FACTUAL CAUSATION: THE MISSING LINK IN HYDRAULIC FRACTURE—GROUNDWATER CONTAMINATION LITIGATION

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INTRODUCTION

Given the heated debate currently surrounding hydraulic fracturing, one might never guess that oil and gas developers have safely used the technique since before The Beatles' first American tour in 1964.[1] Approximately one million oil or gas wells have been fracture stimulated by injecting fluids into rock formations, cracking them to produce oil and gas.[2] The perception that hydraulic fracturing may contaminate groundwater has caused widespread public concern and, in some cases, opposition to hydraulic fracturing. Although various studies fail to confirm a connection between fracture stimulation and groundwater contamination,[3] many environmentalists, policymakers, and citizens remain skeptical. We emphasize, however, there is no conspiracy between the oil and gas industry and government regulators to create a false impression that hydraulic fracture stimulation is safe. Rather, scientific studies and basic geology prove that hydraulic fracturing is a safe and effective way to recover oil and gas from shale formations.

This article addresses the failure of plaintiffs to establish a causal connection between hydraulic fracturing and groundwater contamination in lawsuits against drilling companies. This article suggests that the failure to establish causation can be attributed to the

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1. Alfred R. Jennings, *Fracturing Fluids—Then and Now*, 48 PETROLEUM TECH. 604, 604–10 (1996) (noting the introduction of hydraulic fracturing for well stimulation in 1948).

2. ENERGY INST., THE UNIV. OF TEX. AT AUSTIN, FACT-BASED REGULATION FOR ENVIRONMENTAL PROTECTION IN SHALE GAS DEVELOPMENT 7 (2012) [hereinafter FACT-BASED REGULATION], *available at* http://energy.utexas.edu/index.php?option=com_content&view=article&id=151&Itemid=160.

3. *See infra* Part III.

geologic and scientific unlikelihood that hydraulic fracturing contaminates groundwater. Part I of this article provides a brief overview of the hydraulic fracturing process. Part II discusses private landowner lawsuits filed in various jurisdictions against drilling companies and describes how these claims have been largely unsuccessful due in part to plaintiffs' inability to successfully prove causation. Part III discusses various scientific studies of hydraulic fracturing indicating that, to date, there is no conclusive evidence that hydraulic fracturing contaminates groundwater. Finally, part IV briefly touches upon the disclosure regulations recently enacted by certain states concerning fracturing fluids. At the outset, a reader should note:

i. Oil and gas wells in the United States have been fracture stimulated for the last sixty years (long before shale production).[4]
ii. All fracture stimulations have used some form of chemical injection, from early "flush" production using free gas, to gelatin fluid in the 1980s, to the water-sand-chemical-based mixture of today.[5]
iii. There are no confirmed cases of groundwater contamination caused by hydraulic fracture stimulation.

I. WHAT IS HYDRAULIC FRACTURE STIMULATION?

Hydraulic fracture stimulation (known colloquially as "fracking") has been used to stimulate the production of oil and gas for more than sixty years.[6] The process of hydraulic fracturing involves pumping fluid into a rock formation under sufficient pressure to create fractures, or splits, in the rock matrix.[7] These

4. PHILIPPE A. CHARLEZ, ROCK MECHANICS: PETROLEUM APPLICATIONS 239 (1997) (noting the first hydraulic fracturing job was completed in 1947).

5. *See, e.g.*, GEORGE E. KING, HYDRAULIC FRACTURING 101: WHAT EVERY REPRESENTATIVE, ENVIRONMENTALIST, REGULATOR, REPORTER, INVESTOR, UNIVERSITY RESEARCHER, NEIGHBOR AND ENGINEER SHOULD KNOW ABOUT ESTIMATING FRAC RISK AND IMPROVING FRAC PERFORMANCE IN UNCONVENTIONAL GAS AND OIL WELLS, SPE 152,596, 7–9 (2012), *available at* http://www.kgs.ku.edu/PRS/Fracturing/Frac_Paper_SPE_152596.pdf (discussing common components of fracturing fluids, including water, sand, and various chemicals).

6. AM. PETROLEUM INST., HYDRAULIC FRACTURING: UNLOCKING AMERICA'S NATURAL GAS RESOURCES (2010) [hereinafter API, UNLOCKING AMERICA'S NATURAL GAS RESOURCES], *available at* http://www.api.org/policy/exploration/hydraulicfracturing/upload/HYDRAULIC_FRACTURING_PRIMER.pdf.

7. *Id.*

fractures are approximately one-tenth of an inch in diameter and diminish in size as they spread horizontally from the wellbore. In order to keep the earth's weight and other subsurface pressures from closing the fractures, tiny sand granules, called proppant, are pumped into the wellbore and wedged into the cracks.[8] Today, the fluid mixture used for the hydraulic fracturing process is approximately 98 to 99.5% water and sand.[9] The rest of the mixture is a set of special purpose additives that includes a number of compounds and chemicals found in common consumer products, such as swimming pool chemicals, hair colorings, low-sodium table salt substitutes, and cosmetics.[10] The additives are necessary to deliver the water and sand together into the rock fractures, while simultaneously allowing the water to be removed and the sand to remain, thus "propping" open the fractures. In other words, once the fluid is withdrawn, the fractures are held open by the sand-based proppant.[11] Technicians carefully monitor injection pressure, volume, and rate throughout the fracturing operation to ensure that the process meets design parameters.[12]

Hydraulic fracture stimulation creates new pathways allowing oil and gas to flow more freely through the fractures to the wellbore,[13] exponentially increasing oil and gas flow to the well.[14] Without hydraulic fracture stimulation, oil and gas production from shale

8. AM. PETROLEUM INST., HYDRAULIC FRACTURING OPERATIONS—WELL CONSTRUCTION AND INTEGRITY GUIDELINES: API GUIDANCE DOCUMENT HF1 15 (2009) [hereinafter API GUIDANCE DOCUMENT HF1], *available at* http://www.api.org/policy/exploration/hydraulicfracturing/upload/API_HF1.pdf.

9. API, UNLOCKING AMERICA'S NATURAL GAS RESOURCES, *supra* note 6.

10. *See, e.g.*, *Fracturing Ingredients*, HYDRAULIC FRACTURING FACTS, http://www.hydraulicfracturing.com/Fracturing-Ingredients/Pages/information.aspx (last visited Apr. 3, 2012). Some of the compounds, which comprise a small percentage of the total mixture, can be toxic. *See generally* MINORITY STAFF OF H. COMM. ON ENERGY AND COMMERCE, 112TH CONG., CHEMICALS USED IN HYDRAULIC FRACTURING (2011), *available at* http://democrats.energycommerce.house.gov/sites/default/files/documents/Hydraulic%20Fracturing%20Report%204.18.11.pdf.

11. AM. PETROLEUM INST., HYDRAULIC FRACTURING AT A GLANCE (2008) [hereinafter API, AT A GLANCE], *available at* http://www.api.org/policy/exploration/upload/Hydraulic_Fracturing_at_a_Glance.pdf.

12. API GUIDANCE DOCUMENT HF1, *supra* note 8, at 18–22.

13. AM. PETROLEUM INST., PRACTICES FOR MITIGATING SURFACE IMPACTS ASSOCIATED WITH HYDRAULIC FRACTURING: API GUIDANCE DOCUMENT HF3 4–5 (2011) [hereinafter API GUIDANCE DOCUMENT HF3], *available at* http://www.api.org/policy/exploration/hydraulicfracturing/upload/HF3_e7.pdf; *see also* API, AT A GLANCE, *supra* note 11.

14. API, UNLOCKING AMERICA'S NATURAL GAS RESOURCES, *supra* note 6.

formations is not economically feasible because of the high density and low permeability of shale.[15]

Environmentalists, the media, and some landowners assert that hydraulic fracturing can contaminate groundwater in areas where oil and gas production from shale formations occurs. To date, their allegations have been successfully rebutted.

II. PRIVATE LANDOWNER LITIGATION

Despite the history of safe use of fracture stimulation, the geologic unlikelihood of contamination, and the general lack of contamination evidence,[16] some private landowners have filed lawsuits alleging groundwater contamination as a result of fracture stimulation in shale formations.[17] Many of the cases filed in Texas have been concluded, while those in other states are currently in the pre-trial stages of litigation.[18] To date, not one landowner's claim has succeeded, and at least two cases were voluntarily dismissed when the plaintiffs realized they could not produce any evidence of causation.[19] This section will address the required factual proof a plaintiff must present to show causation, the outcomes of some recent cases asserting that hydraulic fracturing contaminated groundwater, and the procedure being followed by at least one court to ensure plaintiffs provide sufficient evidence of causation in claims alleging groundwater contamination by fracture stimulation.

The cases that have been filed are in different jurisdictions, yet they each assert similar causes of action. The cases typically allege

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15. API GUIDANCE DOCUMENT HF3, *supra* note 13, at 4–5.

16. *See infra* Part III.

17. *See, e.g.*, Harris v. Devon Energy Prod. Co., No. 4:10-CV-00708-MHS-ALM (E.D. Tex. dismissed Jan. 25, 2012); Scoma v. Chesapeake Energy Corp., No. 3:10-CV-01385-N (N.D. Tex. dismissed Dec. 9, 2011); Mitchell v. Encana Oil & Gas (USA), Inc., No. 3:10-CV-02555-N (N.D. Tex. dismissed Nov. 14, 2011); Armstrong v. Chesapeake Appalachia, L.L.C., No.10-CV-2453 (M.D. Pa. July 29, 2011) (order granting motion to remand); Smith v. Devon Energy Prod. Co., No. 4:11-CV-00104 (E.D. Tex. filed Mar. 7, 2011); Berish v. Sw. Energy Prod. Co., 763 F. Supp. 2d 702 (M.D. Pa. 2011) (order granting motion to dismiss granted in part and denied in part); Fiorentino v. Cabot Oil & Gas Corp., No. 3:09-CV-02284 (M.D. Pa. filed Nov. 19, 2009); Strudley v. Antero Res. Corp., No. 2011-CV-2218 (Dist. Ct. Colo. filed March 24, 2011); Zimmermann v. Atlas Am., L.L.C., No. 2009-7564 (Pa. Ct. Com. Pl. filed Aug. 23, 2010); Lipsky v. Range Prod. Co., No. CV11-0798 (Dist. Ct. Tex. filed June 20, 2011); Heinkel-Wolfe v. Williams Prod. Co., No. 2010-40355-362 (Dist. Ct. Tex. filed Nov. 3, 2010); Sizelove v. Williams Prod. Co., No. 2010-50355-367 (Dist. Ct. Tex. filed Nov. 3, 2010); Knoll v. Gulftex Operating, Inc., No. 2010-10345-16 (Dist. Ct. Tex. filed Oct. 22, 2010).

18. *Id.*

19. *See, e.g.*, *Harris*, No. 4:10-CV-00708-MHS-ALM; *Smith*, No. 4:11-CV-00104.

(i) trespass, (ii) negligence, (iii) nuisance, and (iv) strict liability for ultra-hazardous activities.[20] Causation is an essential element of each of these theories of liability.[21] Therefore, a landowner claiming contamination due to fracture stimulation must provide sufficient causation evidence to survive a motion for directed verdict. *Anthony v. Chevron U.S.A., Inc.* demonstrates the type of evidence that must be presented to satisfy the causation requirement and provides an example of a plaintiff's failed attempt to present such evidence.[22]

In *Anthony*, the plaintiffs asserted that Chevron contaminated their water well with chlorides when it injected saltwater into an oil bearing formation approximately 3000 feet below the ground.[23] The plaintiffs claimed that Chevron fracture stimulated two oil wells with a saltwater and sand mixture in order to create more permeable pathways for the oil trapped in the surrounding rock strata to flow towards Chevron's wells.[24] The plaintiffs presented evidence that the resulting fractures from Chevron's operations extended out of the oil-bearing zone and upward 166 feet towards the aquifer into which the plaintiffs had drilled their water well.[25] The plaintiffs' expert theorized that these out-of-zone fractures continued up to the aquifer (almost 1300 feet) due to Chevron's continued high-pressure saltwater injections over time.[26]

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20. *See supra* note 17. Texas has expressly rejected the theory of strict liability for ultra-hazardous activities for injuries related to oil and gas operations. Turner v. Big Lake Oil Co., 96 S.W.2d 221, 221–22 (Tex. 1936). Consequently, that claim was dismissed in *Harris*, No. 4:10-CV-00708-MHS-ALM (E.D. Tex. dismissed Jan. 25, 2012), in response to a motion filed under Fed. R. Civ. P. 12(b)(6).

21. *See* Randall Noe Chrysler Dodge, L.L.P. v. Oakley Tire Co., 308 S.W.3d 542, 548–49 (Tex. App. 2010) (noting that causation is an essential element of trespass); Valley Forge Gardens, Inc. v. James D. Morrissey, Inc., 123 A.2d 888, 891 (Pa. 1956) (same); IHS Cedars Treatment Ctr. of Desoto, Texas, Inc. v. Mason, 143 S.W.3d 794, 798 (Tex. 2004) (noting that causation is an essential element of negligence); Cooper v. Frankford Health Care Sys., Inc., 960 A.2d 134, 140 n.2 (Pa. Super. 2008), appeal denied, 970 A.2d 431 (Pa. 2009) (same); Ehler v. LVDVD, L.C., 319 S.W.3d 817, 823 (Tex. Ct. App. 2010) (noting that causation is an essential element of nuisance); O'Neal v. Dep't of Army, 852 F. Supp. 327, 337 (M.D. Pa. 1994) (quoting Smith v. Alderson, 396 A.2d 808, 810 (1979)) (same). It should be noted that gas well drilling has not been found to be an ultra-hazardous activity in Pennsylvania as of the date of this article. Two courts have, however, deferred ruling on the issue until more facts can be presented. *Berish*, 763 F. Supp. 2d at 706; Fiorentino v. Cabot Oil & Gas Corp., 750 F. Supp. 2d 506, 512 (M.D. Pa. 2010).

22. 284 F.3d 578 (5th Cir. 2002).

23. *Id*. at 581–82.

24. *Id*. at 586.

25. *Id*.

26. *Id*.

In finding that the plaintiffs' expert did not present any evidence that Chevron's hydraulic fracture stimulation caused the contamination of the plaintiffs' water well, the Fifth Circuit held that an expert must present evidence of a factual link between the fracture and the freshwater zone.[27] The only factual evidence presented was that the fracture went out of the oil-bearing zone by 166 feet.[28] The plaintiffs' expert only provided a theory as to how the fracture *could have* spanned the remaining distance of approximately 1300 feet into the aquifer.[29] A theory, while plausible, is not evidence of causation if it has no factual support.[30] A factual nexus must be established.[31]

The evidence presented in the *Anthony* case is illustrative of the speculative cases landowners file against oil and gas producers. Like *Anthony*, in typical shale gas well cases, the landowners claim that gas wells must have caused the contamination of their water wells simply because the gas wells are located nearby. In making these allegations, the plaintiffs fail to make the necessary factual nexus between the hydraulic fracturing activity and the purported contamination. As shown in *Anthony*, the failure to do so is fatal to a landowner's claim.[32]

The lack of factual support for the theory that fracture stimulation can cause groundwater contamination is further demonstrated in some of the Texas cases filed in the Barnett Shale area.[33] As of the date of this article, all of these cases have either been dismissed, or the plaintiffs have jettisoned their allegations of contamination.[34] A review of two of these cases illustrates the point.

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27. *Id*. at 586–87.

28. *Id*.

29. *Id*.

30. *See id*. at 587 (stating that, "this alone, however, is not enough to present a question of fact to the jury").

31. *See id*.

32. *Id*.

33. *See* Lipsky v. Range Prod. Co., No. CV11-0798 (Dist. Ct. Tex. filed Feb. 16, 2012) (order denying plaintiffs' motion to dismiss counter claims); Scoma v. Chesapeake Energy Corp., No. 3:10-cv-01385-N (N.D. Tex. filed Aug. 11, 2010); Mitchell v. Encana Oil & Gas (USA), Inc., No. 3:10-cv-02555-N (N.D. Tex. filed Dec. 15, 2010); Harris v. Devon Energy Prod. Co., No. 4:10-cv-00708-MHS-ALM (E.D. Tex. filed April 8, 2011); Smith v. Devon Energy Prod. Co., No. 4:11-cv-00104-RAS–DDB (E.D. Tex. filed March 21, 2011); Heinkel-Wolfe v. Williams Prod. Co., L.L.C., No. 2010-40355-362 (Dist. Ct.. Tex. filed Feb. 13, 2012); Sizelove v. Williams Prod. Co., L.L.C., No. 2010-50355-367 (Dist. Ct. Tex. filed July 7, 2011); Knoll v. XTO Energy, Inc., No. 2010-10345-16 (Dist. Ct. Tex. filed June 27, 2011).

34. *Lipsky*, No. CV11-0798 (fracture stimulation claim jettisoned and remaining allegations dismissed); *Scoma*, No. 3:10-cv-01385-N (dismissed pursuant to nuisance settlement); *Mitchell*, No. 3:10-cv-02555-N (dismissed pursuant to nuisance settlement); *Harris*, No. 4:10-cv-

In *Harris v. Devon Energy Production Co.*, the plaintiffs alleged that their water well was contaminated by the hydraulic fracturing activities of Devon Energy Production Company.[35] After discovery, Devon filed a motion for summary judgment claiming that the plaintiffs had no evidence that the defendant's hydraulic fracturing operations caused the plaintiffs' water well to become contaminated.[36] When confronted with this motion, the plaintiffs voluntarily dismissed their lawsuit without prejudice, conceding that they could not provide any causation evidence.[37] The concession by the plaintiffs was significant because the filing of the lawsuit was reported in such periodicals as the *Wall Street Journal*[38] and was part of a news story that appeared on local television.[39] The media coverage surrounding the filing of the *Harris* case and the resulting dismissal was not unique.

The case of *Lipsky v. Range Resources*[40] also attracted national attention[41] and demonstrates the calamity that can result from asserting factually unsupported theories in a legal claim. The filing of the *Lipsky* case was preceded by an order from the U.S. Environmental Protection Agency (EPA) in which the EPA stated that Range Resources had "caused or contributed" to the contamination of the plaintiff's water well.[42] As support for its claim,

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00708-MHS-ALM (plaintiff voluntarily dismissed); *Smith*, No. 4:11-cv-00104-RAS–DDB (plaintiff voluntarily dismissed); *Heinkel-Wolfe*, No. 2010-40355-362, (fracture stimulation allegation jettisoned); *Sizelove*, No. 2010-50355-367 (fracture stimulation allegation jettisoned); *Knoll*, No. 2010-10345-16 (fracture stimulation allegation jettisoned).

35. *Harris*, No. 4:10-cv-00708-MHS-ALM.

36. *Id*. at Doc. Entry 55, filed Nov. 22, 2011.

37. *Id*. at Doc. Entry 59, p.2, filed Dec. 14, 2011.

38. Ana Campoy & Daniel Gilbert, *Battle Over Gas-Tainted Well Water*, WALL ST. J. (Dec. 17, 2010), http://online.wsj.com/article/SB10001424052748704098304576021852120669280.html.

39. Jay Gormley, *North Texas Residents Claim Gas Drilling Contaminated Water*, CBS 11 NEWS (Dec. 15, 2010, 9:27 PM), http://dfw.cbslocal.com/2010/12/15/north-texas-residents-lawsuits-claim-gas-drilling-contaminated-water.

40. No. CV11-0798 (Dist. Ct. Tex. filed Feb. 16, 2012).

41. Mike Soraghan, *EPA Action on Texas Natural Gas Driller Escalated Fight Over State Regulation*, N.Y. TIMES (Dec. 8, 2010), http://www.nytimes.com/gwire/2010/12/08/08greenwire-epa-action-on-texas-natural-gas-driller-escala-55869.html; Ryan Dezember & Angel Gonzalez, *EPA Says Range Resources Contaminated Texas Wells*, WALL ST. J. (Dec. 7, 2010), http://online.wsj.com/article/SB10001424052748703921204576006143738482306.html.

42. *Range Resources Imminent and Substantial Endangerment Order, Parker County, TX*, U.S. Envtl. Prot. Agency (EPA), http://www.epa.gov/region6/region-6/tx/tx005.html (last visited Apr. 5, 2012); MARIO LOYOLA, TEX. PUB. POL'Y FOUND., THE CASE OF RANGE RESOURCES (2011), *available at* http://www.texaspolicy.com/pdf/2011-09-PP15-TheCaseofRangeResources-CTAS-MarioLoyola.pdf.

the EPA's order cited Range Resources' hydraulic fracturing operations as an activity that preceded the discovery of gas in the Lipskys' water.[43] Although the EPA later admitted that contamination via fracking could not have occurred, it continued to assert that Range Resources contaminated the water well.[44]

The matter went before the Texas Railroad Commission, which has state oversight for oil and gas operations in the state of Texas.[45] After an evidentiary hearing in which Range Resources had the burden of proving that it did not cause the contamination, the Railroad Commission ruled that there was no evidence that Range Resources' conduct contaminated the Lipskys' water well.[46] Additionally, the EPA enforcement chief who signed the order stating that Range Resources' actions "caused or contributed" to the contamination later admitted under oath only that Range Resources "may have" caused the contamination.[47] Despite the Railroad Commission's findings and the EPA enforcement officer's backtracking from "caused" to "may have" caused, the EPA continued to seek enforcement of the order it issued against Range Resources for an additional fifteen months.[48] Finally, years after launching this mess with a factually baseless order, the EPA dropped its claims against Range Resources in March 2012.[49]

As for the Lipsky family, rather than accept the findings of the Railroad Commission, and without appealing them, they filed suit in Texas state court in their home county.[50] In their lawsuit, the Lipskys asserted that their water well was contaminated as a result of the improper casing of Range Resources' wells and not as a result of hydraulic fracture stimulation.[51] However, because they did not appeal the findings of the Railroad Commission in the proper venue

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43. Loyola, *supra* note 42, at 1.

44. *Id.*

45. TEX. NAT. RES. CODE ANN. § 81.051 (West 2011).

46. R.R. Comm'n of Tex. Doc. No. 7B-0268629 (Mar. 7, 2011), *available at* http://www.rrc.state.tx.us/meetings/ogpfd/RangePFD.PDF.

47. Loyola, *supra* note 42, at 2.

48. United States v. Range Prod. Co., 973 F. Supp. 2d 814 (N.D. Tex. 2011), Doc. Entry 12, May 9, 2011; Doc Entry 23, March 30, 2012.

49. Barry Shlachter, *EPA Drops Action Against Range Resources over Parker County Water Wells*, FT. WORTH STAR-TELEGRAM (Mar. 30, 2012), http://www.star-telegram.com/2012/03/30/3849362/epa-drops-action-against-range.html.

50. *Lipsky*, No. CV11-0798.

51. Jack Z. Smith, *Judge: Parker County Not the Place for Couple's Lawsuit Against Range Resources*, FT. WORTH STAR-TELEGRAM (Jan. 28, 2012), http://www.star-telegram.com/2012/01/28/3694982/judge-parker-county-not-the-place.html.

and since the time to perfect that appeal had expired, the case was dismissed by the trial court on jurisdictional grounds.[52]

Lipsky is emblematic of two trends contributing to unfounded suspicions of hydraulic fracturing. First, most landowners do not understand fracking techniques, shale gas geology, and the chemical composition of water wells in gas-bearing regions. Second, some landowners take dramatic steps to support their claims that over-embellish fracking's effect on their property. For example, in *Lipsky*, the landowner published a video purportedly showing gas-laden water from his water well burning out of a garden hose.[53] It was later discovered that the video was intentionally misleading and that the Lipskys' water was not on fire. Rather, the Lipskys attached a garden hose to a gas vent and then lit the vented gas on fire.[54] The *Lipsky* trial court found that the plaintiffs' actions were deceptive, calculated to alarm the public and the EPA, and were part of a strategy to defame Range Resources.[55]

The causation problems that have permeated the Texas cases are not exclusive to that state. At least one Colorado court has required a pre-discovery prima facie showing of causation and exposure in order to narrow discovery.[56] In *Strudley v. Antero Resources*, the plaintiffs claimed that their groundwater was contaminated as a result of the defendant's gas well operations.[57] Due to the broadness of the plaintiffs' allegations, the *Strudley* court was concerned about the plaintiffs' inability to establish the requisite causal connection. Relying on the procedure set forth in *Lore v. Lone Pine Corp.*,[58] the court demanded admissible evidence pre-discovery. The court required affidavits from experts establishing a causal connection between the defendant's conduct, the contamination, and the plaintiffs' injuries.[59] The court's procedure in the *Strudley* case, which imposes an unusual burden on the plaintiff pre-discovery, is demonstrative of the skepticism some courts are beginning to have about the validity of these types of cases.

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52. *Id.*

53. Chris Hawes, *EPA Acts After Water Contaminated by Drilling*, WFAA-TV DALLAS-FT. WORTH (Dec. 7, 2010, 11:25 PM), http://www.wfaa.com/news/local/EPA-orders—111474704.html.

54. *Lipsky*, No. CV11-0798.

55. *Id*.

56. Strudley v. Antero Res. Corp., No. 2011-CV-2218 (Dist. Ct. Colo. filed Nov. 10, 2011).

57. *Id*.

58. 1986 WL 637507 (N.J. Sup.Ct. 1986).

59. *Strudley*, No. 2011 CV 2218.

Many cases remain in the pre-trial discovery stages in various shale formation jurisdictions, and evidence of causation will be the linchpin to their resolution. Causation will be difficult to establish in these cases because the fracking process itself is highly unlikely to cause groundwater contamination. If the plaintiffs' respective water wells were contaminated by the actions of an oil and gas operator, the injury was likely due to an act or omission that occurred in a different phase of the well drilling process.

III. THERE IS NO EVIDENCE THAT HYDRAULIC FRACTURING CONTAMINATES GROUNDWATER

The reason why the plaintiffs noted above all failed to demonstrate a causal connection between hydraulic fracturing and groundwater contamination in shale formation areas is simple: it is highly unlikely, from a geological perspective, that hydraulic fracturing contaminates groundwater. Current hydraulic fracturing techniques limit fracturing into adjoining, vertical formations and increase the horizontal lengths of fractures within oil and gas bearing shale formations.[60] Minimizing vertical fractures lessens the likelihood that natural gas will escape into adjoining formations and limits potential water inflow from adjoining formations.

Furthermore, it is physically impossible for hydraulic fracturing to create vertical pathways from oil and gas bearing shale formations into aquifers. There is simply too much vertical separation between the two geological structures. The Chairperson of the Texas Railroad Commission, Elizabeth Ames Jones, stated in congressional testimony that, "[w]hether it is fracturing fluid, oil, or natural gas, to affect the usable quality of water, those substances would have to migrate upward through thousands of feet of rock. That is physically impossible."[61] In a press release, Chairperson Jones also noted that one would "have a better chance of hitting the moon with a roman candle than fracturing into fresh water zones by hydraulic fracturing shale rock."[62]

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60. API GUIDANCE DOCUMENT HF1, *supra* note 8, at 18–22.

61. *Review of Hydraulic Fracturing Technology and Practices: Hearing Before the H. Comm. on Sci., Space, and Tech.*, 112th Cong. (2011) (statement of Elizabeth Ames Jones, Chairperson, R.R. Comm'n of Tex.).

62. Press Release, Elizabeth Ames Jones, R.R. Comm'n of Tex., No Water Contamination Ever Due to Homegrown Technology—Hydraulic Fracturing (May 12, 2011) (on file with author).

In addition, the high permeability of the rock between the deep shale formation and the shallow aquifer further reduces the likelihood that hydraulic fracturing could contaminate aquifers. Even if hydraulic fracture stimulation created enough pressure and fluid within the relatively impermeable shale for vertical fractures to reach overlying geologic formations, these fractures would encounter more permeable formations before reaching aquifers.[63] More permeable formations absorb these injection fluids, which will in turn flow laterally through the permeable rock, not vertically into a shallow aquifer.[64] In other words, the hydraulic pressure and the fluid that comes with it are absorbed by the rock strata above the shale, stopping the fractures from continuing vertically into a shallow aquifer.

A. Well Casing

If there is potential for groundwater contamination resulting from oil and gas production, a more likely source (other than a surface spill) is improper surface well casing. This is true whether or not a well is fracture stimulated. Hydraulic fracturing is one of the last steps in drilling an oil and gas well. The first steps, which are crucial to prevent ground water contamination, are the drilling, casing, and cementing of the surface hole portion of the well.[65] The surface hole is drilled to a predetermined depth that is usually established by the deepest usable aquifer.[66] This depth can range from a few hundred feet to a thousand feet or more. State regulations usually dictate the minimum depth in which surface casing must be set,[67] which should be below the deepest freshwater aquifer in the area.[68] The casing is made

63. API GUIDANCE DOCUMENT HF1*, supra* note 8, at 15–18.

64. *Id.* at 16.

65. *Natural Gas Shale Horizontal Drilling Video*, AM. PETROLEUM INST., http://www.api.org/policy-and-issues/policy-items/hf/drilling_video.aspx (last visited Mar. 23, 2012).

66. API GUIDANCE DOCUMENT HF1, *supra* note 8, at 11. Despite what some people may envision, an aquifer is not an underground river or cavern of water. An aquifer is a body of shallow saturated rock through which water can move. Aquifers are permeable and porous and are comprised of sandstone, conglomerate, fractured limestone and unconsolidated sand and gravel. Groundwater squeezes through pore spaces in the rock and sediment in order to move through an aquifer. Because it takes pressure to force water through the tiny rock or sand pores, groundwater loses energy as it flows. *What is an Aquifer?*, IDAHO MUSEUM NAT. HIST., http://imnh.isu.edu/digitalatlas/hydr/concepts/gwater/aquifer.htm (last visited Mar. 21, 2012).

67. For example, in Texas this requirement is mandated by its oil and gas regulatory body, the Texas Railroad Commission. TEX. NAT. RES. CODE ANN. § 91.1015 (West 2011).

68. *Natural Gas Shale Horizontal Drilling Video*, *supra* note 65.

of steel tubes fitted together into the bore hole from the largest diameter casing to the smallest.[69] Casing is used to seal off the usable water bearing formations from drilling fluids and hydrocarbons in order to stop any migration of such substances into groundwater aquifers.[70] The surface casing is fully cemented from bottom to top.[71] Cementing is accomplished by pumping cement into the steel casing, forcing the cement up from the casing's bottom and into the space between the outside of the casing and the wellbore.[72] This cement circulation method ensures the complete isolation of the groundwater zones near the surface from the hydrocarbon bearing zones.

Once the surface casing is set and the cement cured, the production wellbore will be drilled down into the next zone where more casing will be set.[73] When the driller has reached the hydrocarbon-bearing formation, production casing is typically set using the same method as with surface casing.[74] These casing strings are designed to create a hydraulic barrier to both vertical and horizontal fluid migration that prevents fluid from the deeper zones from moving into the shallower groundwater aquifer zones.[75] In other words, casing is designed to prevent communication between the shallow aquifer and deep hydrocarbon bearing formations.

If the surface casing is not set to its proper depth or properly cemented, communication between the deep hydrocarbon-bearing zones and the aquifer is possible. In that event, contamination of the aquifer with hydrocarbons and fracturing fluids might occur. Contamination as a result of a poor surface casing job, therefore, has nothing to do with the actual process of hydraulic fracturing. All wells—hydraulically fractured or conventional—have surface casing, and improper surface casing may lead to contamination under certain circumstances, whether or not the well was fracture stimulated.[76]

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69. API GUIDANCE DOCUMENT HF1, *supra* note 8. The standard for oil and gas casing was established by the API in Spec. 5CT.

70. *Id.* § 7.1.

71. The standards for cement types were established by the API in Spec. 10A.

72. API GUIDANCE DOCUMENT HF1, *supra* note 8, at § 7.

73. *Id.* §§ 7.4–7.5.

74. *Id.* § 7.5.

75. *Id.* § 3.

76. *See generally* George E. King, *Estimating Frac Risk and Improving Frac Performance in Unconventional Gas and Oil Wells* (Jan. 23, 2012), http://gekengineering.com/Downloads/Free_Downloads/Estimating_and_Explaining_Fracture_Risk_and_Improving_Fracture_Performance_in_Unconventional_Gas_and_Oil_Wells.pdf. This article should not be interpreted to mean that a water well that contains water laced with

B. Scientific Studies

Several scientific studies have concluded that hydraulic fracturing is safe and does not threaten the environment or public health. These studies have not found any conclusive evidence that the process causes groundwater contamination. In 2004, the EPA conducted a survey of hydraulic fracturing practices in coal bed methane formations.[77] In this study, the EPA concluded that hydraulic fracturing in coal bed methane formations did not create pathways for fluids to travel between rock formations to affect the drinking water supply.[78] In the EPA's own words:

> The EPA also reviewed incidents of drinking water well contamination believed to be associated with hydraulic fracturing and found no confirmed cases linking fracturing fluid injection into CBM [coal bed methane] wells or subsequent underground movement of fracturing fluids. Although thousands of CBM wells are fractured annually, the EPA found no evidence that drinking water wells have been contaminated by hydraulic fracturing fluid injection into CBM wells.[79]

At least one other study by the EPA of hydraulic fracture stimulation has been ongoing since 2010.[80] The EPA released a final study plan in November 2011,[81] and the anticipated release date for the preliminary report is late 2012.[82] Unlike the 2004 report, which focused only on coal bed methane formations, the 2012 report is expected to address fracture stimulation in both shale and conventional formations.[83]

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thermogenic gas was contaminated as a result of faulty surface casing. Thermogenic gas can naturally migrate into aquifers irrespective of oil and gas operations in the area.

77. EPA, EVALUATION OF IMPACTS TO UNDERGROUND SOURCES OF DRINKING WATER BY HYDRAULIC FRACTURING OF COALBED METHANE RESERVOIRS ES-1 (2004), *available at* http://nepis.epa.gov/Adobe/PDF/P100A99N.PDF.

78. *Id.* at 7-5 ("Based on the information collected and reviewed, EPA has concluded that the injection of hydraulic fracturing fluids into coal bed methane wells poses little or no threat to USDWs and does not justify additional study at this time.").

79. *Id.* at ES-1.

80. EPA, HYDRAULIC FRACTURING RESEARCH STUDY (2010) [hereinafter HYDRAULIC FRACTURING STUDY], *available at* http://www.epa.gov/owindian/tribal/pdf/hydraulic-fracturing-fact-sheet.pdf.

81. EPA, PLAN TO STUDY THE POTENTIAL IMPACTS OF HYDRAULIC FRACTURING ON DRINKING WATER RESOURCES (2011), *available at* http://water.epa.gov/type/groundwater/uic/class2/hydraulicfracturing/upload/hf_study_plan_110211_final_508.pdf.

82. Pierre Bertrand, *EPA Asks for $14 M for Fracking Studies*, INT'L BUS. TIMES (Feb. 28, 2012), http://www.ibtimes.com/articles/306216/20120228/epa-hydraulic-fracturing-study-2013-natural-gas.htm.

83. EPA, HYDRAULIC FRACTURING STUDY, *supra* note 81. One of the study areas to be addressed in the 2012 EPA report is Pavillion, Wyoming. In December 2011, the EPA released

In early May 2011, researchers from Duke University analyzed drinking water samples taken from sixty-eight water wells in the Marcellus Shale.[84] Although various media reports suggested that the Duke Study demonstrates a causal link between water well contamination and hydraulic fracturing, these reports are inaccurate.[85] After looking for evidence that might indicate water contamination from hydraulic fracturing, the Duke Study found that all "concentrations in wells from active drilling areas were consistent with the baseline historical data."[86]

The Duke Study found methane in a large majority of the water wells sampled, even in water wells not located near active gas wells. Specifically, the researchers found methane in 85% of the water wells they sampled, "regardless of gas industry operations."[87] The Duke researchers concluded that much of the methane they found in water samples collected near active gas wells was thermogenic methane (from deep underground formations), rather than biogenic methane (that forms naturally in shallower formations). However, the study notes that this finding does not establish a causal link between fracturing and methane levels.[88] Why? First, the researchers did not have any historical background data on methane concentrations or isotopic concentrations to compare pre-drilling and post-drilling

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a draft report stating that, based on its testing of water wells near Pavillion, it found compounds in Pavillion's local aquifer likely associated with gas production practices, including hydraulic fracturing. Press Release, EPA, EPA Releases Draft Findings of Pavillion, Wyoming Ground Water Investigation For Public Comment and Independent Scientific Review (Dec. 8, 2011), *available at* http://yosemite.epa.gov/opa/admpress.nsf/0/EF35BD26A80D6CE3852579600065C94E. This report drew heavy criticism due to its reliance on test results that were not conducted in accordance with EPA testing standards or accepted protocols. Jeremy Fugleberg, *EPA Improperly Tested Pavillion Water Samples*, BILLINGS GAZETTE (Dec. 27, 2011), http://billingsgazette.com/news/state-and-regional/wyoming/epa-improperly-tested-pavillion-water-samples/article_7f7f1bf4-553e-52c9-85eb-ce7fd06628ef.html. As a result of the complaints about the testing methods, the EPA and the state of Wyoming agreed to conduct additional testing on the wells before a final report is issued. Mark Drajem, *Wyoming Joins EPA to Test Water in Pavillion Fracking Area*, BLOOMBERG NEWS (March 8, 2012), http://www.bloomberg.com/news/2012-03-08/wyoming-joins-epa-to-test-water-in-pavillion-fracking-area-1-.html.

84. Stephen G. Osborn et al., *Methane Contamination of Drinking Water Accompanying Gaswell Drilling and Hydraulic Fracturing*, 108 PROC. NAT'L ACAD. SCI. 8172 (2011), *available at*

http://www.nicholas.duke.edu/cgc/pnas2011.pdf.

85. *See, e.g.*, Bryan Walsh, *Another Fracking Mess for the Shale-Gas Industry*, TIME (May 9, 2011), http://www.time.com/time/health/article/0,8599,2070533,00.html.

86. Osborn et al., *supra* note 84, at 8175.

87. *Id*. at 8173.

88. *Id*. at 8173–75.

levels.[89] Second, the Duke Study found no evidence of fracking fluid in the drinking water samples.[90]

In October 2011, the Center for Rural Pennsylvania released the findings of a study of 233 private water wells near Marcellus Shale gas wells in rural regions of Pennsylvania.[91] The Center is a bipartisan, bicameral legislative agency that serves as a resource for rural policy within the Pennsylvania General Assembly.[92] Like the EPA and Duke studies, the Pennsylvania Study also found no causal link between hydraulic fracturing and water well contamination.[93] Phase One of the research focused on forty-nine private water wells located within 2500 feet of a nearby gas well.[94] Phase Two focused on an additional 185 private water wells located within 5000 feet of a gas well. Some of these private water wells were analyzed as treatment sites, while others served as control sites.[95] The analyses of post-drilling versus pre-drilling water chemistry "did not suggest major influences from gas well drilling or hydrofracturing . . . on nearby water wells, when considering changes in potential pollutants that are most prominent in drilling waste fluids."[96] Like the Duke Study, the Pennsylvania Study also found no statistically significant increases in methane levels after drilling and no significant correlation between distance from drilling and dissolved methane concentrations in the forty-eight Phase One water wells, sampled both before and after drilling.[97]

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89. *Study Links Methane in Water to Gas Extraction* (NPR radio broadcast May 13, 2011), *available at* http://www.npr.org/2011/05/13/136280456/study-links-methane-in-water-to-gas-extraction (interviewing Dr. Rob Jackson, co-author of the Duke Study).

90. Osborn et al., *supra* note 84, at 1872.

91. CTR. FOR RURAL PA., THE IMPACT OF MARCELLUS GAS DRILLING ON RURAL DRINKING WATER SUPPLIES (2011) [hereinafter IMPACT OF MARCELLUS GAS DRILLING], *available at* http://www.rural.palegislature.us/documents/reports/Marcellus_and_drinking_water_2011_rev.pdf.

92. THE CENTER FOR RURAL PENNSYLVANIA, http://www.rural.palegislature.us (last visited Mar. 23, 2012).

93. IMPACT OF MARCELLUS GAS DRILLING, *supra* note 91, at 4. In this study, statistical analyses of post-drilling versus pre-drilling water chemistry did not suggest major influences from gas well drilling or fracking on nearby water wells, when considering changes in potential pollutants that are most prominent in drilling waste fluids. When comparing dissolved methane concentrations in the forty-eight water wells that were sampled both before and after drilling from Phase One, the research found no statistically significant increases in methane levels after drilling and no significant correlation to distance from drilling.

94. *Id*. at 6.

95. *Id*. at 8–9.

96. *Id.* at 4.

97. *Id.*

While the initial report indicated data showing bromide increases in seven water wells after drilling (with or without hydraulic fracturing) in nearby Marcellus Shale gas wells, the researchers later admitted that the bromide concentration data were incorrect due to a lab error.[98] Updated results showed that the occurrence of bromide in water wells after gas drilling occurred in only a single well.[99] Accordingly, as noted above, the Pennsylvania Study found no causal link between hydraulic fracturing and water well contamination.

In February 2012, the University of Texas at Austin's Energy Institute released its findings from a review of hydraulic fracturing and shale gas development (the Texas Review).[100] The Energy Institute, which seeks "to promote shale gas policies and regulations that are based on facts . . . rather than claims or perceptions,"[101] focused on the Barnett Shale in Texas, the Haynesville Shale in Texas and Louisiana, and the Marcellus Shale in the northeast United States.[102] Utilizing a team comprised of representatives from several disciplines and with participation from the Environmental Defense Fund,[103] the Texas Review found little or no evidence of groundwater contamination by hydraulic fracturing fluids in aquifers as a result of fracturing operations.[104]

The Texas Review also analyzed claims brought by private landowners alleging groundwater contamination of water wells from fracture stimulation. The review found no evidence of fracturing chemicals in aquifers as a result of fracturing operations,[105] and found that "properties and constituents in many cases were present in water wells before shale gas development began."[106] The review concluded that the greatest potential for aquifer contamination from fracturing fluid additives is the failure of the integrity of surface casing, which

98. *Id.* at i. ERROR NOTICE.

99. *Id.*

100. FACT-BASED REGULATION, *supra* note 2.

101. *Id.* at 4.

102. *Id.*

103. The Energy Institute utilized energy experts in geosciences, economic geology, law, communications, and from the Institute itself. *Id.* at 5.

104. *Id.* at 18.

105. *Id.* at 19. Rather, the *energy* (vibrations and pressure pulses) from the shale drilling mobilized contaminants that were already present.

106. *Id.* While the hydraulic fracturing did not necessarily introduce contaminants such as iron and manganese oxides, the fracturing disturbed the accumulated particles causing them to change color, increase turbidity, and release odors.

would allow produced gas and fluids into the groundwater.[107] The Texas Review noted with regard to hydraulic fracturing fluid additives in wells drilled at normal depths:

> Although claims have been made that "out-of-zone" fracture propagation or intersection with natural fractures, could occur, this study found no instances where either of these has actually taken place. In the long term after fracturing is completed, the fluid flow is toward (not away from) the well as gas enters the well bore during production.[108]

As the Texas Review demonstrates, a thorough analysis is required to fully assess whether fracture stimulating shale formations can cause groundwater contamination. Improperly, some studies have used inappropriately limited factual findings, such as only considering water quality, to support unsubstantiated opinions that hydraulic fracture stimulation "might" or "could possibly" be a source of contamination. For example, though the Duke Study did not find any evidence of fracking fluids in the water wells it tested, it did state that it was "possible" for hydraulically-induced fractures in the Utica Shale to have propagated to the groundwater-bearing formations, and thus contaminate the groundwater with thermogenic methane.[109] This conclusion is questionable due to the failure of the authors to investigate other possible causes of contamination. For instance, the Duke Study did not consider the integrity of the well casing of the nearby gas wells and it failed to adequately address the density and permeability of the geologic formations that exist between the aquifer and the shale formation that received the fracture stimulation. Because the authors failed to take these steps, their opinions as to what is "possible" are merely speculation. Causation opinions that are not based on fact are rarely admitted into evidence in a court of law.[110]

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107. *Id.* (noting that drilling fluids could leak into the aquifer by flowing up the well bore or by radiating out of the well into the formation, and that well leaks can lead to house explosions).

108. *Id.* at 18 (separating the issue of drilling fluid flow from the risk of house explosions, methane contamination of water wells, well integrity, and leakage). *But see id.* (distinguishing cases in Wyoming where fracturing was performed at depths "shallower than normal").

109. Osborn et al., *supra* note 84, at 8175.

110. *See* Daubert v. Merrell Dow Pharms., Inc., 509 U.S. 579, 590 (1993) ("'[K]nowledge' connotes more than subjective belief or unsupported speculation."); Moore v. Ashland Chem., Inc., 151 F.3d 269, 278 (5th Cir. 1998) ("[A] district judge asked to admit scientific evidence must determine whether the evidence is genuinely scientific, as distinct from being unscientific speculation offered by a genuine scientist."); Watkins v. Telsmith, Inc., 121 F.3d 984, 988–89 (5th Cir. 1997) (noting that the "trial judge must perform a screening function to ensure that the expert's opinion is reliable and relevant to the facts at issue in the case"); *see also* FED. R. EVID. 702 cmt. 10 (explaining that testimony must be "properly grounded, well reasoned, and not speculative before it can be admitted" and the "expert's testimony must be grounded in an

A complete analysis of all relevant data is always necessary when making a causation determination, especially in a legal setting.

As noted above, at least one other EPA study on hydraulic fracture stimulation has been ongoing since 2010 and it will be important to monitor its findings as they are released.

IV. HYDRAULIC FRACTURE STIMULATION REGULATION

Since 2010 both state legislatures and the federal government have considered and enacted a number of regulations that relate to hydraulic fracturing.[111] The National Conference on State Regulators estimates that more than one hundred bills across nineteen states have been introduced and considered, with New York and Pennsylvania considering the most legislation.[112]

Chemicals disclosure, in particular, is the subject of much regulatory concern. Although the oil and gas industry has complied with the rules and regulations requiring disclosure of materials used at well sites, there remains general public concern that the chemicals used in hydraulic fracturing are overly obscured. Wyoming, Arkansas, Pennsylvania, Texas, and Colorado have all passed legislation requiring some level of chemicals disclosure. Wyoming was the first state to actually enact legislation that requires full disclosure of chemicals used in the fracturing process. Wyoming's rule requires companies to make an initial disclosure of the planned content of hydraulic fracturing fluids and then an additional disclosure informing the state of the actual contents used at each well site.[113] That information is then made available to the public with certain exceptions to protect proprietary information.[114] The Arkansas rules

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accepted body of learning or experience in the expert's field, and the expert must explain how the conclusion is so grounded").

111. *See, e.g.*, Fracturing Responsibility and Awareness of Chemical Act of 2009, H.R. 2766, 111th Cong. (2009). The "FRAC Act," which was originally introduced in both houses of Congress in June 2009, was reintroduced in the House of Representatives and the Senate in March 2011. The bill, if passed, would have eliminated the hydraulic fracturing exemption from the Safe Drinking Water Act and required public disclosure of the chemicals used in the hydraulic fracturing process.

112. Jacquelyn Pless, *Fracking Update: What States Are Doing to Ensure Safe Natural Gas Extraction*, NAT'L CONF. STATE LEGISLATURES (2011), http://www.ncsl.org/issues-research/energyhome/fracking-update-what-states-are-doing.aspx.

113. Wyo. Oil & Gas Comm'n Operational Rules, Drilling Rules, 3 §§ 8(c)(ix), 12, 45, *available at* http://soswy.state.wy.us/Rules/RULES/7928.pdf (requiring operators to disclose chemical additives and proposed concentrations in the Application for Permit to Drill or Deepen).

114. *Id.* § 45(f).

do not require the disclosure of the exact chemical composition of certain fracking additives, but do require that the fluids be categorized by type, such as acid, biocide, or friction reducer.[115] Pennsylvania's regulations require, as part of the permitting process, drilling companies to disclose the names of all chemicals to be stored and used at a drilling site.[116] Texas's rule, the "Hydraulic Fracturing Fluid Disclosure Rule," requires oil and gas operators to publicly disclose the ingredients and water volumes used to hydraulically fracture wells.[117] The rule applies to all wells for which the Texas Railroad Commission issues an initial drilling permit on or after February 1, 2012.[118] The rules approved by Colorado's regulators are similar to those required by Texas, but go further by requiring the identities and concentrations of all chemicals to be disclosed.[119] Colorado's rule takes effect in April 2012.[120] Both Texas and Colorado require public disclosure to the hydraulic fracturing registry site: fracfocus.org.[121]

Although new hydraulic fracturing regulations vary from state to state, most focus on requiring public disclosure of some or all of the fluids used as a part of the process. Other types of rules, which are smaller in number, focus on protecting water and air quality.[122] Most of these regulations, however, are only in their infancy.[123] Clearly,

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115. Ark. Oil & Gas Comm'n, General Rules and Regulations, Rule B-19, *available at* http://www.aogc.state.ar.us/OnlineData/Forms/Rules and Regulations.pdf. The rule also requires drillers to disclose the exact concentration of each compound in the hydraulic fracturing mixture.

116. 25 PA. CODE § 78.55 (2011).

117. 16 TEX. ADMIN. CODE, § 3.29 (2011).

118. Press Release, R.R. Comm'n of Tex., Railroad Commissioners Adopt One of Nation's Most Comprehensive Hydraulic Fracturing Chemical Disclosure Requirements (Dec. 13, 2011), *available at* http://www.rrc.state.tx.us/pressreleases/2011/121311.php.

119. Final Modified Staff Proposal, *Before the Oil and Gas Conservation Commission of the State of Colo., available at* http://cogcc.state.co.us/RR_HF2011/FinalModifiedStaff Proposal12_13_11V4.pdf.

120. *Id.*

121. *Commissions Adopt Fluid Disclosure Rules*, FRACFOCUS.ORG, http://fracfocus.org/node/327 (last visited Mar. 25, 2012).

122. *See* Adam Orford, *Hydraulic Fracturing: Legislative and Regulatory Trends,* MARTENLAW.COM (Oct. 4, 2011), http://www.martenlaw.com/newsletter/20111004-fracking-roundup. For example, Michigan requires as part of the permitting process that drillers submit extensive documentation of their expected water use. Michigan also requires drillers to install monitor wells, used to ensure active freshwater wells' safety, when fracking operations are near more than one freshwater well.

123. *Id.*

disclosure of chemicals used in the hydraulic fracturing process is the regulatory trend in the oil and gas producing states.

CONCLUSION

Fracture stimulation has been used safely for decades. Recent studies fail to provide any evidence that the hydraulic fracturing process causes groundwater contamination in shale production areas. Yet landowners and government agencies continue to launch baseless accusations against fracking operators for water contamination. Landowners filing suit against drilling companies have been unable to provide any evidence of a causal link between hydraulic fracturing and water contamination. Some landowners appear to simply be opportunists taking advantage of the volley of public criticism currently being launched against hydraulic fracturing.

From environmentalists to litigious landowners, those opposing fracking have simply failed to bring forth any evidence that substantiates their protests. These lawsuits will likely continue to fail because opponents of hydraulic fracture stimulation do not understand the science that demonstrates that groundwater contamination from hydraulic fracturing is geologically impossible. As the Texas Review observes, hydraulic fracture stimulation in shale formations simply does not cause groundwater contamination. By continuing to attack hydraulic fracturing without adequate factual support, these opponents recklessly hamper our economy, energy independence, and environmental future.