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NOTE

THE SOLUTION TO UNSOUND SCIENCE BEHIND REGULATION OF HYDRAULIC FRACTURING IS . . . TRACEABLE

Valeriia Hatami*

I. INTRODUCTION

Hydraulic fracturing—or as petroleum engineers call it, "fracking"—first appeared in 1949.[1] Thus, contrary to popular opinion, fracking is anything but new. What is new, however, is a vehement debate among opponents and proponents of fracking regarding the safety and soundness of this sophisticated process.[2] The former think hydraulic fracturing is

* Valeriia Hatami is a third-year law student at Oklahoma City University School of Law and a staff member of the Oklahoma City University Law Review. The Author would like to thank her supervising professor, Paula J. Dalley, for advice and guidance; petroleum chemistry expert, Amanda N. North, for providing invaluable scientific perspective; and her husband, Matthew J. Hatami, for sparking interest in the subject of hydraulic fracturing.

1. Carl T. Montgomery & Michael B. Smith, *Hydraulic Fracturing: History of an Enduring Technology*, J. PETROLEUM TECH., Dec. 2010, at 26, 27, *available at* http://www.spe.org/jpt/print/archives/2010/12/10Hydraulic.pdf; Morgan R. Whitacre, Note, *An Environmentally Hazardous Process: Why the United States Should Follow France's Lead and Ban Hydraulic Fracturing*, 23 IND. INT'L & COMP. L. REV. 335, 335 (2013).

2. *See generally* Samuel C. Stephens, Comment, *Poison Under Pressure: The EPA's New Hydraulic Fracturing Study and the Case for Rational Regulation*, 43 CUMB.

evil: It poisons drinking water, pollutes the environment, and helps wealthy energy companies become even wealthier.[3] The latter believe hydraulic fracturing, when used in conjunction with such technologies as horizontal drilling, strengthens American independence from foreign oil.[4] They call it the "fracking revolution"[5] and compare it to the American Revolution and the invention of the Internet.[6]

Not surprisingly, the difference in views of opponents and proponents of hydraulic fracturing—environmental activists and industry representatives—puts pressure on national and state lawmakers and prompts them to address the "fracking issue" by introducing a plethora of new laws and heightening regulations.[7] Nevertheless, how many of these regulations are based on valid scientific conclusions rather than attempts to accommodate public apprehensions that are sometimes founded on

L. REV. 63, 64 (2012–2013) (discussing recent media scrutiny of hydraulic fracturing and accompanying environmental concerns and suggesting that the federal government and the states should model Alabama's environmental regulation of fracturing); *but see* Whitacre, *supra* note 1 at 336 (advocating for complete prohibition of hydraulic fracturing in the United States). *See generally* Dana Bohan, *Studies: "Not Physically Plausible" for HF to Pollute Water*, ENERGY IN DEPTH (Aug. 8, 2013, 2:02 PM), http://energyindepth.org/national/studies-not-physically-plausible-for-hf-to-pollute-water/ (discussing various reports and studies that address the likelihood of frac fluid migration).

3. *See* NovaB, Comment to *Why Horizontal Drilling Is Such a Game-Changer for America*, MOTLEY FOOL (Aug. 10, 2013, 4:41 PM), http://www.fool.com/investing /general/2013/08/10/why-horizontal-drilling-is-such-a-game-changer-for.aspx ("Horizontal drilling allows BIG BUSINESS to steal mineral rights out from under everyone."). *See also* Jason Silverstein, *How Fracking Is Bad for Our Bodies*, ATLANTIC (Oct. 8, 2013, 1:00 PM), http://www.theatlantic.com/health/archive/2013/10/how-fracking-is-bad-for-our-bodies/280384/ (discussing chemical imbalances due to increased industrial activity and the resulting symptoms of the affected population); Paul Gallay, *Fracking—A Bad Bet for the Environment and Economy*, ECOWATCH (Jan. 6, 2012, 3:38 PM), http://ecowatch.com/2012/01/06/fracking-a-bad-bet-for-the-environment-and-economy/ (arguing that New York's drilling plans would give "drillers . . . one hell of a party, and we New Yorkers will end up with the hangover"); Kevin Drum, *Is Fracking Good for the Environment?*, MOTHER JONES (Sept. 7, 2012, 6:00 AM), http://www.motherjones.com /kevin-drum/2012/09/fracking-good-environment (admitting that gas leakage from natural gas production is relatively low but that increased consumption negatively impacts global warming).

4. Christopher Helman, *Happy (Energy) Independence Day*, FORBES (July 4, 2013, 9:40 AM), http://www.forbes.com/sites/christopherhelman/2013/07/04/happy-energy-independence-day/.

5. David Biello, *Fracking Can Be Done Safely, But Will It Be?*, SCI. AM. (May 17, 2013), http://www.scientificamerican.com/article/can-fracking-be-done-without-impacting-water.

6. Helman, *supra* note 4.

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

nothing more than a remote prospect of a burning kitchen faucet?[8]

Since the process of hydraulic fracturing, similar to the process of developing a well,[9] is inherently dangerous and does pose various risks (specifically, the risk of groundwater contamination), it must be properly regulated. Part II of this Note asserts that unsound science, combined with a lack of accurate information communicated to the public, is responsible for much of the confusion and inconsistency behind current regulation of hydraulic fracturing on both federal and state levels. Part III of this Note explains why current water sampling techniques that attempt to link hydraulic fracturing to groundwater contamination are inadequate and why some solutions, such as chemical disclosure requirements or complete bans on fracturing, not only fail to make the current regulatory system more effective but also have detrimental economic effects. Finally, Part IV argues that the mandatory injection of tracers into frac fluids will resolve the issue of causation between hydraulic fracturing and groundwater contamination, make the energy industry more accountable without imposing unnecessary regulatory hurdles, and provide a sound scientific foundation for hydraulic fracturing regulation.

II. CURRENT REGULATION AND PUBLIC PERCEPTION

A. The "Fractured" Nature of Current Legislation

Perhaps none of the other techniques used by the energy industry to extract natural resources from the ground generate as much controversy or attract as much publicity as hydraulic fracturing.[10] The innovation of fracking has allowed energy companies to increase the production not only of conventional plays but also of the wells located in areas

8. While interviewing a family in Dimock, Pennsylvania, Josh Fox, the director of the documentary *Gasland*, lit their tap water on fire as an alleged proof that water contamination resulted from hydraulic fracturing conducted in the area. GASLAND (New Video Group 2010), *available at* http://www.youtube.com/watch?v=4ApZkNsXfJE (*Gasland* excerpt). *See* Seamus McGraw, *Is Fracking Safe? The Top 10 Controversial Claims About Natural Gas Drilling, Claim No. 7*, POPULAR MECHANICS, http://www.popularmechanics.com/science/energy/coal-oil-gas/top-10-myths-about-natural-gas-drilling-6386593#slide-8 (last visited June 19, 2014).

9. *See infra* Part II.A.1 (describing the federal level categories of injection wells and their significant differences from production wells).

10. *Fractured: The Road to the New EPA "Fracking" Study*, MARTEN LAW (Sept. 17, 2010), http://www.martenlaw.com/newsletter/20100917-new-epa-fracking-study [hereinafter *Fractured*].

previously considered impermeable due to the scarcity of pathways sufficient for oil or gas to flow easily to the wellbore.[11] At the same time, certain aspects of hydraulic fracturing (specifically, the process of pumping chemicals into the ground) have raised a number of environmental concerns.[12] Consequently, it appears that current legislation regulating hydraulic fracturing is primarily aimed at reconciling two conflicting interests.[13] On the one hand, lawmakers are driven by a desire to increase energy independence and improve local economies by continually increasing energy production.[14] On the other hand, lawmakers have to address environmental concerns that accompany fracking—a procedure that is by no means risk-free.[15] In addition to the conflicting nature of above-mentioned interests, current legislation is affected by strong public opinion fueled by faulty claims of environmental activists and media misrepresentation.[16] This love-hate relationship with hydraulic fracturing, combined with inconclusive results of various scientific studies, has become the foundation of inconsistent governmental "policies of caution and expansion"[17] which, in turn, have created significant "confusion"[18] regarding who regulates what and to what extent.

11. Montgomery & Smith, *supra* note 1, at 31–32. "Many fields would not exist today without hydraulic fracturing." *Id.* at 32.

12. Despite the scarcity of evidence that would conclusively link hydraulic fracturing to water contamination, the allegations regarding its negative effect on water quality "date back to at least the early 1990s." *Fractured*, *supra* note 10. *See* MARY TIEMANN & ADAM VANN, CONG. RESEARCH SERV., R41760, HYDRAULIC FRACTURING AND SAFE DRINKING WATER ACT REGULATORY ISSUES, CONG. RESEARCH SERV. 4 (2013), *available at* http://www.fas.org/sgp/crs/misc/R41760.pdf.

13. *Fractured*, *supra* note 10.

14. Dan Eberhart, *The Pursuit of U.S. Energy Independence: A History of Wishful Thinking?*, CANARY (May 7, 2014), http://canaryusa.com/us-energy-independence-quest/.

15. Patricia Doxsey, *Dutchess County Lawmakers Disagree over Purported Rules of Fracking Brine*, DAILY FREEMAN (Sept. 6, 2012, 7:58 PM), http://www.dailyfreeman.com/general-news/20120906/dutchess-county-lawmakers-disagree-over-purported-risks-of-fracking-brine.

16. Drew Johnson, *Fracking Debate Needs Science, Not Superstition*, W. NEWS (May 9, 2014, 3:01 PM), http://www.thewesternnews.com/opinion/fracking-debate-needs-science-not-superstition/article_1f6f4eda-d7bd-11e3-9d12-0019bb2963f4.html.

17. *Fractured*, *supra* note 10.

18. *Id.*

1. Federal Level Regulation

On the federal level, regulatory confusion stems from the fact that hydraulic fracturing, while being a matter of national concern, is exempt from the Safe Drinking Water Act (SDWA) requirements.[19] The SDWA, adopted by Congress in 1974, is the primary federal statute authorizing the EPA's regulation of injection of fluids underground.[20] Provisions regarding the protection of underground sources of drinking water, known as the Underground Injection Control (UIC) program, are enacted in Part C of the SDWA.[21] These provisions give the Environmental Protection Agency (EPA) the authority to regulate and oversee underground injections defined in the SDWA as "the subsurface emplacement of fluids by well injection."[22] Specifically, § 300h authorizes the EPA to adopt minimum requirements and to promulgate regulations necessary "to prevent underground injection which endangers drinking water sources."[23]

By its design, the SDWA gives the states two options for implementing the UIC.[24] The first option allows the states to assume primary responsibility for implementing the entire UIC program.[25] Accordingly, under § 300h-1, the EPA is required to delegate primary enforcement responsibility to those states whose UIC program "meets the requirements of regulations in effect under section 300h."[26] Demonstrating "to [the] EPA that [the state] UIC program is at least as stringent as the federal standards" is usually sufficient for states to qualify.[27] The second option provides states with an opportunity to let the

19. Safe Drinking Water Act, Pub. L. No. 93-523, 88 Stat. 1660 (1974) (codified as amended in scattered sections of 42 U.S.C.).

20. TIEMANN & VANN, *supra* note 12, at 7.

21. *Id.* (citing Safe Drinking Water Act of 1974, §§ 1421–26, 88 Stat. at 1674–80 (codified as amended at 42 U.S.C. §§ 300h to 300h-5 (2012)). *See* Terry W. Roberson, *Environmental Concerns of Hydraulically Fracturing a Natural Gas Well*, 32 UTAH ENVTL. L. REV. 67, 77–78 (2012).

22. 42 U.S.C. § 300h(d).

23. *Id.* § 300h(b)(1).

24. U.S. ENVTL. PROT. AGENCY, EPA 816-R-00-008, STATE IMPLEMENTATION GUIDE: REVISIONS TO THE UNDERGROUND INJECTION CONTROL REGULATIONS FOR CLASS V INJECTION WELLS 1–2 (Sept. 2000), *available at* http://www.epa.gov/safewater/uic/class5/pdf /guide_uic-class5_state_imp_guid.pdf.

25. *Id.*

26. 42 U.S.C. § 300h-5(b)(1)(A)(ii).

27. TIEMANN & VANN, *supra* note 12, at 13 n.47.

EPA administer the entire UIC program.[28] Currently, 33 states have assumed primary enforcement responsibility "for all classes of injection wells."[29] The EPA has direct implementation authority in ten states, including Kentucky, Michigan, New York, Pennsylvania, and Virginia, which are some of the nation's leading oil and gas producers.[30] In the remaining states, the authority is shared.[31]

For the purposes of the UIC program implementation, the EPA has divided wells that perform underground injections into six classes. Class I wells isolate hazardous and non-hazardous wastes and liquids by injecting them into rock formations located significantly below the lowest underground sources of drinking water.[32] Class III wells "[i]nject fluids for the extraction of minerals."[33] Class IV wells perform shallow "inject[ions of] hazardous or radioactive wastes," but they are currently "banned unless authorized under a federal or state groundwater remediation project."[34] Class V wells are shallow disposal systems that inject non-hazardous fluids.[35] Class VI wells, established by the EPA in 2010,[36] "inject[] . . . carbon dioxide . . . into underground subsurface rock formations for long-term storage."[37]

28. *Id.* at 13.

29. *Alabama State Water Program: Frequently Asked Questions (FAQ) Result*, ALA. COOPERATIVE EXTENSION SYS., http://www.aces.edu/waterquality/faq/faq_results.php3?rowid=1415 (last visited Jan. 26, 2014); U.S. ENVTL. PROT. AGENCY, EPA 816-K-10-004, PROTECTING DRINKING WATER THROUGH UNDERGROUND INJECTION 35 (2012) [hereinafter EPA PROTECTING DRINKING WATER], *available at* http://water.epa.gov/type/groundwater/uic/upload/pocketguide_uic_protecting_dw_thru_uic.pdf.

30. TIEMANN & VANN, *supra* note 12, at 13.

31. EPA PROTECTING DRINKING WATER, *supra* note 29, at 7.

32. Keith B. Hall, *Regulation of Hydraulic Fracturing Under the Safe Drinking Water Act*, 19 BUFF. ENVTL. L.J. 1, 13 (2011–2012).

33. EPA PROTECTING DRINKING WATER, *supra* note 29, at 7.

34. TIEMANN & VANN, *supra* note 12, at 10.

35. *Id.*

36. *Id.*

37. *Geological Sequestration Class VI Wells*, U.S. ENVTL. PROT. AGENCY, http://water.epa.gov/type/groundwater/uic/class6/gsclass6wells.cfm (last updated July 30, 2012).

Class II wells are wells "associated with oil and gas production"[38] and include disposal wells,[39] enhanced recovery wells,[40] and wells injecting hydrocarbons for storage purposes.[41] Wells used exclusively for production of oil and gas (i.e., wells that use fracking) do not fall into this class.[42] How is it possible, then, that hydraulic fracturing—the process of pumping frac fluids underground—is not covered by the UIC regulation?

To a petroleum engineer, excluding fracking from the UIC program needs no additional reason beyond the fact that hydraulic fracturing and injection are technically two different processes.[43] The primary purpose of fracking is "to artificially fracture a reservoir rock in order to increase permeability and production."[44] Fracking is therefore part of the production process[45] and is used in production, or producing, wells—which the EPA does not regulate.[46] In other words, the injection of frac fluids underground is not the primary purpose of fracturing. The primary

38. *Class II Wells—Oil and Gas Related Injection Wells (Class II)*, U.S. ENVTL. PROT. AGENCY, http://water.epa.gov/type/groundwater/UIC/class2/ (last visited June 20, 2014) [hereinafter *Class II Wells*]; EPA PROTECTING DRINKING WATER, *supra* note 29, at 7.

39. NORMAN J. HYNE, DICTIONARY OF PETROLEUM EXPLORATION, DRILLING & PRODUCTION 141 (1991) ("[A] disposal well [is] a well used to inject the salt water that is produced along with oil into the subsurface.").

40. A DICTIONARY FOR THE OIL AND GAS INDUSTRY 89 (2d ed. 2011) ("[E]nhanced oil recovery [is] the introduction of artificial . . . displacement mechanisms into a reservoir to produce a portion of the oil unrecoverable by primary recovery methods. To restore formation pressure and fluid flow . . . fluid or heat is introduced through injection wells located in rock that has fluid communication with production wells.").

41. EPA PROTECTING DRINKING WATER, *supra* note 29, at 7; RICK MCMURDY, UNDERGROUND INJECTION WELLS FOR PRODUCED WATER DISPOSAL 13 (2014), *available at* http://www2.epa.gov/sites/production/files/documents/21_McCurdy_-_UIC_Disposal_508.pdf.

42. *Class II Wells*, *supra* note 38.

43. Richard Nemec, *Fracking Not Responsible for Quakes, Professor Says*, NGI'S SHALE DAILY (Apr. 17, 2014), http://www.naturalgasintel.com/articles/98094-quakes-not-problem-for-fracking-professor-says (stating that "[f]racking and the disposal of the fracking water 'are two different things'").

44. HYNE, *supra* note 39, at 249.

45. *Id.* at 396 ("[P]roduction [is] 1) the removal of petroleum from a subsurface reservoir by wells 2) oil or gas wells 3) oil and/or gas produced from wells 4) the part of the petroleum industry that is concerned with bringing gas and oil to the surface and separating, gauging, storing, and preparing it for transport.").

46. "[A] producing well [is] a well that produces petroleum in a field. A producing well is in contrast to an injection, service, or plugged and abandoned well." *Id.*; *see Class II Wells*, *supra* note 38 (stating that "the UIC Program does not regulate wells that are sole[l]y used for production").

purpose of injection, unlike that of fracturing, is to force liquids[47] underground for a variety of reasons as demonstrated by the UIC categories.[48] Thus, the injection process generally takes place *after* primary production and is implemented through separate injection wells, which are distinct from production wells.[49]

Confusion between production wells that use fracking and injection wells that do not use fracking became a subject of public scrutiny in 1995 when Alabama citizens, represented by the Legal Environmental Assistance Foundation (LEAF), "petitioned [the] EPA to require Alabama to regulate [hydraulic fracturing] under the UIC."[50] Instead of granting the petition, the EPA distinguished between injection and fracking based on their corresponding "principal function[s]."[51] Pursuant to this explanation, the EPA denied LEAF's petition and "approved Alabama's UIC regulations, which did not govern fracking."[52] Two years later, the U.S. Court of Appeals for the Eleventh Circuit overruled the EPA's decision.[53] The court rejected the EPA's argument that the SDWA authorized it to regulate injection wells only.[54] The EPA attempted to substantiate its argument: "[T]he statutory definition of 'underground injection' is ambiguous, [and] Congress intended to exclude wells whose principal function [was] not the injection of fluids from the UIC regulatory scheme."[55] Nevertheless, the court held that the SDWA's definition of "underground injection" was unambiguous because the context reflected an ordinary and sensible meaning of the words used.[56] Additionally, the court reasoned that:

> The process of hydraulic fracturing obviously falls within this definition, as it involves the subsurface emplacement of fluids by forcing them into cracks in the ground through a well. Nothing in

47. A DICTIONARY FOR THE OIL AND GAS INDUSTRY, *supra* note 40, at 138.

48. HYNE, *supra* note 39, at 261.

49. John Freeland, *The Ins and Outs of Fracking and Underground Waste Injection Wells*, AM. GEOPHYSICAL UNION BLOGOSPHERE (July 31, 2013), http://blogs.agu.org /terracentral/2013/07/31/fracking-and-epas-underground-injection-program/.

50. *Fractured*, *supra* note 10.

51. *Id.*; Legal Envtl. Assistance Found., Inc. v. U.S. Envtl. Prot. Agency (*LEAF I*), 118 F.3d 1467, 1471 (11th Cir. 1997).

52. *Fractured*, *supra* note 10. Alabama is one of the 33 states that obtained primary enforcement authority. EPA PROTECTING DRINKING WATER, *supra* note 29.

53. *LEAF I*, 118 F.3d at 1478.

54. *Id.* at 1475.

55. *Id.* at 1473–74.

56. *Id.* at 1474.

> the statutory definition suggests that [the] EPA has the authority to exclude from the reach of the regulations an activity (i.e., hydraulic fracturing) which unquestionably falls within the plain meaning of the definition, on the basis that the well that is used to achieve that activity is also used—even primarily used—for another activity (i.e., methane gas production) that does not constitute underground injection. . . . Congress directed [the] EPA to regulate "underground injection" activities, not "injection wells."[57]

In other words, the court disagreed with the EPA's interpretation of the SDWA "as excluding hydraulic fracturing from the reach of the regulations,"[58] stating that "[i]n view of clear statutory language requiring the regulation of *all* [underground injection] activities, they must be regulated, regardless of the other uses of the well in which these activities occur."[59] Based on these findings, the court overruled the EPA's decision to deny the petition requesting to withdraw the approval of Alabama's UIC program and "remanded the decision to [the] EPA for reconsideration."[60]

In 1999, before the EPA had an opportunity to finalize the process of the withdrawal of its approval, "Alabama submitted a revised UIC program."[61] This time, the program requested approval not under § 300h but under a different statutory provision: § 300h-4.[62] Section 300h-4 allows those states that already have a functioning injection-control program to regulate underground injections associated with the production of oil and gas (Class II wells) and to obtain enforcement primacy by demonstrating that "the [s]tate program . . . represents an effective program (including adequate recordkeeping and reporting) to prevent underground injection which endangers drinking water sources."[63] In other words, upon demonstrating the effectiveness of their regulatory program, these states do not have to meet the EPA requirements promulgated in § 300h.[64] Consequently, a year later, the

57. *Id.* at 1474–75.
58. *Id.* at 1477.
59. *Id.* at 1475.
60. *Id.* at 1478; TIEMANN & VANN, *supra* note 12, at 16.
61. TIEMANN & VANN, *supra* note 12, at 16.
62. *Id.* at 16 & n.59.
63. 42 U.S.C. § 300h-4(a) (2012).
64. "[T]he practical difference between the two statutory methods for approval is that

EPA approved the revised UIC program in Alabama under § 300h-4.[65]

One of the revisions included in the program was crafted in response to the holding of the Eleventh Circuit and authorized "regulation of hydraulic fracturing as 'Class II-like' wells."[66] LEAF once again petitioned the Eleventh Circuit to review the EPA's decision.[67] LEAF demonstrated three reasons to set aside the EPA's approval, one of which asserted that to classify hydraulic fracturing as Class II-like injection activity was contrary to the law.[68] LEAF argued "that wells used for the injection of hydraulic fracturing fluids . . . are 'Class II wells' as defined in 40 C.F.R. § 144.6(b)."[69] The court agreed with LEAF's argument and directed the EPA to establish whether Alabama's program modifications matched federal regulatory requirements.[70] Pursuant to the court's decision, Alabama reviewed its state regulations relating to the UIC program, adding provisions that required state approval of individual frac jobs and required tap-water standards to apply to frac fluids should the fluids mix with local drinking water underground.[71] Essentially, as a result of the Eleventh Circuit's decisions, Alabama adopted most of its current hydraulic fracturing regulations.[72]

Since the EPA itself seemed to believe fracking was outside of its regulatory reach, the Eleventh Circuit's holdings created significant confusion.[73] In order to resolve this confusion, Congress adopted the Energy Policy Act of 2005 (EPAct 2005).[74] Section 322 of EPAct 2005 amended the SDWA's definition of "underground injection," excluding from its scope "the underground injection of fluids or propping agents

the requirements [for the injection-control programs] covered under [§ 300h-4] are more flexible than the requirements for those programs covered under [§ 300h]." Legal Envtl. Assistance Found., Inc. v. U.S. Envtl. Prot. Agency (*LEAF II*), 276 F.3d 1253, 1257 (11th Cir. 2001).

65. TIEMANN & VANN, *supra* note 12, at 16. *See* Akiah C. Highsmith, Note, *Is It Tomorrow, or Just the End of Time? Why You Shouldn't Be Worried About Fracking and the EPA Should Keep It That Way*, 7 APPALACHIAN NAT. RESOURCES L.J. 157, 160 (2011–2013).

66. TIEMANN & VANN, *supra* note 12, at 17.

67. *LEAF II*, 276 F.3d at 1254–55.

68. *Id.* at 1256. LEAF's other two reasons were that fracking activity could not properly fall under § 300h-4 and that the EPA's approval of the revised program was "arbitrary and capricious." *Id.*

69. *Id.*

70. *Id.* at 1264.

71. TIEMANN & VANN, *supra* note 12, at 18.

72. *Id.* at 18–19.

73. *See Fractured*, *supra* note 10.

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

(other than diesel fuels) pursuant to hydraulic fracturing operations related to oil, gas, or geothermal production activities."[75] Unfortunately, EPAct 2005 brought little clarity to the regulatory chaos. Without a statutory requirement that they adhere to the uniform regulations promulgated by the EPA, states could regulate fracturing as they saw fit.[76] Consequently, the debate surrounding hydraulic fracturing reached a whole new level—with environmentalists demanding full disclosure of the chemical composition of frac fluids and industry representatives claiming such disclosure would violate companies' proprietary interests.[77]

The increase of "regulatory uncertainty" was not the only consequence resulting from the Eleventh Circuit's decisions.[78] In a way, the decisions marked the beginning of an era of various studies aimed at establishing a connection between hydraulic fracturing and groundwater contamination.[79] For example, in 2004, two years after issuing preliminary study results, the EPA issued a final report finding "no confirmed cases of [groundwater] contamination from hydraulic fracturing."[80] The EPA study was limited to coalbed methane wells[81] and was not viewed as particularly credible,[82] perhaps because it was "based primarily on an assessment of the available literature and extensive interviews"[83] rather than on firsthand scientific observations.

75. *Id.* § 322, 119 Stat. at 694 (codified at 42 § U.S.C. 300h (2012)).

76. *See* Pless, *supra* note 7.

77. *Hydraulic Fracturing: Legislative and Regulatory Trends*, MARTEN LAW (Oct. 4, 2011), http://www.martenlaw.com/newsletter/20111004-fracking-roundup [hereinafter *Trends*].

78. *Fractured*, *supra* note 10.

79. *See, e.g.*, Dave Quast, *Hydraulic Fracturing: Tightly Regulated, Extensively Studied*, ENERGY IN DEPTH (Nov. 11, 2013, 12:12 PM), http://energyindepth.org/california/hydraulic-fracturing-tightly-regulated-extensively-studied/.

80. TIEMANN & VANN, *supra* note 12, at 19.

81. *Id.* at 19 n.80.

82. "Since 2004, numerous studies and scholarly critiques have shown that the EPA's 2004 conclusion was an extremely lackadaisical approach to a critically important environmental issue." Whitacre, *supra* note 1, at 350. "While the report vindicated the industry position, it quickly drew criticism. One EPA scientist went so far as to publicly call the report 'scientifically unsound' and accused members of the report's peer review panel of conflicts of interest." *Fractured*, *supra* note 10.

83. TIEMANN & VANN, *supra* note 12, at 19.

In 2011, the Ground Water Protection Council (GWPC), a nonprofit organization representing state groundwater regulatory agencies,[84] released a review of Ohio and Texas investigations of possible causes of groundwater contamination, including oil and gas production and exploration activities.[85] In the 1950s, the Texas Railroad Commission (RRC) was the first to begin conducting investigations; the Ohio Division of Mineral Resources Management (DMRM) began investigations about 30 years later.[86] In Texas, "over 16,000 horizontal shale gas wells, with multi-staged hydraulic fracturing stimulations, were completed" between 1993 and 2008.[87] In Ohio, "only one horizontal shale gas well was completed" between 1983 and 2007.[88] The findings of Texas's and Ohio's respective studies revealed that "neither the RRC [nor] the DMRM identified a single groundwater contamination incident resulting from site preparation, drilling, well construction, completion, hydraulic fracturing stimulation, or production operations at any of these horizontal shale gas wells."[89]

Another study that appeared in 2011 was "conducted by four [researchers] at Duke University."[90] They "tested 68 drinking water wells in the Marcellus and Utica shale drilling areas"[91] and found an increased level of methane in those "water samples taken closest to the gas wells."[92] The researchers did not find any evidence of drinking-water wells' contamination by chemicals used in hydraulic fracturing.[93] Although the researchers themselves described their findings as "a strong relationship between the concentration of methane in water and the

84. *About*, GROUND WATER PROTECTION COUNCIL, http://www.gwpc.org/about-us (last visited Jan. 26, 2014).

85. SCOTT KELL, STATE OIL AND GAS AGENCY GROUNDWATER INVESTIGATIONS AND THEIR ROLE IN ADVANCING REGULATORY REFORMS A TWO-STATE REVIEW: OHIO AND TEXAS 1 (2011), *available at* http://www.gwpc.org/sites/default/files/State%20Oil%20%26%20Gas%20Agency%20Groundwater%20Investigations.pdf.

86. *Id.*

87. *Id.* at 2.

88. *Id.*

89. *Id.*

90. Abrahm Lustgarten, *Scientific Study Links Flammable Drinking Water to Fracking*, PROPUBLICA (May 9, 2011, 1:00 PM), http://www.propublica.org/article/scientific-study-links-flammable-drinking-water-to-fracking; Jeffrey C. King et al., *Factual Causation: The Missing Link in Hydraulic Fracture—Groundwater Contamination Litigation*, 22 DUKE ENVTL. L. & POL'Y F. 341, 354 (2012).

91. Lustgarten, *supra* note 90.

92. *Id.*

93. King et al., *supra* note 90, at 355.

nearest gas wells,"[94] ProPublica,[95] a website claiming that it conducts "investigative journalism in the public interest," posted an article about this study, entitling it *Scientific Study* Links *Flammable Drinking Water to Fracking*.[96]

In the first session of the 113th Congress, Congressman Lamar Smith (R-Texas) introduced the EPA Hydraulic Fracturing Study Improvement Act, H.R. 2850.[97] This bill, if enacted, would require EPA reports regarding the relationship between hydraulic fracturing and drinking water "to meet the standards and procedures for the dissemination of influential scientific, financial, or statistical information."[98] It would also require that "identification of the possible impacts of hydraulic fracturing on drinking water resources included in such reports be accompanied by objective estimates of the probability, uncertainty, and consequence of each identified impact."[99] Although it is not clear whether this bill will become law,[100] its introduction serves as an acknowledgment of a "major data gap in environmental regulation."[101]

2. State Level Regulation

Exempting hydraulic fracturing from the SDWA's requirements meant that its regulation would be implemented through state laws. While some people view this approach as effective,[102] others question the adequacy of state regulation because hydraulic fracturing, combined with

94. Lustgarten, *supra* note 90.

95. *About Us*, PROPUBLICA, http://www.propublica.org/about/ (last visited Jan. 26, 2014).

96. Lustgarten, *supra* note 90 (emphasis added).

97. H.R. 2850, 113th Cong. § 1 (2013), *available at* https://beta.congress.gov/113/crpt/hrpt252/CRPT-113hrpt252.pdf.

98. *Id.* § 2.

99. *Id.*

100. "The House Science Space and Technology Committee . . . advanced the bill . . . but it stands little chance in the Democratic-controlled Senate." Nick Juliano, *Bill to Expand EPA Study Would Cost $1M per Year—CBO*, ENV'T & ENERGY DAILY (Sept. 10, 2013), http://www.eenews.net/eedaily/stories/1059986955/.

101. Hannah J. Wiseman, *Hydraulic Fracturing and Information Forcing*, 74 OHIO ST. L.J. FURTHERMORE 86, 89 (2013).

102. "[T]he states have a greater breadth and depth of knowledge on oil and gas regulation than the federal government." Wes Deweese, *Fracturing Misconceptions: A History of Effective State Regulation, Groundwater Protection, and the Ill-Conceived FRAC Act*, 6 OKLA. J.L. & TECH., 2010, at 1, 31, *available at* https://www.law.ou.edu/content/vol-6-2010.

new technological advancements, is steadily broadening its geological and geographical reach.[103]

In those states where specific regulatory programs are absent, hydraulic fracturing is regulated "through general oil and gas production regulations, policies, and practices."[104] Not only does this mean that regulations vary from state to state, but this also means that regulatory policies and practices within an individual state are likely to appear "uneven."[105] For example, in 2009, the GWPC reviewed state oil and gas regulations of 27 major oil-producing states.[106] The review focused on eight different areas, including hydraulic fracturing, which was divided into several sub-areas.[107] It covered the history of hydraulic fracturing, chemical composition of the fracture fluids, general isolation techniques, and well-treatment reporting.[108] The review recognized that other factors such as improper cementation of well casing, violation of state well-construction requirements, and improper surface-fluid handling posed bigger risks of groundwater contamination than hydraulic fracturing.[109] Additionally, it stated that 25 states required well-treatment reporting, 18 states required reports listing the materials used, 22 states required reporting of the treatment intervals, and 10 states required reports of chemicals used.[110] Based on this review, the GWPC concluded that "[s]tate oil and gas regulations are adequately designed to directly protect water resources through the application of specific programmatic elements."[111] Since the GWPC released its review, various states have made changes to their rules and regulations.[112]

Despite obvious variability of state regulations and the fact that "fracking itself [is] not as comprehensively regulated as the drilling,

103. TIEMANN & VANN, *supra* note 12, at 30. *See* Michael Zehr, *Fracking Market Continues to Grow: Despite New Regs, HF Market Expected to Reach $64 Billion by 2017*, HBW RESOURCES (Jan. 8, 2014, 8:15 AM), http://hbwresources.com/fracking-market-continues-grow-despite-new-regs-hf-market-expected-reach-64-billion-2017/.

104. TIEMANN & VANN, *supra* note 12, at 30.

105. *Id.* at 31.

106. These states are responsible for 99.9% of the nation's oil and natural gas production. GROUND WATER PROT. COUNCIL, STATE OIL AND NATURAL GAS REGULATIONS DESIGNED TO PROTECT WATER RESOURCES, 9–10 (2009), *available at* http://www.gwpc.org/resources/publications/.

107. *Id.* at 6.

108. *Id.* at 21–25.

109. *Id.* at 21–23.

110. *Id.* at 25.

111. *Id.* at 7.

112. TIEMANN & VANN, *supra* note 12, at 33.

casing, and cementing process,"[113] there are several regulatory trends common to those states that are preoccupied with the proper regulation of hydraulic fracturing.[114] One of the recent significant trends is mandatory disclosure of the chemical composition of fracturing "cocktail."[115] Currently, 21 states require companies to disclose chemicals they use.[116] Additionally, companies can voluntarily submit data to be presented by FracFocus, an online hydraulic fracturing chemical registry.[117] FracFocus helps companies in some states to meet state mandates for chemical disclosure.[118] Overall, this tendency among the states to move toward heightened regulation is increasing: "Since October 2010, more than 100 bills across 19 states have been introduced relating to hydraulic fracturing for natural gas."[119]

Another trend represents the states' desire to enhance the well construction and operation requirements.[120] When well integrity is not properly ensured, the chances of water contamination increase significantly.[121] Thus, a number of states require a particular composition of cement mixture.[122] Fifteen of the 21 states with specific casing requirements include the requirement to adhere to "a specified *minimum* depth" when casing and cementing a well.[123] In at least 26 states, including those where water availability is limited, water usage is regulated through general permitting requirements.[124] Although several

113. NATHAN RICHARDSON ET AL., THE STATE OF STATE SHALE GAS REGULATION 40 (2013), *available at* http://www.rff.org/rff/documents/RFF-Rpt-StateofStateRegs_Report.pdf.

114. *Trends*, *supra* note 77. *See also* JACQUELYN PLESS, NATURAL GAS DEVELOPMENT AND HYDRAULIC FRACTURING: A POLICYMAKER'S GUIDE 1 (2012), *available at* http://www.ncsl.org/documents/energy/frackingguide_060512.pdf.

115. *Trends*, *supra* note 77.

116. Jeff Tollefson, *Secrets of Fracking Fluids Pave Way for Cleaner Recipe*, 501 NATURE 146, 146 (2013), *available at* http://www.nature.com/journal/v501/n7466/index.html.

117. *About Us*, FRACFOCUS, http://fracfocus.org/welcome (last visited Jan. 26, 2014).

118. These states include Colorado, Oklahoma, Louisiana, Texas, North Dakota, Montana, Mississippi, Utah, Ohio, and Pennsylvania. *Id.*

119. Pless, *supra* note 7.

120. TIEMANN & VANN, *supra* note 12, at 33.

121. *How Casing Protects Groundwater*, FRACFOCUS, http://fracfocus.org/water-protection/casing-process (last visited Jan. 26, 2014).

122. RICHARDSON ET AL., *supra* note 113, at 33–34.

123. *Id.* at 32.

124. *Id.* at 40.

states have contemplated very specific water-usage restrictions, they have not yet enacted corresponding laws.[125]

In summary, states are trying to move toward "reasonable regulation"[126] of fracking; however, the necessity to balance "risks and opportunities" results in significant regulatory "heterogeneity."[127] Unfortunately, this heterogeneity is not always based on objectively different environmental conditions of the states but may be "dependent on politics, regulatory capture, economic concerns about jobs, or simply . . . unexamined assumptions."[128]

B. Earthquakes? Confused Bees? Let's Blame It All on Fracking!

For a while, complaints regarding hydraulic fracturing were limited to claims of groundwater contamination. However, with the expansion of fracking's geographical reach, the variety of accusations expanded.[129] A threat to "the communities we love,"[130] "the tornado on the horizon,"[131] "[a] monster"[132]—these are words used by some to express concerns about the negative effects of fracking. Unfortunately, accusations of this nature are often based on emotions rather than scientific research. "Whether fracking causes contamination is an important question to answer because any causes of contamination must be accurately identified in order to be remedied or prevented."[133]

In addition to being misguided, such negative publicity does indeed turn hydraulic fracturing into a "monster" and creates numerous misconceptions among ordinary people. For example, a comprehensive

125. *Id.*
126. *Trends*, *supra* note 77.
127. RICHARDSON ET AL., *supra* note 113, at 1.
128. *Id.*
129. "Most of the [regulatory] action regarding fracking occurred largely outside the perception of the mainstream public. Fracking was not making headlines. In the wake of the EPA study and EPAct 2005, as natural gas exploration and development moved forward, fracking opponents began to change this." *Fractured*, *supra* note 10.
130. Steve Everly, *How Anti-Fracking Activists Deny Science: Water Contamination*, ENERGY IN DEPTH (Aug. 13, 2013, 9:09 AM), http://energyindepth.org/national/how-anti-fracking-activists-deny-science-water-contamination.
131. Sandra Steingraber, *The Whole Fracking Enchilada: Violating the Bedrock, the Atmosphere, and Everything in Between*, ORION MAG. Sept.–Oct. 2010, at 14, 14, *available at* http://www.orionmagazine.org/index.php/articles/article/5839/.
132. *Id.* at 15.
133. Judith H. Jordan, *Proving Whether or Not Contamination Is Caused by Oil and Gas Operations* 2 (unpublished manuscript) (July 5, 2011), *available at* http://ssrn.com/abstract=1879485.

public-opinion research study conducted by the Western Energy Alliance[134] in six major production states—Colorado, Montana, New Mexico, North Dakota, Utah, and Wyoming—revealed that one of the biggest problems facing the energy industry today is "false perceptions around fracturing."[135] When rating "their level of concern about hydraulic fracturing," 31% indicated that they were either "Extremely" or "Very" concerned, 30% were "Somewhat" concerned, 25% had no concerns, and 14% indicated that they were "Unsure."[136] Common concerns included "groundwater pollution and contamination[,] [negative] environmental impact . . . [l]and instability—earthquakes/sink holes . . . [u]nknown long-term impacts . . . [negative] health impact" and concerns about undisclosed chemicals.[137] Twenty-one percent of those voters who indicated that they were "Extremely" or "Very" concerned were nevertheless unable to articulate any specific apprehensions, indicating that they did not have enough knowledge about hydraulic fracturing.[138] Voters noted their support for hydraulic fracturing with a number greater than the concern: 49%.[139] Interestingly, this figure increased significantly after "[v]oters . . . were presented with a series of positive, factual statements about [hydraulic] fracturing."[140] Among them were such statements as "[f]racturing is heavily regulated by state government[] and has been used to safely and effectively extract oil and natural gas since 1947" (showing a vote change from 49% to 71%) and "[b]efore fracturing, seven layers of cement and steel are used to protect underground sources of drinking water while drilling a well" (changing the vote from 49% to 67%).[141]

The results described above may be troublesome but not surprising. For quite some time, the debate surrounding hydraulic fracturing was one-sided: While media (particularly, entertainment industry

134. Western Energy Alliance is a group of policy analysts who focus on "federal legislative, regulatory, [and] environmental" issues. *Who We Are*, W. ENERGY ALLIANCE, http://www.westernenergyalliance.org/alliance/who-we-are (last visited Jan. 26, 2014).

135. Tim Wigley, *People Support Energy, Not Fracturing*, AM. OIL & GAS REP., May 2013, at 167, 167.

136. *Id.* at 169 fig.1 ("Concern About Fracking").

137. *Id.* at 169 tbl.1 ("Open-Ended Responses—What Concerns Voters Most About Fracking").

138. *Id.*

139. *Id.* at 170.

140. *Id.*

141. *Id.*

representatives)[142] were attacking the unscrupulous energy companies for having no regard for the environment, energy companies did little to address mushrooming accusations.[143] As a result, reasonable concerns about the safety of hydraulic fracturing have grown into a crusade against it. Now, the public holds hydraulic fracturing accountable not only for the quality of drinking water but also for bees' foraging habits.[144]

One of the latest and most significant misconceptions about hydraulic fracturing emerged after tangible seismic activity was detected in Arkansas, Colorado, Oklahoma, and Texas and attempts to link hydraulic fracturing to earthquakes.[145] Though explaining the difference between wastewater injection and fracking, NaturalNews nevertheless continued to blame this seismic activity on fracking, blurring the line once again between production activity and post-production activity.[146] This recent example of inaccurate representation of facts demonstrates how easily misled the public can be by the interchange of two absolutely distinct terms. More often than not, those who assert that hydraulic fracturing causes earthquakes do not differentiate between hydraulic fracturing and "disposal of drilling fluids in underground injection wells."[147] Even the article titled "Confirmed: Fracking Triggers Quakes and Seismic Chaos" provides the following animated GIF description of how fracking "triggers" earthquakes:

> Drillers inject high-pressure fluids into a hydraulic fracturing well, making slight fissures in the shale that release natural gas. The wastewater that flows back up with the gas is *then transported to disposal wells*, where it is injected deep into

142. Catherine Reheis-Boyd, *The "Other" Side of the Hydraulic Fracturing Debate*, *Blog*, W. STS. PETROLEUM ASS'N, https://www.wspa.org/blog/post/other-side-hydraulic-fracturing-debate (last visited Jan. 26, 2014).

143. *See* Nicolas Parke, *Focusing on Real Issues: Debunking the Rumors Surrounding Hydraulic Fracturing*, *Dateline*, JURIST (Mar. 3, 2013, 5:30 PM), http://jurist.org/dateline/2013/03/nicolas-parke-fracking-regulation.php.

144. *New Study: Shows Bees Are the Latest Victims of Fracking*, TXSHARON: BLUEDAZE: DRILLING REFORM (Oct. 3, 2013), http://www.texassharon.com/2013/10/03/new-study-shows-bees-are-the-latest-victims-of-fracking.

145. *See* David Gutierrez, *Fracking Pinpointed as Cause of Texas Earthquakes*, NATURALNEWS (Nov. 8, 2013), http://www.naturalnews.com/042824_fracking_Texas_earthquakes_gas_extraction.html.

146. *Id.*

147. *Seismologist: Fracking Doesn't Cause Earthquakes*, NEWSOK (Sept. 9, 2013, 11:12 AM), http://newsok.com/seismologist-fracking-doesnt-cause-earthquakes/article/feed/588526.

> porous rock. Scientists now believe that the pressure and lubrication of that *wastewater* can cause faults to slip and unleash an earthquake.[148]

Nevertheless, hydraulic fracturing itself only generates as much energy as "a gallon of milk falling off the kitchen counter."[149] Claiming that hydraulic fracturing—instead of wastewater injection—causes earthquakes sadly generates only another myth that is not easily disentangled.[150]

Because elected officials take into account views and perceptions held by their constituents, they can no longer ignore meritless attacks and faulty accusations, especially since "[e]ffective public communication of information plays a significant role in . . . governance."[151] Distorted perceptions fueled by inaccurate facts or partial truth affects the "course of policy-making."[152] Laws, policies, and regulations based on such perception "bear[] profound implications for energy security."[153] The regulatory system will not improve without the oil and gas industry's effort to improve communication, educate the public, and use "science-based arguments to overcome emotional claims."[154]

148. Kate Sheppard et al., *Confirmed: Fracking Triggers Quakes and Seismic Chaos*, MOTHER JONES (July 11, 2013), http://www.motherjones.com/blue-marble/2013/07/earthquakes-triggered-more-earthquakes-near-us-fracking-sites (emphasis added).

149. *Does Hydraulic Fracturing Cause Earthquakes? Facts on Geo-Seismic Activity & Natural Resource Development*, COLO. OIL & GAS ASSOC. (2012), *available at* http://www.coga.org/index.php/FastFacts/Hydraulic_Fracturing#sthash.gHZ6Dylp.dpbs.

150. Tom Shepstone, *The Five Biggest Fracking Fables*, NATURALGASNOW.ORG (July 24, 2013), http://naturalgasnow.org/five-biggest-fracking-fables.

151. ZYGMUNT J.B. PLATER ET AL., ENVIRONMENTAL LAW AND POLICY: NATURE, LAW, AND SOCIETY 100 (3d ed. 2004).

152. BUS. & INDUS. ADVISORY COMM. TO THE OECD, ADDRESSING PERCEPTION AND COMMUNICATION IN THE ENERGY SECTOR 2 (2009), *available at* http://www.biac.org/statements/energy/FIN09-04_Addressing_Perception_and_Communication_in_the_Energy_Sector.pdf.

153. *Id.*

154. Dan Holder, *CIPA Says Fracture Debate Needs More Science*, AM. OIL & GAS REP., May 2013, at 147, 149.

III. INADEQUACY OF EXISTING METHODS OF CONTAMINATION ANALYSIS AND INFEASIBILITY OF SOME PROPOSED ALTERNATIVES

A. The Inadequacy of Water Sampling Analysis

Currently, analysts predominantly rely on water chemistry to determine the causal relationship between hydraulic fracturing and groundwater contamination.[155] Although comparing pre-drilling and post-drilling water samples could be useful, baseline data regarding present concentration of chemicals in groundwater is not always available.[156] Ideally, these samples would come from "multiple geographical points, covering many environmental media, prior to the emergence of industrial activity."[157] In reality, water sampling is limited in radius and scope, focusing on "*simple* . . . indicators such as alkalinity, pH, specific conductance, TDS, chloride, sulfate, cations . . . and common metals."[158] If any subsequent groundwater contamination is detected, baseline test results (obtained through pre-drilling sampling) are crucial for determining whether drilling activities caused contamination.[159] Without this essential information, it is impossible to establish a causal link between hydraulic fracturing and groundwater contamination. First, there are certain areas where the presence of harmful chemicals in the groundwater can be attributed to natural causes.[160] Second, "[m]any parts of the United States already have . . . some level of industrial activity and residential and commercial development, all of which impact human health and environment."[161] Thus, although running pre-drilling water tests could establish baseline water quality for an area prior to any oil and gas production activities taking place, testing has to be done consistently.[162] Otherwise, incorrect

155. *See* Jordan, *supra* note 133, at 4.
156. Wiseman, *supra* note 101, at 90.
157. *Id.*
158. *State Fracking Regulations*, ALS, http://www.alsglobal.com/en/Our-Services/Life-Sciences/Environmental/Capabilities/North-America-Capabilities/USA/Oil-and-Gasoline-Testing/Oil-and-Gas-Production-and-Midstream-Support/Fracking-Regulations-by-State (last visited July 10, 2014) (emphasis added). *See* Wiseman, *supra* note 101, at 93 ("[T]he limited baseline data . . . is not comprehensive; some states only require sampling for existing pollutants in water.").
159. Wiseman, *supra* note 101, at 89–90.
160. Keith B. Hall, *Hydraulic Fracturing Contamination Claims: Problems of Proof*, 74 OHIO ST. L.J. FURTHERMORE 71, 74 (2013).
161. Wiseman, *supra* note 101, at 90.
162. *See* MARCELLUS SHALE COALITION, PRE-DRILL WATER SUPPLY SAMPLING FACTS

and inconsistent approaches to water analysis will produce data that lacks uniformity and accuracy, thus "prevent[ing] the formation of a nationwide, comparable dataset on existing water . . . quality."[163]

B. The Impracticality of Disclosing the Chemical Composition of Frac Fluids

Advocates for full disclosure of frac fluid chemical composition consider such disclosure an important and helpful tool for "determining the source of any subsequent groundwater contamination."[164] Advocates insist that by testing water from those drinking-water wells that are located close to oil and gas production wells, the landowners would be able to establish "the presence or absence of identified chemical constituents of frac fluids."[165] This assertion would be valid if states required pre-drilling (baseline) water-well testing.

The requirement that energy companies disclose what chemicals they use in frac fluids does not achieve its purported purpose of establishing a causal link between hydraulic fracturing and water contamination, since most states "do not require baseline water well testing."[166] Colorado, Ohio, Nebraska, Illinois, Michigan, New York, Virginia, and West Virginia are the only states that require pre-drilling water quality sampling.[167] Pennsylvania does not have such requirements but encourages energy companies to perform baseline tests.[168] New York proposed rules that, if adopted, would require energy companies "to sample all wells within 1000 [feet] or 2000 [feet] if none [are] available within 1000 [feet]."[169] Additionally, since energy companies consider chemical composition of frac fluids proprietary, most state disclosure statutes provide trade secret exemptions, limiting "disclosure only to the

(2013), *available at* http://marcelluscoalition.org/wp-content/uploads/2013/03/predrill_water_sampling.pdf.

163. Wiseman, *supra* note 101, at 93.

164. MATTHEW MCFEELEY, STATE HYDRAULIC FRACTURING DISCLOSURE RULES AND ENFORCEMENT: A COMPARISON 4 (2012), *available at* http://www.nrdc.org/energy/files/Fracking-Disclosure-IB.pdf.

165. *Id.*

166. RICHARDSON ET AL., *supra* note 113, at 29.

167. *Id.*

168. *Id.*; Wiseman, *supra* note 101, at 92.

169. ROBERT W. PULS, OVERVIEW OF STATE PRE-DRILL WATER QUALITY TESTING 11 (2013), *available at* http://www.gwpc.org/sites/default/files/event-sessions/Puls_Robert_0.pdf.

relevant state regulator."[170] The result of such selective disclosure is obvious: "[C]ompanies are still operating under their own risk assessments and not disclosing all of the information that might be needed for independent verification."[171]

C. The Non-Viability of Banning Hydraulic Fracturing

There are several reasons why banning hydraulic fracturing is not a viable solution. First, fierce advocates for complete prohibition of hydraulic fracturing[172] fail to recognize that the overall process of "developing a natural gas or oil well" is not risk-free.[173] It is accompanied by various dangers, including the possibility of groundwater pollution: "The challenges of sealing off the groundwater and isolating it from possible contamination . . . are not unique to hydraulic fracturing."[174] Such well-integrity incidents as cement failure, casing rupture, and well-head failure could result in significant chemical leakages and potentially contaminate drinking water.[175] Although hydraulic fracturing is only one of the multiple steps generally pursued in developing a well, lack of accurate information and an abundance of inaccurate information cause people to believe that fracturing a well and drilling a well are two identical processes.[176] Consequently, whenever there is seepage of chemicals, it is automatically assumed that fracturing is to blame.

What proponents of complete prohibition of fracturing fail to realize is that fracturing takes place at a much later stage of the well's life. Before a well can withstand fracturing operations, the layers of casing need to be added.[177] Thus, proper casing design is paramount[178] because

170. Matthew F. Prewitt & Katherine G. Cisneros, *Protecting Fracking Fluids Trade Secrets: From the Experts*, CORP. COUNS. (Oct. 7, 2013), http://www.corpcounsel.com /id=1202622422789.

171. Tollefson, *supra* note 116, at 146.

172. *See generally* Whitacre, *supra* note 1, at 336–37 (praising France's 2011 ban on hydraulic fracturing in order to become "the leader in environmental protectionism").

173. TIEMANN & VANN, *supra* note 12, at 5.

174. *Id.*

175. *Id.*

176. "The 'hydraulic fracturing' debate also has been complicated by terminology. Many who express concern over the potential environmental issues associated with hydraulic fracturing do not differentiate the well stimulation process of 'frac[k]ing' from the broader range of activities associated with unconventional oil and gas exploration and production." *Id.* at 6.

177. *How Does Casing Work?*, RIGZONE, http://www.rigzone.com/training/insight.asp

it prevents any drilling fluids from "zonal migration"[179] and supports the wellbore structure. Carefully designed casing allows the well to endure a variety of pressures and forces that it will encounter in the process of drilling.[180] Since hydraulic fracturing pumps fluid under pressure, inadequate casing could result in leakage of frac fluid.[181] Does it mean that banning hydraulic fracturing will make it possible to eliminate the issue of poor casing designs? or the risk of blowouts? or the possibility of human error? Taking into consideration the totality of risks associated with energy production, complete prohibition of fracturing is unlikely to eliminate all those risks that are frequently, although not always correctly, attributed to fracking. Additionally, such an extreme view regarding the destiny of hydraulic fracturing in this country does not seem to reflect public opinion on the issue. For example, a survey of 1,000 voters conducted across the country[182] revealed that "a majority (59%) would vote to allow fracturing" in their state,[183] and less than half of that number—28%—would support "statewide bans."[184] Thirteen percent of voters would not lean one way or the other.[185]

The second reason against complete prohibition of fracturing rests in its countless benefits and the pervasive nature of its application. Currently, over 90% of new oil and gas wells are being hydraulically fractured.[186] In view of declining availability of easily extractable oil and gas, hydraulic fracturing marked the beginning of "[t]he revolution" in domestic production.[187] It made America more energy independent. For example, "U.S. net oil imports have declined from a 60 percent peak in 2005 to 40 percent" in 2013.[188] Where other supply sources have failed, the extensive shale oil and gas exploration, made possible by hydraulic

?insight_id=333&c_id=24 (last visited July 30, 2014).

178. Deweese, *supra* note 102, at 17.

179. *Id.* at 18.

180. *Id.*

181. "Casing is used . . . b) to prevent pollution of fresh water reservoirs." HYNE, *supra* note 39, at 69.

182. Wigley, *supra* note 135, at 167.

183. *Id.* at 170.

184. *Id.*

185. *Id.*

186. SIERRA CLUB: ATLANTIC CHAPTER, HYDRAULIC FRACTURING AND THE FRAC ACT: FREQUENTLY ASKED QUESTIONS 1 (2011), *available at* http://atlantic2.sierraclub.org/sites/newyork.sierraclub.org/files/documents/2013/02/FracAct_Facts_3_11.pdf.

187. *U.S. Must Resolve Challenges of Energy Success, Yergin Says*, AM. OIL & GAS REP., May 2013, at 162, 162 [hereinafter *Yergin*].

188. *Id.* at 165.

fracturing, has been fueling U.S. energy production.[189] According to the senior market analyst at Price Futures Group, the U.S. is "changing the face of the global energy market."[190] Had it not been "producing the amount of oil [it is]," such events as the Syrian crisis, or the Libyan reduction of oil production, would have had a much more serious influence on the price of oil and on the economic stability of the country.[191]

Not only did hydraulic fracturing enhance "domestic energy supplies,"[192] it also significantly improved local communities in various states by creating "new direct and indirect jobs."[193] In 2013, it was partly responsible for the creation of 1.7 million jobs in the oil and gas industry.[194] This number could increase to 3.5 million by 2035.[195] Hydraulic fracturing brought a "manufacturing renaissance"[196] to the United States, revitalizing its "petrochemical, steel and other manufacturing industries and reinvigorat[ing] American ingenuity and economic competitiveness."[197] It also increased average American household income due to "lower energy costs and a related decrease in prices of other goods and services."[198]

In addition to undeniable domestic benefits, unconventional oil and gas production, which became possible due to a combination of horizontal drilling and fracturing, has significant "geopolitical implications."[199] Not only has there been an increase in gas production,

189. *Id.*

190. Daniel P. Collins, *USA: Energy Producer for the World?*, FUTURES, Oct. 2013, at 20, 20.

191. *Id.*

192. *Energy 101: Hydraulic Fracturing*, ENERGY TOMORROW, http://energytomorrow.org/energy-101/hydraulic-fracturing (last visited Jan. 27, 2014).

193. Paul Driessen, *Fracking Brings Employment and Economic Revival*, TOWNHALL.COM (July 27, 2013, 12:01 AM), http://townhall.com/columnists/pauldriessen/2013/07/27/fracking-brings-employment-and-economic-revival-n1648970/page/full.

194. *Yergin*, *supra* note 187.

195. Press Release, HIS, Unconventional Oil and Gas Production Supports More Than 1.7 Million U.S. Jobs Today; Will Support 3 Million by the End of the Decade, HIS Study Finds (Oct. 23, 2012), *available at* http://press.ihs.com/press-release/commodities-pricing-cost/unconventional-oil-and-gas-production-supports-more-17-millio.

196. *Yergin*, *supra* note 187.

197. Driessen, *supra* note 193.

198. Mohammed Aly Sergie, *Hydraulic Fracturing (Fracking)*, COUNCIL ON FOREIGN REL. (Oct. 15, 2013), http://www.cfr.org/energy-and-environment/hydraulic-fracturing-fracking/p31559.

199. MARJOLEIN DE RIDDER & SIJBREN DE JONG, THE "GAME CHANGER": GEOPOLITICAL IMPLICATIONS OF THE "SHALE GAS REVOLUTION" 9 (2013), *available at*

but the production of shale oil in the United States has also experienced growth.[200] It is possible that by 2030, "the U.S. may become the world's largest oil producer, overtaking Saudi Arabia."[201] This leap from being "a net consumer . . . to being a net producer"[202] may allow the United States to reorient its foreign policy in the Middle East, where it has traditionally had strategic interests related to energy resources, toward other regions of the world, such as Asia or the Pacific.[203]

In light of all the facts discussed above, complete prohibition of hydraulic fracturing would be neither feasible nor prudent. It would clearly have significant negative consequences for the national economy and adversely affect foreign policy by preventing the United States from diversifying its interests abroad. A total ban would also be an inadequate measure to address risks associated with general wells' development.

IV. TRACERS AS AN EFFECTIVE SOLUTION TO UNSOUND SCIENCE BEHIND REGULATION OF HYDRAULIC FRACTURING

A. What Tracers Are and What They Would Solve

Excessive regulation that lacks clarity and is based on a variety of inaccuracies rather than hard evidence could hamper the progress of the entire industry. Unless there is conclusive evidence that proves or disproves the existence of a causal relationship between hydraulic fracturing and ground water contamination, the debate surrounding fracking will continue to cause confusion. Does this mean that fracking is doomed to remain the subject of this "Guessing Game" forever?[204] Not if energy companies are required to inject harmless tracers into frac fluids.

http://www.atlcom.nl/upload/AP_6_2013_De_Ridder___De_Jong.pdf.

200. *Id.*

201. *Id.*

202. *Id.* at 9–10.

203. *Id.* at 10.

204. Carol Linnitt, *DNA Tracers Could Put End to Fracking Guessing Game on Water Contamination*, DESMOGBLOG.COM (Jan. 9, 2013, 5:00 AM), http://www.desmogblog.com /2013/01/09/dna-tracers-could-put-end-fracking-guessing-game-water-contamination.

Tracers are "substance[s] added to reservoir fluids to permit the movements of the fluid to be followed or traced."[205] Once fluids have traveled some distance from the "point of injection," analysts can map out the fluid routes.[206] Currently, tracers consist of either chemical dyes or radioactive substances and are being used to estimate flowback efficiency,[207] wells' vertical flow,[208] and vertical communication between zones.[209]

Requiring energy companies to inject tracers into frac fluids could potentially end the discussion about the safety of hydraulic fracturing since tracers could reliably link "any alleged contamination . . . to its source."[210] However, since the safety of radioactive substances could, in itself, be an issue, there are other options available that are "stable, non-invasive, non-toxic"[211] and "simple and cheap to identify."[212] For example, BaseTrace, a company created by recent Duke alumni, is developing an environmentally friendly tracer that would be unique to each individual well and would serve as its "fingerprint":[213] "The tracer [would be] composed of inexpensive, inert strands of resilient DNA mixed into hydraulic fracturing fluid."[214] According to BaseTrace's CEO and founder, Justine Chow, if groundwater demonstrates any signs of a DNA tracer, a simple water sample would immediately reveal those signs and pinpoint the well which contaminated the water.[215] In other words, each well would have "harmless chemical I.D. tags" in its

205. A DICTIONARY FOR THE OIL AND GAS INDUSTRY, *supra* note 40, at 284.

206. *Id.*

207. MAHMOUD ASADI ET AL., MONITORING FRACTURING FLUID FLOWBACK WITH CHEMICAL TRACERS: A FIELD CASE STUDY 1 (2002), *available at* https://www.onepetro.org/conference-paper/SPE-77750-MS.

208. HYNE, *supra* note 39, at 533.

209. ASADI ET AL., *supra* note 207, at 1.

210. John Laumer, *Tracers in the Hydraulic Fracturing Fluid: Accountability for Marcellus Shale Drillers*, TREEHUGGER (Dec. 24, 2009), http://www.treehugger.com/corporate-responsibility/tracer-in-the-hydraulic-fracturing-fluid-accountability-for-marcellus-shale-drillers.html.

211. Andrew C. Revkin, *Ideas to Watch in 2013: Traceable Gas—Drilling Fluids*, N.Y. TIMES (Jan. 8, 2013, 11:31 AM), http://dotearth.blogs.nytimes.com/2013/01/08/ideas-to-watch-in-2013-traceable-frackin-fluids/?_php=true&_type=blogs&_php=true&_type=blogs&_r=1.

212. Linnitt, *supra* note 204.

213. Imani Moise, *Duke Alums Create DNA Tracer Prototype*, CHRONICLE (Apr. 29, 2013), http://www.dukechronicle.com/articles/2013/04/29/duke-alums-create-dna-tracer-prototype.

214. Linnitt, *supra* note 204.

215. Moise, *supra* note 213.

contents, making "the fluids . . . individually identifiable."[216] It would be particularly useful for long-term identification of contamination issues over significant distances because chemicals used in such tags would not "react with each other . . . and [would] not degrade with temperature or time."[217]

Another company, called FracEnsure, has taken a different approach and created a tracer that consists of magnetic nanoparticles.[218] These particles, which are similar to rust, also contain "naturally occurring metals added in varying amounts to create a unique signature."[219] If a water sample contains these particles, running it through a magnetic separator would not only reveal contamination but would also "identify specifically which well or set of wells they came from."[220]

In addition to "ending fights over the source of any subsequent contamination of water supplies in a drilling area,"[221] mandatory introduction of tracers into frac fluids will have a number of other benefits. First, it will eliminate meritless lawsuits brought by landowners who claim that "wells must have caused the contamination of their water . . . simply because the . . . wells are located nearby."[222] At the same time, plaintiffs whose water has indeed been contaminated by local oil and gas production will be able to use tracers to establish a "factual nexus between the hydraulic fracturing activity and the purported contamination"—an element necessary for successfully demonstrating oil and gas producers' liability.[223] Furthermore, energy companies could use tracers to "prove they're not the source of the pollution."[224]

Second, the uniform use of tracers could improve public trust through facilitating a greater accountability of energy companies without imposing on them an undue burden of rebutting groundless accusations.[225] Since each well will be more readily identifiable due to

216. Revkin, *supra* note 211.
217. ASADI ET AL., *supra* note 207, at 1.
218. Dave Levitan, *Fingerprinting Fracking Fluid*, CONSERVATION (June 10, 2013), http://conservationmagazine.org/2013/06/fingerprinting-fracking-fluid.
219. *Id.*
220. *Id.*
221. Revkin, *supra* note 211.
222. King et al., *supra* note 90, at 346.
223. *Id.*
224. Tay Wiles, *New Tech to Trace Fracking Fluid Could Mean More Accountability*, GOAT BLOG HIGH COUNTRY NEWS (Aug. 22, 2013, 2:55 PM), http://www.hcn.org/blogs/goat/fracking-technology-oil-and-gas-drilling-regulation.
225. Laumer, *supra* note 210.

tracers, companies will find it harder to deny responsibility if a tracer ends up in an aquifer or a drinking-water well. Furthermore, a company whose well-contaminated drinking water would be responsible for the clean-up. For instance, the EPA could enforce accountability through the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA).[226] CERCLA allows the EPA "to force parties responsible for environmental contamination to clean it up or to reimburse . . . for response or remediation costs incurred by [the] EPA."[227]

In addition to strengthening public trust, tracers may eliminate the issue of revealing trade secrets and proprietary information. Ever since state authorities started either requiring or encouraging the disclosure of the chemical composition of frac-fluid blends, energy companies have been voicing their concern because they often see that kind of information as proprietary.[228] Consequently, "company leaders may be more willing to let an outside party trace their fluid than they are to give away their specific formula to fracking fluid."[229]

Finally, tracers could potentially reduce countless regulatory hurdles that energy companies must overcome to access areas with strict regulatory requirements. If federal agencies require tracers to be injected into frac fluids, state governments can eliminate various local requirements, such as chemical disclosure requirements or requirements for well owners and operators who, in order to obtain a permit to extract natural gas, must provide detailed information regarding "the formation depth, geological characteristics, stimulation fluid additives and compounds."[230]

226. 42 U.S.C. §§ 9601–75 (2012).

227. *Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), Agriculture*, ENVTL. PROTECTION AGENCY, http://www.epa.gov/oecaagct/lcla.html#Summary_of_CERCLA (last updated June 27, 2012).

228. Jarit C. Polley, Comment, *Uncertainty for the Energy Industry: A Fractured Look at Home Rule*, 34 ENERGY L.J. 261, 266 (2013).

229. Wiles, *supra* note 224.

230. Pless, *supra* note 7 ("In Illinois, Senate Bill 2058 . . . would amend the Drilling Operations Act to require permit applications to extract natural gas from shale using well stimulation fluids . . . . Well owners and operators would have to provide specific information about the formation depth, geological characteristics, stimulation fluid additives and compounds, and more.").

B. Introduction of Tracers into Frac Fluids Should Be Mandatory and Implemented Under the SDWA

Tracers are sporadically used to study whether hydraulic fracturing contaminates groundwater. For example, in 2012, the Department of Energy's National Energy Technology Laboratory (NETL) started injecting experimental tracers into frac-fluid blends "at an undisclosed drill site with eight wells in Greene County, Pennsylvania."[231] The NETL monitored the eight wells and released preliminary findings, demonstrating that "potentially dangerous substances stayed about a mile away from surface drinking water supplies."[232] These findings, albeit preliminary, are promising. Not only do they demonstrate lack of migration of frac fluids into surface drinking water, but they also show that tracers can be used safely and effectively to establish a connection, or absence thereof, between hydraulic fracturing and groundwater contamination.

Despite these efforts by the Department of Energy, isolated and limited application of tracers is not going to solve public anxiety over false claims about fracking. Localities where wells are drilled differ geologically from state to state. Conditions surrounding the drilling of every well are unique, causing "[t]he mix of chemicals [used in frac fluids] to vary by company and region."[233] Because many variables are at play, solving the problem of unsound science behind regulation of hydraulic fracturing means making the use of tracers mandatory at the federal level.

1. The EPA Should Regulate Hydraulically Fractured Production Wells Under the SDWA by Aggregating Production Wells into Class VII

Several steps must precede making tracers mandatory. First, hydraulic fracturing should be regulated by the EPA under the SDWA. Currently, the EPA regulates only those hydraulic fracturing operations

231. Jim Willis, *DOE Finds Fracking Fluids Don't Migrate to Water Supplies*, NATURALGASNOW (July 20, 2013), http://naturalgasnow.org/fracking-fluids-dont-migrate-to-water-supplies-the-doe-finds/.

232. Kevin Begos, *DOE Study: Fracking Chemicals Didn't Taint Water*, *Big Story*, ASSOCIATED PRESS (July 19, 2013, 5:48 PM), http://bigstory.ap.org/article/ap-study-finds-fracking-chemicals-didnt-spread/.

233. *Id.*

that use diesel fuel.[234] In 2010, the EPA stipulated that hydraulic fracturing operations injecting diesel fuel underground would be "subject to Class II permit requirements under the SDWA."[235] Although some people argue that wells using hydraulic fracturing should be categorized as Class II wells, such an approach ignores the crucial distinction between production wells (wells that use fracking the most) and injection wells (wells that fall into Class II). Bearing this distinction in mind, production wells should be aggregated into a separate class: Class VII wells. Based on the division of authority between the EPA and the states, described in Part II of this Note, production wells could be regulated either directly by the EPA (in those states where it already oversees the implementation of the entire UIC program) or by the states through their primary enforcement authority (provided these states will satisfy the new requirement to inject tracers into frac fluids).

Section 300h-4 is another reason why production wells using hydraulic fracturing should not be added to Class II.[236] Since the requirement to inject tracers will be mandatory under regulations promulgated by the EPA in § 300h, allowing states to regulate production wells under § 300h-4 could potentially defeat the whole purpose of the statutory reform. It is possible that instead of revising their UIC programs to require an injection of tracers, the states could choose to demonstrate that their existing programs are sufficiently effective under § 300h-4.[237] Although the EPA may generally require that in order to obtain approval state programs "address hydraulic fracturing," it is unclear whether, under the more lax provisions of § 300h-4 (as it is currently worded), it would be possible to make the injection of tracers into frac fluids mandatory.[238]

2. Permitting Requirements for Class VII Wells Should Mandate the Introduction of Tracers into Fracturing Fluids

For this new class of wells, the EPA would adopt permitting

234. Jason Obold, Note, *Leading by Example: The Fracturing Responsibility and Awareness of Chemicals Act of 2011 as a Catalyst for International Drilling Reform*, 23 COLO. J. INT'L ENVTL. L. & POL'Y 473, 484 (2012).

235. TIEMANN & VANN, *supra* note 12, at 21.

236. 42 U.S.C. § 300h-4 (2012).

237. *UIC Program Primacy*, ENVTL. PROTECTION AGENCY, http://water.epa.gov/type/groundwater/uic/Primacy.cfm#option (last updated Aug. 1, 2012).

238. TIEMANN & VANN, *supra* note 12, at 27.

requirements that could replicate those currently in place for hydraulic fracturing operations involving the use of diesel fuels. The introduction of tracers into frac fluids could be required either statutorily (in which case the SDWA would have to be amended) or as part of "testing and monitoring obligations [imposed by the EPA] with respect to [every] well."[239] Some energy companies have voiced concerns that requiring "a separate permit . . . each time a well is hydraulically fractured" would "repeatedly disrupt[] oil and gas production activities."[240] Although permits to frac wells would be required, it does not mean that energy companies would have to jump through additional hoops. On the contrary, such requirements as giving notice and receiving state approval before fracturing, disclosing chemicals, and submitting separate analyses[241] could be eliminated completely, thus making the entire process less burdensome.

Taking into consideration the inherently local nature of hydraulic fracturing, states' reservations regarding federal regulation are understandable. However, the SDWA specifically requires that the EPA's UIC regulations must account for "varying geologic, hydrological, or historical conditions in different States and in different areas within a State."[242] Moreover, although the EPA has general authority to regulate the UIC program, the SDWA allows states to take over the implementation process and even introduce more stringent regulatory requirements that are tailored to states' individual conditions and needs.

C. Tracers Should Be Administered and Monitored by Third-Party Contractors

"Who would be on site to verify the tracer and would they be tied to government agencies who can be bought off such as [sic] an EPA report?"[243] Doubtful comments, such as the one quoted above, are

239. *Id.* at 21.
240. *Id.* at 18.
241. *Id.* at 16–18 (discussing Alabama's regulatory requirements regarding hydraulic fracturing).
242. 42 U.S.C. § 300h(b)(3)(A) (2012).
243. Bianca, Comment to *Tracers in the Hydraulic Fracturing Fluid: Accountability for Marcellus Shale Drillers*, TREEHUGGER (Mar. 9, 2010, 6:29 PM), http://www.treehugger.com/corporate-responsibility/tracer-in-the-hydraulic-fracturing-fluid-accountability-for-marcellus-shale-drillers.html#comment-38792640.

understandable and not unreasonable. An abundance of negative publicity, coupled with lack of a clear understanding of how the process of hydraulic fracturing really works, affects public trust.[244] In order to eliminate any apprehensions that energy companies will interfere with the proper injection of tracers into frac fluids,[245] this task should be performed by independent, licensed contractors. Not only will they oversee the injection process, independent licensed contractors will also systematically monitor wells to accurately record the migration of frac fluids. Additionally, independent contractors could audit companies' compliance with federal requirements and report their findings to the agency.

Energy companies will be interested in cooperating[246] because continuing uncertainty surrounding the causal relationship between hydraulic fracturing and groundwater contamination could inhibit shale gas exploration, a detriment not only to individual oil and gas producers but also to the entire energy industry of the country.[247] Additionally, with independent contractors overseeing the process, it will be difficult for opponents of fracturing to accuse energy companies of manipulating the results.

V. CONCLUSION

The energy industry has been successfully utilizing hydraulic fracturing for more than 60 years. However, after certain technological advancements significantly increased the geographical reach of hydraulic fracturing, bringing it into more populated localities, the public has developed apprehensions regarding the procedure's safety. Unfortunately, existing methods of analysis are unable to address these fears by demonstrating the absence of a causal link between fracturing and the risks that people generally associate with it. Due to uncertainty, hydraulic fracturing has become a subject of heated debate that is

244. *See* Parke, *supra* note 143.

245. Wiles, *supra* note 224.

246. *Safety First, Fracking Second, Energy & Sustainability*, SCI. AM. (Oct. 12, 2001), http://www.scientificamerican.com/article/safety-first-fracking-second/?page=2 (stating that adding tracers to frac fluid is "in the industry's interest to accept improved oversight").

247. John Miller, *What Would Be the Impacts of Shutting Down All Fracking?*, THEENERGYCOLLECTIVE (Sept. 18, 2013), http://theenergycollective.com/jemillerep/274626/what-would-be-impacts-shutting-down-all-fracking.

affecting not only the public but also national and state lawmakers, who are mindful of public sentiments yet unwilling to jeopardize continuing energy development. The uncertainty regarding the critical issue of water contamination could be resolved by federally mandating that tracers be introduced into frac fluids. This would not only definitively answer the question of causation but would also help eliminate unnecessary and burdensome regulations while improving the accountability of the energy industry.