulically fractured wells.[180]

Presumably awaiting further study and information from the EPA, Congress has allowed the expiration of several bills intended to modify these federal regulations.[181] The draft of the five-year study was finally released in June 2015. However, the inconclusive statements in the report, citing a lack of pre- and post-fracturing data,[182] only further the notion that Congress and the EPA lack the same contamination evidence as plaintiffs, which has proven detrimental to plaintiffs' claims. These exemptions show that the federal government is either unable or unwilling to enforce the same regulatory standards on hydraulic fracturing operations as it imposes on other similar industries. Consequently, the regulation of hydraulic fracturing is largely left to the states.

### *B. State Regulations*

A comprehensive federal regulatory strategy would be cumbersome and largely impractical given that the practice of hydraulic fracturing can vary significantly by rock formation and other regional conditions. States are in a better position to develop regulatory strategies because of their knowledge of their respective geologies and other local concerns.[183] Many state regulatory agencies, however, are already understaffed for purposes of handling the increased workload that the shale boom caused and would likely find it difficult to propose and implement new regulations governing

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178. *Id.* § 7412(d)(2)(A).

179. 42 U.S.C § 7412(n)(4)(A).

180. 40 C.F.R. § 60.5375 (2012).

181. Fracturing Responsibility and Awareness of Chemicals ("FRAC") Act of 2011, H.R. 1084, 112th Cong. (2011); Fracturing Regulations Are Effective in State Hands (FRESH) Act, S. 2248, 112th Cong. (2012).

182. The report found that contamination has occurred through multiple avenues in a relatively small number of cases, but notes that the number of cases might be understated because of insufficient pre- and post-fracturing data of the groundwater resources. U.S. ENVTL. PROT. AGENCY, *supra* note 11, at 10-20.

183. Wes Deweese, *Fracturing Misconceptions: A History of Effective State Regulation, Groundwater, and the Ill-Conceived FRAC Act*, 6 OKLA. J.L. & TECH. 49, May 2010, at 1, 31, https://www.law.ou.edu/sites/default/files/files/FACULTY/2010okjoltrev49.pdf [https://perma.cc/SZ2X-CGV6].

hydraulic fracturing that require heavy oversight.[184] If hydraulic fracturing continues in its projected growth pattern, regulations requiring oversight at any level will likely be impractical without the allocation of significant additional resources. Any proposed regulations should provide a benefit that the cost of enforcing the regulations balances to prevent the stifling of the industry or overburdening of regulatory agencies.

### *1. Baseline Water Testing*

Various states have implemented different forms of regulation on the hydraulic fracturing industry. Baseline water testing alleviates the states' regulatory strain by imposing the burden of testing and monitoring on the companies engaging in the potentially hazardous activity. Several states require baseline water testing of the water resources within a certain radius of the well.[185] Baseline water testing provides valuable information to state regulators, fracking operators, and injured plaintiffs. The testing establishes a record of the chemical composition of the water before hydraulic fracturing occurred in the area.[186] This baseline composition can then be compared to new water tests to determine if and when contamination has occurred.[187] If contamination has occurred, the data

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184. *See* Hannah Wiseman, *Fracturing Regulation Applied*, 22 DUKE ENVTL. L. & POL'Y F. 361, 371 (2012) ("Some state agencies tasked with executing environmental regulations - often in addition to ensuring oil and gas conservation and protecting mineral rights - have been overwhelmed by the pace and volume of new well development."). In Texas, the number of wells drilled increased by 75% from 2003 to 2008 while the regulatory staff increased by only 4% over the same time period. With over 273,000 wells in Texas in 2009, the administrative burden of additional regulations would be tremendous. *How Big is the Gas Drilling Regulatory Staff in Your State?*, PROPUBLICA, http://projects.propublica.org/gas-drilling-regulatory-staffing/states/TX.html [https://perma.cc/LFQ6-8E69] (last visited Sept. 11, 2016). In Louisiana, the number of new wells drilled annually increased by 42% between 2003 and 2009, while the regulatory staff increased by only 3%. *Id.*

185. *See* OHIO REV. CODE ANN. 1509.06(A)(8)(c) (West 2016) (requiring testing of water sources within 1,500 feet of the well); N.C. GEN. STAT. ANN. § 113–423(f) (West 2016) (requiring the testing of water sources within 5,000 feet of the well).

186. *See* Keith B. Hall, *Hydraulic Fracturing and the Baseline Testing of Groundwater*, 48 U. RICH. L. REV. 857, 870 (2014).

187. *Id.* at 871.

might also be used in conjunction with fracking fluid chemical compositions to determine which operator caused the contamination.[188]

Some operators in states without mandatory testing perform the baseline testing on a voluntary basis.[189] Presumably, operators performing voluntary testing do so as part of their well monitoring and information gathering, as well as to create an evidentiary record showing that they have not caused contamination.[190] Several states, such as Colorado, Illinois, North Carolina, Ohio, and Wyoming, require mandatory baseline water testing before the fracturing of wells.[191] These requirements typically vary by the number of water sources that must be tested, the anticipated impact radius, and the population density of the drilling area.[192] The radius of water sources that must be tested varies significantly, from 1,500 feet in Ohio to 5,000 feet in North Carolina, with the variation presumably based on the various states' tailoring of their regulations to fit unique geologic formations and other conditions.[193]

Illinois requires baseline water testing before hydraulic fracturing and places a particularly onerous presumption of liability against the operator. The presumption is applied if pollution of a water source occurs within 1,500 feet of the well site and is shown to have occurred within 30 months of the hydraulic fracturing operation.[194] Rebutting this presumption requires the operator to affirmatively prove by clear and convincing evidence that the water source was not within 1,500 feet of the well site, that the pollution did not occur during the 30-month window, or to prove another cause of the contamination.[195] This form of presumption places the operator in the same position as plaintiffs in other states because the operator lacks the evidence to prove a factual link between the source of

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188. For an in depth discussion of baseline groundwater testing see *id.* at 887–89.

189. *See id.* at 874; *see Voluntary Baseline Water Sampling Guideline*, N.M. OIL & GAS ASSOC., http://www.nmoga.org/voluntary-baseline-water-sampling-guideline [https://perma.cc/2MCY-7L7Y] (last visited Oct. 6, 2015).

190. *See* Hall, *supra* note 186, at 874.

191. 2 COLO. CODE REGS. § 404–1:609(b) (2016); 225 ILL. COMP. STAT. 732 732/1–80(b) (2016).; N.C. GEN. STAT. ANN. § 113–423(f) (West 2016); OHIO REV. CODE ANN. 1509.06(A)(8)(b)–(c) (2016); 055-003 WYO. CODE R., § 46(a) (LexisNexis 2016).

192. *See, e.g.*, 225 ILL. COMP. STAT. 732/1-80(b).

193. *Cf.* Oil and Gas; Hydraulic Fracturing on Federal and Indian Lands, 80 Fed. Reg. 16,183 (proposed Mar. 26, 2015) (to be codified at 43 C.F.R. pt. 3160) (deciding against a national requirement for baseline testing partially because local authorities are better informed of their specific geologic conditions).

194. 225 ILL. COMP. STAT. 732/1-85(b).

195. 225 ILL. COMP. STAT. 732/1-85(c).

the contaminant and the actual contamination. These presumptions might incentivize safe practices by operators to an extent, but they will likely stifle the industry for fear of liability for contaminations caused by third parties.[196]

Other states, such as Pennsylvania and West Virginia, do not require operators to perform baseline testing, but encourage the exercise by establishing evidentiary presumptions against operators who decline to do so. Pennsylvania establishes a presumption of liability against operators of unconventional wells where water contamination occurs within 2,500 feet of the wellbore and the pollution occurs within 12 months of completion, drilling, stimulation, or alteration.[197] This presumption is rebuttable, however, with pre-drilling baseline water data proving that the contamination existed before drilling or that the landowner refused testing.[198]

Incentivizing the performance of baseline testing alleviates some of the issues related to contamination litigation by improving a plaintiff's chances of proving at least a portion of the factual nexus required. It also provides evidence that can protect defendant operators when their particular operations are not the cause of the alleged contamination. Despite the perceived benefits associated with requiring baseline water testing before hydraulic fracturing, including enhanced data acquisition and safer production, Louisiana does not require any form of baseline water testing.[199]

*2. Chemical Disclosures*

In a recent study on the impact of hydraulic fracturing on groundwater resources, the EPA identified more than 1,000 chemicals—including acids, alcohols, aromatic hydrocarbons, bases, hydrocarbon mixtures, polysaccharides, and surfactants—used in various quantities in hydraulic

196. North Carolina has a similar rebuttable presumption. The presumption is rebuttable, however, with a more lenient standard of preponderance of the evidence. To rebut the presumption, the evidence must show that the water supply is not within a half mile of the well, the contamination occurred prior to the fracturing, a separate cause for the contamination existed, or that the owner refused the baseline water testing. N.C. GEN. STAT. ANN. § 113–421(a1) (West 2016). The statute also requires that operators causing contamination must provide to the users of the water supply a replacement water supply that is adequate in quality and quantity for their use, in addition to any other damages. *Id.*. § 113–421(a5).

197. 58 PA. STAT. AND CONS. STAT. ANN. § 3218(c) (West 2016). West Virginia has similar statutes to encourage baseline testing, but they require a reduced radius of 1,500 feet. W. VA. CODE ANN. § 22-6A-18 (West 2016).

198. 58 PA. STAT. AND CONS. STAT. ANN. § 3218(d)(2).

199. *See infra* Part V.B.1 for detailed discussion.

fracturing operations.[200] Prior to 2010, operators did not have to disclose the chemicals contained in their fracturing fluid in any state.[201] Currently, the majority of states permitting hydraulic fracturing activities have some form of disclosure requirements.[202] Many states permit the disclosure to Fracfocus, an easily accessible online registry of fracturing fluid compositions being used in wells across the country.[203]

Full-disclosure states, such as Arkansas[204] and Texas,[205] require that all chemicals added to the fracturing fluid be disclosed by type and concentration, including specific names of each additive, to the director.[206] Once disclosed to the director, the operator may apply to have any trade-secret portion withheld from the subsequent public disclosure.[207] The director of the regulating agency must keep the qualifying trade-secret chemicals confidential.[208] Because trade-secret chemicals might hold tremendous value, some states might prefer a partial-disclosure strategy because of liability concerns associated with holding the full-disclosure trade-secret chemicals confidential.

Several states, such as Michigan[209] and Louisiana,[210] have a partial-disclosure requirement for chemicals used during hydraulic fracturing. In partial-disclosure states, the operator is required to disclose all of the chemicals added to the fracturing fluid unless the chemicals are protected as trade secrets.[211] If the chemicals are trade secrets, the operator may choose to disclose the chemical family of the trade-secret chemical

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200. The ten most common chemicals are methanol, hydrotreated light petroleum distillates, hydrochloric acid, isopropanol, ethylene glycol, peroxydisulfuric acid diammonium salt, sodium hydroxide, guar gum, glutaraldehyde, and propargyl alcohol. U.S. ENVTL. PROT. AGENCY, *supra* note 11, at 5-72.

201. Keith B. Hall, *Hydraulic Fracturing: Trade Secrets and the Mandatory Disclosure of Fracturing Water Composition*, 49 IDAHO L. REV. 399, 406 (2013). Noting that Wyoming became the first state to require fracturing fluid chemical disclosures in 2010.

202. Fracfocus.org contains a database of the disclosure regulations of each state. FRACFOCUS, *supra* note 46.

203. *Id.* (allows operators to disclose the chemical composition of their hydraulic fracturing treatments either voluntarily or mandatorily).

204. 178.00.1-B-19 ARK. CODE R. § (l)–(m) (LexisNexis 2015).

205. 16 TEX. ADMIN. CODE § 3.29(c)(2) (2016).

206. *Id.* § 3.29(c)(2)(A). The "director" in Texas is the director of the Oil and Gas Division of the Railroad Commission of Texas. *Id.* § 3.29(a)(13).

207. *Id.* § 3.29(c)(2)(C).

208. *Id.* § 3.29(e).

209. MICH. ADMIN. CODE r. 324.1406 (2016).

210. LA. ADMIN. CODE tit. 43, pt. 19, §118(C)(1)(b) (2016).

211. *Id.* §118(C)(2)(a) (2016); MICH. ADMIN. CODE r. 324.1406(2).

instead.[212] The non-trade-secret chemicals are first disclosed to the state and then to the public.[213]

The trend of states requiring public disclosure is helpful in establishing public reassurance that the industry is being regulated and monitored. Landowners and concerned citizens alike are able to access this data and personally inspect the chemicals being injected near them, and operator employees can determine what types of chemicals are on their jobsite.[214] Additionally, the disclosed chemicals may be compared to baseline water tests in states requiring them to determine which operator might be the most likely source of contamination.[215] Operators can also compare their fluid compositions with other companies and adjust them to better suit the specific rock formation or location.

*3. Fracturing Bans*

In contrast, some jurisdictions have outright bans on hydraulic fracturing, such as the country of France[216] and several states, including Vermont,[217] Maryland,[218] and New York.[219] Such bans should be

212. LA. ADMIN. CODE tit. 43, pt. 19, §118(C)(2)(a)(i); MICH. ADMIN. CODE r. 324.1406(2).

213. LA. ADMIN. CODE tit. 43, pt. 19, § 118(C)(f)(5).

214. FRACFOCUS, *supra* note 46.

215. *See generally* Hall, *supra* note 186, at 870.

216. Tara Patel, *France Vote Outlaws 'Fracking' Shale for Natural Gas and Oil Extraction*, BLOOMBERG (July 1, 2011, 5:22 AM), http://www.bloomberg.com/news/articles/2011-07-01/france-vote-outlaws-fracking-shale-for-natural-gas-oil-extraction [https://perma.cc/ZCZ6-7BM5].

217. VT. STAT. ANN. tit. 29, § 571(a) (West 2016); *Vermont First State to Ban Fracking*, CNN (May 17, 2012, 4:35 PM), http://www.cnn.com/2012/05/17/us/vermont-fracking/ [https://perma.cc/AK9K-U7G8]. Because Vermont does not have any proven natural gas resources, however, the law has been compared to banning offshore drilling in Oklahoma. *A Fracking Fixation in Vermont*, OKLAHOMAN (May 19, 2012, 12:00 AM), http://newsok.com/article/3676611 [https://perma.cc/B9AB-ELQE].

218. Josh Hicks, *Md. Fracking Moratorium to Become Law without Hogan's Signature*, WASH. POST (May 29, 2015), https://www.washingtonpost.com/local/md-politics/md-fracking-moratorium-to-become-law-without-hogans-signature/2015/05/29/e1d10434-062c-11e5-a428-c984eb077d4e_story.html [https://perma.cc/PE6Z-HDRR] (The Maryland law is a two year moratorium on additional fracturing that expires in October 2017.).

219. Freeman Klopott, *N.Y. Officially Bans Fracking with Release of Seven-Year Study*, BLOOMBERG (June 29, 2015, 2:16 PM), http://www.bloomberg.com/news/articles/2015-06-29/n-y-officially-bans-fracking-with-release-of-seven-year-study [https://perma.cc/P8PR-2SB4].

considered only in areas where the specific geologic formations, along with other conditions, do not lend themselves to the safe practice of hydraulic fracturing. Because hydraulic fracturing is a necessity to the current and future economy,[220] solutions that increase innovation and the safety of the practice should be preferred over outright bans.

## IV. ANALYSIS OF OPTIONS AND PROPOSED SOLUTIONS

Proving negligence in Louisiana requires the plaintiff to demonstrate that the conduct in question was a cause in fact of the resulting harm, the defendant owed a duty to the plaintiff, the duty was breached, and the risk and harm caused were within the scope of the duty breached.[221] The evidentiary burden on the plaintiff to succeed in a negligence claim is nearly impossible to overcome in contamination cases,[222] with causation being the most difficult element to prove.[223] However, proving that the defendant was negligent and actually breached a duty is often just as difficult for plaintiffs in contamination cases involving hydraulic fracturing.

### *A. Burden on the Claimant*

In most cases, if contamination occurs, the fracturing fluid's migration through the subsurface formations to reach the groundwater would likely take years.[224] Any changes in mineral lease ownership during that time would further complicate the plaintiff's evidentiary requirements. Over several decades, the operator of a specific well or unit portion might change several times, and operators may begin fracturing operations on nearby lands as well, thus increasing the number of companies that might

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220. *See supra* Part I.

221. *See* Mart v. Hill, 505 So. 2d 1120, 1122 (La. 1987); Hill v. Lundin & Associates, Inc., 256 So. 2d 620, 622 (1972); *see also* Timothy J. McNamara, *The Duties and Risks of the Duty-Risk Analysis*, 44 LA. L. REV. 1227 (1984); David W. Robertson, *Reason Versus Rule in Louisiana Tort Law: Dialogues on* Hill v. Lundin & Associates, Inc., 34 LA. L. REV. 1, 2 (1973).

222. *See supra* Part II.A.

223. King, *supra* note 48, at 346; Anthony v. Chevron USA, Inc., 284 F.3d 578, 587–88 (5th Cir. 2002).

224. U.S. ENVTL. PROT. AGENCY, *supra* note 11, at 6-56–6-57. ("Given the surge in the number of modern high-pressure hydraulic fracturing operations dating from the early 2000s, evidence of any fracturing-related fluid migration affecting a drinking water resource (as well as the information necessary to connect specific well operation practices to a drinking water impact) could take years to discover.").

have caused the injury. Under a negligence theory, the plaintiff would have to prove which company caused the contamination by establishing a factual nexus between that company's operations and the contamination.[225] Consequently, the plaintiff might have to prove that other companies' operations did not cause the contamination.[226]

In states that permit claims based on ultra-hazardous activities and impose strict liability, some of the evidentiary burdens for ordinary negligence claims are lifted.[227] Negligence imposes liability on actors for harm that their failure to exercise reasonable care causes.[228] Under a strict-liability theory, the defendant is liable for harms that the activity in question causes.[229] The plaintiff does not bear the burden of proving that the defendant's actions were negligent or careless, which has proven difficult in contamination cases.[230] This burden might be replaced, however, with burdens requiring the plaintiff to prove that the activity itself satisfies the ultra-hazardous factors.[231] The primary inquiry established by the six-factor test[232] is

> whether the nature of the activity and the potential dangers associated with it, given the particular location, are so great that despite the usefulness it may have for the community, it should be required as a matter of law to pay for any harm it causes without the need of a finding of negligence.[233]

All factors should be considered, but no requirement that all factors be present exists.[234] Ordinarily, a finding that several factors are satisfied is required for a finding of strict liability.[235] The burden of establishing

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225. *Anthony*, 284 F.3d at 590.

226. *Id.* at 587.

227. *See* Alan O. Sykes, *Strict Liability versus Negligence in Indiana Harbor*, 74 U. CHI. L. REV. 1911, 1918–19 (2007).

228. *Id.* at 1918.

229. *Id.*

230. *Id.* at 1918–19.

231. RESTATEMENT (SECOND) OF TORTS § 520 (AM. LAW INST. 1977); *see* Perkins v. F.I.E. Corp., 762 F.2d 1250, 1255–56 (5th Cir. 1985) (listing the factors in Louisiana for determining whether an activity is ultra-hazardous prior to the 1996 amendment).

232. *See supra* Part II.A.2.

233. RESTATEMENT (SECOND) OF TORTS §520 cmt. f (AM. LAW INST. 1977); *see also* Nathan R. Hoffman, *The Feasibility of Applying Strict-Liability Principles to Carbon Capture and Storage*, 49 WASHBURN L.J. 527, 541–42, n.144 (2010).

234. RESTATEMENT (SECOND) OF TORTS §520 (AM. LAW INST. 1977).

235. *Id.* at cmt. f.

evidence that tips the balance of the factors in favor of a finding that hydraulic fracturing is an ultra-hazardous activity has proven arduous in recent decisions.[236] For example, in *Ely v. Cabot Oil & Gas Corp.*, the plaintiffs established that their water supply had been contaminated but were unable to provide substantial evidence to support their claim that hydraulic fracturing constituted an ultra-hazardous activity.[237] Additionally, they could not establish that the drilling company's operations caused the contamination.[238]

### *B. Lack of Evidence*

The overarching problem in the case law, public opinion, and regulations is a lack of evidence and information. Plaintiffs have been able to prove that their water supplies are contaminated on several occasions;[239] however, they have not been able to provide evidence proving that hydraulic fracturing caused the contamination.[240] Furthermore, permitting claims to be brought under an ultra-hazardous activity theory might further equitable relief in some cases, but generally these claims will still suffer from a lack of causation evidence.[241] The lack of evidence infiltrates the case law under the ultra-hazardous analysis in two ways. First, the plaintiff generally lacks the evidence to establish the factual link between the source of the hydraulic fluid and the contamination of the groundwater.[242] Second, this same lack of evidence in the aggregate weighs against a finding that hydraulic fracturing is ultra-hazardous—the factors will weigh against a finding of the activity being ultra-hazardous if the risk of the activity has not been sufficiently established.[243] The risk of hydraulic fracturing cannot be sufficiently established without the acquisition of data over many years, as the EPA study evidences.[244]

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236. *See* Ely v. Cabot Oil & Gas Corp., 38 F. Supp. 3d 518, 534 (M.D. Pa. 2014); Berish v. Sw. Energy Prod. Co., 763 F. Supp. 2d 702, 706 (M.D. Pa. 2011).

237. *Ely*, 38 F. Supp. at 523.

238. *Id.* (plaintiff offered expert witness testimony that the fluid contaminant likely migrated from the wells into the water supply).

239. Anthony v. Chevron USA, Inc., 284 F.3d 578, 581–82 (5th Cir. 2002); *Ely*, 38 F. Supp. 3d at 523.

240. *Anthony*, 284 F.3d at 586–87; *Ely*, 38 F. Supp. 3d at 523.

241. *See* King, *supra* note 48, at 344.

242. *See, e.g.*, *Anthony*, 284 F.3d at 590; *see also* King, *supra* note 48, at 346.

243. *Ely*, 38 F. Supp. 3d at 529 (citing Smith v. Weaver, 665 A.2d 1215, 1219 (Pa. Super. Ct. 1995) (noting that "whether an activity presents a high degree of risk should not focus on whether the Defendants acted negligently, but instead should remain focused on whether the activity itself is abnormally dangerous").

244. *See supra* Part III.A.

*C. Regulation*

The same lack of information has affected the implementation of federal regulations as well. In 2011, Congress proposed the Fracturing Responsibility and Awareness of Chemicals ("FRAC") Act.[245] The FRAC Act would amend the SDWA by repealing the fracking exemption, or "Halliburton Loophole," and requiring hydraulic fracturing operators to disclose the chemicals used in their fracturing fluid mixture.[246] In 2012, Congress introduced another piece of legislation entitled the "Fracturing Regulations are Effective in State Hands" ("FRESH") Act, which proposed that all regulatory authority over fracking should be left to the states.[247] However, neither piece of legislation was reported out-of-committee.[248] Congress either chose to continue its disregard for establishing some form of hydraulic fracturing legislation, or it was awaiting guidance from an EPA study on the potential effects of hydraulic fracturing on water resources.

The 2015 Draft Assessment of the EPA study[249] cited several instances in which fluid migration occurred and was caused by hydraulic injections, and it concluded that the evidence shows drinking water resources might have been impacted by hydraulic fracturing fluids escaping the wellbore and surrounding formations in certain areas.[250] The study confirmed that water contamination occurred through spills of hydraulic fracturing fluid, discharge of treated hydraulic fracturing wastewater, underground migration of fluids and gas, and direct injection.[251] The study found that occurrences of drinking water impacts are minimal relative to the number of hydraulically fractured wells.[252] This result might imply that drinking water impacts by fracking operations are rare or that the results might be understated because of "insufficient pre- and post-hydraulic fracturing data on the quality of drinking water resources."[253] Presumably, the EPA's

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245. Fracturing Responsibility and Awareness of Chemicals (FRAC) Act, H.R. 1084, 112th Cong. (2011).

246. Rebecca Jo Reser & David T. Ritter, *State and Federal Legislation and Regulation of Hydraulic Fracturing*, 57 ADVOCATE 31, 33 (2011).

247. Fracturing Regulations Are Effective in State Hands (FRESH) Act, S. 2248, 112th Cong. (2012).

248. CARL E. BEHRENS, CONG. RESEARCH SERV., R42756, ENERGY POLICY: 112TH CONGRESS ISSUES AND LEGISLATIVE PROPOSALS 9 (2012).

249. *See supra* Part III.A.

250. U.S. ENVTL. PROT. AGENCY, *supra* note 11, at 6-57.

251. *Id.* at 10-19–10-20.

252. *Id.* at 10-20.

253. *Id.*

study will not aid Congress in a determination of how to proceed with regulations, and Congress will continue to leave regulation up to the states.[254] The study's findings on the effects of hydraulic fracturing remain inconclusive because of the same lack of information impacting potential plaintiffs.

## V. A STRATEGY TO ADDRESS CONTAMINATION CONCERNS

Although the detrimental effects of hydraulic fracturing remain unclear, the process is beneficial in a number of ways.[255] With this in mind, any proposed strategy should not act as a roadblock to the shale boom, but rather should facilitate its continuance while incentivizing innovation, information gathering, and operating under best practices. Baseline water testing and chemical disclosures are both regulations that will further the knowledge of the industry's practices while furthering the industry itself. Innovation and advancing technology require a substantial data set as a prerequisite. Thus, all regulations applied to the industry should further the acquisition of data. However, hydraulic fracturing provides a difficult set of circumstances to determine whether *ex post* or *ex ante* schemes would be more beneficial, given the lack of conclusive findings.

### *A. Ex Post Regulation*

Tort liability is an *ex post* regulatory strategy because it imposes monetary sanctions on parties causing injury after the injury occurred and the cause has been determined.[256] The policy benefits of imposing liability on hydraulic fracturing operations are two-fold. First, the companies are incentivized to reduce harm by implementing new innovations, high safety standards, and self-regulation.[257] Second, parties who suffer harm will be compensated if they can establish the required elements.[258] This form of regulation is beneficial when the activity being regulated is not very well understood or is very complex, thus rendering the drafting of an all-encompassing set of regulations impractical. However, *ex post* liability does not always grant equitable relief in hydraulic fracturing cases.[259] Additionally, tort liability as a regulatory strategy might make operators' predictions of costs in their risk analysis difficult because of the uncertainty

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254. *See supra* Part III.A.
255. *See supra* Part I.C.
256. Merrill & Schizer, *supra* note 160, at 212.
257. *Id.* at 209.
258. *Id.*
259. *See supra* Part II.A.

involved with jury decisions, which often leads to inefficiencies associated with under- or over-deterrence.[260] When one regulatory strategy cannot fulfill its goals, a blended strategy of tort liability and best-practice regulation might be beneficial.[261]

### *B. Ex Ante Regulation*

*Ex ante* regulation attempts to reduce the risk of harm before its occurrence through several methods, including establishing best-practice standards.[262] Best-practice regulations encourage industries to develop standard practices that provide a safe, efficient, and economical method of operation.[263] When these regulations are enforced efficiently, industries benefit by having predictable regulatory costs and standards to follow, as opposed to unpredictable settlement costs and jury awards.[264] Additionally, applying a regulatory standard provides reassurance to the public, which may prove beneficial to the hydraulic fracturing industry given the bitter debate, much of which may be attributed to the lack of regulation.[265] Implementing standard methods in the industry will also further the information assimilation and understanding of hydraulic fracturing.

When industries perform similar tasks in a similar fashion, it facilitates the gathering of data in a more expedient and reliable way. When the number of variables is reduced and the amount of data is increased, the study of fracking will produce more conclusive results, thus culminating in answers to important unanswered questions. Hydraulic fracturing has provided tremendous beneficial impacts to Louisiana with a negligible amount of currently known harm.[266] Any regulations implemented should take this factor into account to prevent overregulation or stifling of the

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260. Merrill & Schizer, *supra* note 160, at 209.

261. *Id.* at 216 (recommending a blended regulation strategy comprising both "command and control regulation" for issues that are well understood and liability for the other issues).

262. *Id.* at 221; Gerken, *supra* note 109, at 99.

263. Merrill & Schizer, *supra* note 160, at 222–23.

264. *Id.* at 207 (citing *cf.* Khalid A Rahim, *Why Pollution Standards Are Preferred by Industries: Pragmatism and Rent-Seeking Behavior*, 16 ENVIRONMENTALIST 49, 52–53 (1996)).

265. *See* Samantha-Rae Tuthill, *Understanding Fracking: Arguments for and Against Natural Gas Extraction*, ACCUWEATHER (Sept. 9, 2013, 8:31 AM), http://www.accuweather.com/en/weather-news/fracking-environmental-health/17444221 [https://perma.cc/X8B4-X45E].

266. *See supra* Part I.C. *But see supra* Part I.B.

industry.[267] The regulations should advance the industry while incentivizing the assimilation of information and innovation.

*1. Baseline Testing*

Currently, Louisiana does not require fracking operators to perform water testing before commencing operations. Incorporating a baseline water-testing requirement into Louisiana's regulatory strategy is imperative to the long-term betterment of the hydraulic fracturing industry. Baseline water testing provides a benchmark for the water composition before commencing drilling operations.[268] Once fracking has begun, or ceased, and contamination has been alleged, the water can be retested to determine any changes in the water's composition. If contaminants are found in the second sample that were not present in the first and the contaminant is an oil- and gas-production-related chemical, an allegation of contamination would likely be supported. The baseline water testing data would benefit the landowner by supplementing his or her case with evidence of causation that is typically lacking.[269] By contrast, if the second water test revealed that the contaminant was not a chemical related to the hydraulic fracturing process or that the water had not been contaminated, the operator would be able to use this evidence to prove that its operations did not contaminate the water. If a presumption of liability were enforced in these cases, the operator would have to prove that his operations did not cause the contamination or that a third party's operations did. In either case, the plaintiff would likely obtain an equitable remedy, as long as the contamination occurred within the required radius and time frame.

Members of the hydraulic fracturing production community often claim that hydraulic fracturing has never been proven to be the cause of groundwater contamination.[270] Baseline testing gives the industry an opportunity to prove how small the risk of contamination is while accumulating data that may facilitate innovation. Additionally, numerous

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267. Merrill & Schizer, *supra* note 160, at 203–04.

268. *See* Hall, *supra* note 186, at 870.

269. *See* King, *supra* note 48, at 344.

270. AM. PETROLEUM INST., *supra* note 12, at 7 ("There have been no confirmed cases of groundwater contamination from hydraulic fracturing itself in 1 million wells fracked over the past 60 years."); *but see* U.S. ENVTL. PROT. AGENCY, *supra* note 11, at 20 ("Below ground movement of fluids, including gas, most likely via the production well, have contaminated drinking water resources. In some cases, hydraulic fracturing fluids have also been directly injected into drinking water resources, as defined in this assessment, to produce oil or gas that co-exists in those formations.").

studies seeking to determine the effects of hydraulic fracturing on groundwater have found contaminants, such as methane, in drinking water wells from natural occurrences.[271] Having baseline water data gives operators the data necessary to prove that they are not the source of contamination to not only plaintiffs, but also to the public in general.

The cost of sampling and testing is a deterrent for requiring operators to perform baseline testing. The states with these requirements in place have attempted to reduce the cost burden by limiting the number of water sources that an operator would have to sample and permitting the use of sampling done for nearby wells, that is, if they were performed in the time frame permitted.[272] In Wyoming, the average cost of sampling is between $680 and $1,090 per sample—testing the four wells the law requires, including the initial sampling and analyses, would cost approximately $5,800, if isotopic testing of the methane is not required.[273] If the sampling is done both before and after fracturing, the total cost would be an estimated $11,600.[274] In comparison, the average cost of drilling and completing a well in the popular Haynesville Shale formation located in Louisiana is $9.95 million.[275] At first glance, baseline testing might seem expensive, but when considered as a relative cost of drilling and completing a well in Louisiana, the cost would be just over 0.1% of the total cost of drilling and completing a well. This cost is entirely reasonable considering the benefits provided.

At the federal level, the Department of the Interior recently removed the requirement that operators perform baseline water testing from its proposed

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271. Hall, *supra* note 186, at 888 n.141 (citing ELIZABETH W. BOYER ET AL., CTR. FOR RURAL PA., THE IMPACT OF MARCELLUS GAS DRILLING ON RURAL DRINKING WATER SUPPLIES 4 (2012) (finding that pre-drilling samples from about 20% of the sites contained methane); Stephen G. Osborn et al., *Methane Contamination of Drinking Water Accompanying Gas-Well Drilling and Hydraulic Fracturing*, 108 PROC. NAT'L ACAD. SCI. 8172, 8173 (2011) (finding that a large portion of the drinking water wells tested for the study contained methane regardless of industry operations).

272. 055-003 WYO. CODE R. § 46(e) (LexisNexis 2016).

273. Hall, *supra* note 186, at 875.

274. This total estimated cost of $11,600 is calculated by simply doubling $5,800, the cost of pre-operation testing, to account for both pre- and post-operation testing. Hall does not derive the total cost, but mentions that post-operation testing may be cheaper because post-operation costs would not include the costs associated with identifying which wells to test. *See id*.

275. Mark Kaiser & Yunke Yu, *North Louisiana Drilling Costs Vary Slightly 2007-12*, OIL & GAS J., Jan. 2014, at 1, http://www.ogj.com/articles/print/volume-112/issue-1/exploration-development/north-louisiana-drilling-costs-vary-slightly-2007-12.html [https://perma.cc/HCW5-H4A3].

rules governing hydraulic fracturing on federal lands.[276] The Bureau of Land Management ("BLM") agrees with the commentators—acquiring baseline water data is a good policy, a best practice, and is beneficial to all parties.[277] Although BLM encourages baseline testing, it will not require the testing on a national level for two reasons. First, the hydrogeological conditions vary significantly across the nation, and establishing a single comprehensive rule to cover all such conditions would be difficult.[278] Second, in many instances, BLM does not manage the surface above the leased minerals.[279] However, BLM recommends that if water quality impacts are anticipated, baseline testing may be implemented with requirements developed on a case-by-case basis.[280] Thus the federal government has again left the requirement of best practices to local authorities, who are better informed of the states' specific conditions and variables.

Louisiana should require baseline testing as a preventative measure to increase the likelihood of early detection and promote innovation, while simultaneously protecting its landowners and resources. The state has regretted taking a lackadaisical approach to hazardous material regulation in the past[281] and will find itself in a similar situation if preventative actions are not taken.

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276. Oil and Gas; Hydraulic Fracturing on Federal and Indian Lands, 80 Fed. Reg. 16,183 (Mar. 26, 2015) (to be codified at 43 C.F.R. pt. 3160).

277. *Id.*

278. *Id.*

279. *Id.*

280. *Id.*

281. LA. REV. STAT. §30:2193(A) (2016) provides,

> It is the determination of the legislature that Louisiana is particularly ill-suited both hydrologically and climatically to hazardous waste land disposal methods and past land disposal methods, siting criteria, and maintenance procedures have, despite the degree of stringency, been inadequate to insure the health of the citizens of the state and in maintaining the integrity of the environment generally and water resources specifically. It is further determined that eventual releases of hazardous constituents from land disposal facilities are highly probable if land disposal methods continue to be relied upon and that there presently exists alternatives which may be used to destroy, reduce, or lessen the toxicity of or lessen the leaching potential of hazardous wastes. In order to preclude further environmental damage and endangerment to the citizens of the state, it is the purpose of this Section to provide for restrictions and incentives designed to encourage alternative methods of hazardous waste disposal, destruction, and reduction; to lessen the possibility of hazardous waste releases from existing land disposal sites; and to provide for the eventual prohibition of land disposal of hazardous waste.

If baseline water testing is required and over time the data proves that contamination is not occurring as a result of hydraulic fracturing, Louisiana will benefit by removing the burden of enforcing the unnecessary regulation of a safe industry. Conversely, if the data shows that groundwater contamination is occurring, early detection will allow Louisiana to determine the additional regulatory or statutory restrictions required to protect its underground water supply. If Louisiana is constantly acquiring data, evidence of a systemic problem will be known years in advance compared to the timeline of Louisiana beginning data acquisition as problems arise. Additionally, the data might evidence that certain formations or regions are more susceptible to drinking water impacts by hydraulic fracturing. If that happens, the state may apply more rigid regulations in those locations to combat the increased risk of contamination.

*2. Best Practices*

Over time, as a comprehensive data set is established, best-practices regulations should be enacted for those aspects of hydraulic fracturing operations that become well-understood with established methods. For areas that remain dubious or are lacking in data, Louisiana should establish required testing, similar to baseline water testing, by in-state operators to gather the data. If the proposed measures are in place and injury occurs, the injured parties must seek equitable relief through liability claims. The injured parties will be in a better position because they will have the baseline water data, which will provide the means to prove causation. As the number of fracking operations continues to increase, the amount of data regarding its effects will also increase, and the industry will become standardized. This data will further the understanding of the effects of fracking while providing operators and injured parties the data necessary either to prove or disprove the element of causation.[282]

Data accumulated over a number of years could show helpful trends in the locations and level of any contamination. These trends can then be evaluated to determine which methods and materials are more prone to causing injury and in what geologic formations the injury is most likely to occur. This information will allow the industry to adjust its operations accordingly to avoid litigation based on methods and conditions found to be more at risk for contamination. State regulators may also evaluate the data to determine whether further regulation is required in certain areas or for certain operations, or whether imposed regulations are unnecessary and should be removed. As the information develops, certain practices will be found to be

282. Merrill & Schizer, *supra* note 160, at 158.

the safest and most effective. These practices should become the best-practices standard. The best-practice standards should provide methods an operator can follow that are proven safe and effective and require minimum regulation.

For an evolving and growing industry such as hydraulic fracturing production, regulations should promote research and development of the industry while protecting Louisiana's finite resources. Hydraulic fracturing has provided significant benefits with minimal known injuries; therefore, Louisiana's movement toward practical and efficient steps to protect the industry is important.

## CONCLUSION

Louisiana is in the midst of a manufacturing renaissance[283] that is pumping billions of dollars into its economy,[284] the essence of which is hydraulically fractured natural gas. As the growth of the industry continues, hydraulic fracturing will be performed on an expanding scale with an increasing number of operators. Louisiana must take steps to promote safe hydraulic fracturing and data acquisition while the long-term effects of hydraulic fracturing are determined. Initially, the state should impose required baseline water testing prior to any hydraulic fracturing activity. If Louisiana waits until widespread contamination occurs it will be too late, because the time frame for contamination may be decades. As the industry becomes better understood, the state may choose to increase or reduce regulations accordingly. Ideally, the data will prove that contamination is rare. However, until conclusive determinations can be made on the long-term effects of widespread hydraulic fracturing use, Louisiana must require operators to acquire the data necessary to protect landowners, natural resources, and the industry itself.

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283. DAVID DISMUKES, CTR. FOR ENERGY STUDIES, LA. STATE UNIV., UNCONVENTIONAL RESOURCES AND LOUISIANA'S MANUFACTURING DEVELOPMENT RENAISSANCE (2013), http://loga.la/pdf/DismukesStudy.pdf [https://perma.cc/4NH6-WLFE].

284. SCOTT & RICHARDSON, *supra* note 26, at 10.

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