Frack to the Future: Considering a Strict Liability Standard for Hydraulic Fracturing Activities

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As the United States continues to pursue its goal of energy independence, many scholars, policymakers, and analysts have pointed to an increase in domestic production of natural gas as a necessary bridge between imported oil and domestic renewable energy.[1] Natural gas is frequently held out as a short-term solution to America's dependence on foreign oil while renewable energy technology continues to be developed and improved.[2] Natural gas is also abundant in the United States, with a total resource base of over 1.8 quadrillion cubic feet,[3] and has the potential to be used as automobile fuel in addition to its more traditional uses such as electricity generation.[4]

Just as natural gas is important to America's energy future, the Marcellus shale formation—a massive region covering large portions of Pennsylvania, New York, Ohio, and West Virginia[5]—is important to America's natural gas future. In 2008, geologists estimated that the formation contained more than 500 trillion cubic feet of natural gas,[6] of which 50 trillion are recoverable with current technology—enough to cover nearly two years of total U.S. consumption and increase the value of American energy resources by $1 trillion.[7] The Marcellus is an "unconventional" gas play, meaning that a horizontal drilling technique called hydraulic fracturing (also called "fracking" or "fracing") is necessary to extract the gas.[8] The U.S. Environmental Protection Agency ("EPA") estimates that over twenty percent of the nation's natural gas supply will be drawn from unconventional shale sources such as the Marcellus by 2020.[9]

Fracking is a controversial activity. The process involves the injection of water, sand, and chemicals deep into the ground at high pressure[10] and has been blamed for drinking water contamination in as many as eleven states.[11] This potential for environmental harm has been the subject of careful study[12] and recent media attention.[13]

At present, fracking is not covered by most forms of federal environmental regulation; it was exempted from the Safe Drinking Water Act ("SDWA") in 2005,[14] and oil- and

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1. *See, e.g.*, John Podesta & Timothy E. Wirth, Ctr. for Am. Progress, Natural Gas: A Bridge Fuel for the 21st Century (2009), *available at* http://www.americanprogress.org/issues/2009/08/pdf/naturalgasmemo.pdf; Joel Kirkland, *Natural Gas Could Serve as a 'Bridge' Fuel to Low-Carbon Future*, Sci. Am., June 25, 2010, http://www.scientificamerican.com/article.cfm?id=natural-gas-could-serve-as-bridge-fuel-to-low-carbon-future; *The Plan*, Pickens Plan, http://www.pickensplan.com/theplan2/ (last visited Oct. 31, 2011).
2. *See, e.g.*, *The Plan*, *supra* note 1.
3. Press Release, Colo. Sch. of Mines, Potential Gas Committee Reports Unprecedented Increase in Magnitude of U.S. Natural Gas Resource Base (June 18, 2009), http://www.mines.edu/Potential-Gas-Committee-reports-unprecedented-increase-in-magnitude-of-U.S.-natural-gas-resource-base.
4. *See* Cal. Energy Comm'n, *Compressed Natural Gas (CNG) as a Transportation Fuel*, Consumer Energy Center, http://www.consumerenergycenter.org/transportation/afvs/cng.html (last visited Oct. 31, 2011); *CNG Vehicles*, CNG Now!, http://www.cngnow.com/EN-US/Vehicles/Pages/default.aspx (last visited Oct. 31, 2011).
5. For the U.S. Geological Survey's map of the Marcellus formation, see *USGS Marcellus Shale Sedimentary Bedrock Formation*, Penn St. Extension, http://extension.psu.edu/naturalgas/maps/devonian/usgs-map/view (last visited Oct. 31, 2011).
6. David Bertola, *Researchers: Shale Holds Vast Supply of Natural Gas*, Buffalo Bus. First, Feb. 11, 2008, http://www.bizjournals.com/buffalo/stories/2008/02/11/story2.html?b=1202706000%255E1587557.
7. *Unconventional Natural Gas Reservoir Could Boost U.S. Supply*, Penn St. Live (Jan. 17, 2008), http://live.psu.edu/story/28116.
8. *Id.*
9. Office of Research & Dev., EPA, EPA/600/F-10/002 Hydraulic Fracturing Research Study 1 (2010), *available at* http://www.epa.gov/safewater/uic/pdfs/hfresearchstudyfs.pdf.
10. *Id.*; *Hydraulic Fracturing 101*, Halliburton, http://www.halliburton.com/public/projects/pubsdata/Hydraulic_Fracturing/fracturing_101.html (last visited Oct. 31, 2011).
11. *See* Amy Mall, *Incidents Where Hydraulic Fracturing Is a Suspected Cause of Drinking Water Contamination*, Nat. Resources Def. Council (Dec. 22, 2010), http://switchboard.nrdc.org/blogs/amall/incidents_where_hydraulic_frac.html.
12. *E.g.*, Office of Ground Water & Drinking Water, EPA, EPA 816-R-04-003, Evaluation of Impacts to Underground Sources of Drinking Water by Hydraulic Fracturing of Coalbed Methane Reservoirs ch. 6 (2004), *available at* http://water.epa.gov/type/groundwater/uic/class2/hydraulicfracturing/wells_coalbedmethanestudy.cfm; Bureau of Oil & Gas Regulation, N.Y. State Dep't of Envtl. Conservation, Draft Supplemental Generic Environmental Impact Statement on the Oil, Gas and Solution Mining Regulatory Program ch. 6 (2009), *available at* http://www.dec.ny.gov/energy/58440.html.
13. *E.g.*, *60 Minutes* (CBS television broadcast Nov. 14, 2010), *available at* http://www.cbsnews.com/video/watch/?id=7054210n; *CSI: Crime Scene Investigation: Fracked* (CBS television broadcast Nov. 11, 2010); Gasland (Josh Fox 2010).
14. Energy Policy Act of 2005 § 322, 42 U.S.C. § 300h(d) (Supp. V 2005) (amending Safe Drinking Water Act (SDWA), 42 U.S.C. § 300h (2000)).

gas-related wastes have been exempt from the Resource Conservation and Recovery Act ("RCRA") since 1980.[15] Federal exemptions like these have left responsibility for the regulation of fracking to state governments, and the adequacy of state regulation is in question even in Pennsylvania, which has relatively strong regulations compared to other states.[16] Industry groups, however, maintain that the process is safe and does not contaminate groundwater, and that further regulation is unnecessary.[17]

This note argues that an effective way to control fracking's risks to the environment and public health while preserving the economic potential of shale gas is to define fracking as an "abnormally dangerous activity"[18] and hold drilling companies strictly liable for environmental damage caused by fracking. Part I of this note explains how fracking works, discusses its environmental effects, and introduces case studies in Susquehanna County, Pennsylvania. Part II provides an overview of the federal statutory and regulatory approach to fracking. Part III discusses the common law tort doctrines that presently apply to fracking, including trespass, negligence, and nuisance. Part IV analyzes the abnormally dangerous activity doctrine, the extent to which it may apply to fracking, and the consequences of applying the doctrine instead of the default negligence standard. Finally, Part V concludes that applying strict liability can effectively address the environmental and public health risks of fracking while preserving its long-term economic potential.

I. Background

A. *Spills and Accidents Associated with Fracking Have Caused Drinking Water Contamination: Case Studies in Susquehanna County, Pennsylvania*

In 2008, several residents of Dimock, a small town in northeastern Pennsylvania, reported that their water had turned brown and was ruining their dishes and clothing.[19] Residents living near natural gas wells experienced dizziness while taking showers, and tests performed by the Pennsylvania Department of Environmental Protection ("DEP") found elevated levels of methane, iron, and aluminum in the water.[20] Residents also alleged that the levels of chemicals such as trimethylbenzene and toluene in the water exceeded state standards.[21] Elsewhere in Susquehanna County, other families near natural gas wells reported barium, manganese, and strontium in their drinking water.[22] At the time, however, the director of DEP's Bureau of Oil and Gas Management remarked, "What do you have to be afraid of? [Fracking fluid is] only sand and water."[23]

In September 2009, a series of fracking fluid spills occurred at the site of a natural gas well near Dimock.[24] Cabot Oil and Gas ("Cabot"), the operator of the well, used hay bales and earth dams in an effort to contain the spill,[25] and determined that migration of fluid to surface waters was unlikely.[26] Nevertheless, the fluid reached a nearby creek and wetland.[27]

DEP, which had been investigating reports of contamination in the region since January of that year,[28] issued an

15. Solid Waste Disposal Act Amendments of 1980 § 7, 42 U.S.C. § 6921(b)(2)(A) (2006) (creating presumption of no regulation for oil- and gas-related waste unless EPA determines that regulation is needed; such regulations take effect only when authorized by Act of Congress). For an in-depth account of this deregulation, see James R. Cox, *Revisiting RCRA's Oilfield Waste Exemption as to Certain Hazardous Oilfield Exploration and Production Wastes*, 14 Vill. Envtl. L.J. 1 (2003).
16. *See* Hannah Wiseman, *Regulatory Adaptation in Fractured Appalachia*, 21 Vill. Envtl. L.J. 229, 260, 262–67 (2010) (discussing Pennsylvania's strong regulations in comparison to other Marcellus states); Steve Mocarsky, *Report: Firms Commit 1,500 Infractions in Pa. in 30 Months*, Wilkes-Barre Times Leader, Oct. 29, 2010, http://www.timesleader.com/news/hottopics/shale/Report__Firms_commit_1_500_infractions_in_Pa__in_30_months_08-02-2010.html (featuring different opinions from land trust and industry officials on whether Pennsylvania should strengthen its regulations); Edward G. Rendell & John Hanger, Letter to the Editor, N.Y. Times, Mar. 6, 2011, at 9, *available at* http://www.nytimes.com/2011/03/06/opinion/l06gas.html?_r=1&ref=waterpollution ("Pennsylvania has the strongest enforcement program of any state with gas drilling.").
17. *E.g.*, Am. Petroleum Inst., *Hydraulic Fracturing*, Energy Tomorrow, http://energytomorrow.org/energy/hydraulic-fracturing/#/type/all (last visited Nov. 1, 2011) ("[Fracking] has a strong environmental track record and is employed under close supervision . . . . Studies by [EPA] and the Ground Water Protection Council (GWPC) have confirmed no direct link between hydraulic fracturing operations and groundwater contamination."); *Regulation and Safety*, Energy in Depth, http://www.energyindepth.org/in-depth/frac-in-depth/regulation-and-safety/ (last visited Nov. 3, 2011) ("Hydraulic fracturing is a safe, well-regulated, environmentally sound practice that has been employed over one million times without a single incidence of drinking water contamination."); *Water*, Marcellus Shale Coalition, http://marcelluscoalition.org/marcellus-shale/protection/water/ (last visited Nov. 1, 2011) ("A series of environmental safeguards are included . . . . [T]hese controls protect surface water in the area of the well from runoff and groundwater from impacts associated with drilling operations.").
18. Restatement (Second) of Torts §§ 519–20 (1979).
19. Christopher Bateman, *A Colossal Fracking Mess*, Vanity Fair (June 21, 2010), http://www.vanityfair.com/business/features/2010/06/fracking-in-pennsylvania-201006.
20. *Id.*
21. Second Amended Complaint ¶ 47, Fiorentino v. Cabot Oil & Gas Corp., No. 3:09-cv-02284-TIV (M.D. Pa. May 17, 2010), 2010 WL 2070478. These chemicals are also subject to federal reporting requirements. Emergency Planning and Community Right-to-Know Act (EPCRA) of 1986 § 313, 42 U.S.C. § 11,023 (2006); 40 C.F.R. § 372.65 (2010). Toluene and many of its derivatives are also subject to the reporting requirements of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). 40 C.F.R. § 302.4 (2008). For a comprehensive list of all chemicals covered by EPCRA, CERCLA, and the Clean Air Act, see Office of Emergency Mgmt., EPA, EPA 550-B-10-001, List of Lists (2010), *available at* http://www.epa.gov/oem/docs/chem/list_of_lists_05_07_10.pdf.
22. Complaint ¶ 16, Berish v. Sw. Energy Prod. Co., No. 3:10-cv-01981 (M.D. Pa. Sept. 14, 2010), 2010 WL 4230599.
23. Bateman, *supra* note 19.
24. Parker Waichman Alonso LLP, *Dimock, a Town Fractured*, Water Contamination from Shale, http://www.water-contamination-from-shale.com/story_3.php (last visited Nov. 2, 2011); URS Corp., Engineering Study for Submittal to Pennsylvania Department of Environmental Protection, in Response to Order Dated September 24, 2009, at 1–3 & annot. (2009), *reprinted in Documents: Natural Gas's Toxic Waste*, N.Y. Times, 741–43 (Feb. 26, 2011), http://www.nytimes.com/interactive/2011/02/27/us/natural-gas-documents-1.html#document/p1/a9895 (describing three releases from the Heitsman 4H well pad).
25. URS Corp., *supra* note 24, at 1–2 & annot.
26. Cabot Oil & Gas Corp., Preparedness, Prevention, and Contingency Plan, Susquehanna County, Pennsylvania 12 (2009), *reprinted in Documents: Natural Gas's Toxic Waste*, *supra* note 24, at 890.
27. Parker Waichman Alonso LLP, *supra* note 24.
28. Press Release, Pa. Dep't of Envtl. Prot., Dimock Residents to Share $4.1 Million, Receive Gas Mitigation Systems Under DEP-Negotiated Settlement with Cabot Oil and Gas (Dec. 16, 2010), http://www.portal.state.pa.us/portal/server.pt/community/newsroom/14287?id=15595&typeid=1.

order on September 24, 2009, requiring Cabot to cease its fracking operations in Susquehanna County.[29] Cabot, however, was allowed to resume operations three weeks later.[30] Subsequently, DEP ordered Cabot to install water treatment systems in several homes and permanently close three wells.[31] In May 2010, several Dimock residents sued Cabot in federal court for damage to their property.[32] Other Susquehanna County families sued another natural gas company for similar damage in state court, but the company had the case removed to federal court.[33]

Although methane in water is not uncommon in Pennsylvania, DEP determined that the methane in Dimock's water supplies was thermogenic rather than biogenic, meaning that it came from the rock layers beneath the Earth's surface rather than from traditional biological sources such as cattle,[34] and was tied to Cabot's wells.[35] DEP observed "bubbling gas and high pressure readings from a number of wells that prove[d] poor well construction, and [took] readings that show[ed] excessive gas levels that could only exist in wells that [were] leaking."[36] By the end of 2010, DEP had fined Cabot a total of $1.1 million.[37]

In 2010, DEP began to aggressively pursue the construction of a new water main that would run to Dimock from the neighboring town of Montrose, and attempted to force Cabot to pay the entire cost, which was estimated to be more than $10 million.[38] Cabot maintained that it did not cause the contamination and criticized DEP's actions as "arbitrary and unreasonable."[39] In December of that year, DEP and Cabot agreed to abandon the water main plan in favor of a $4.1 million direct payout to the affected families.[40] However, both Susquehanna County lawsuits continued despite the payout.[41]

B. Scientific Background

1. Use and Disposal of Fracking Fluid Presents Several Challenges

Fracking was first developed and used by Halliburton in 1947 to stimulate flow in natural gas fields.[42] The process requires "fracking fluid," which is primarily composed of water and sand but also includes industrial chemicals such as trimethylbenzene, toluene, xylene, and many others.[43]

Before fracking begins, a typical well is drilled vertically into the shale bed, then horizontally along the bed.[44] The driller then injects fracking fluid into the drill bore at high pressure.[45] The pressurized fluid fractures the shale, and the sand becomes lodged in the cracks, holding them open and allowing gas to flow out and be extracted.[46] The driller then recovers a portion of the fracking fluid, while the remaining fluid stays in the well.[47] Although fracking fluid is typically more than ninety-nine percent water and sand,[48] EPA cautions that "two to five million gallons of water may be neces-

29. Second Amended Complaint, *supra* note 21, ¶ 45(k); Press Release, Pa. Dep't of Envtl. Prot., DEP Orders Cabot Oil and Gas to Cease All Gas Well Fracking in Susquehanna County (Sept. 25, 2009), http://www.portal.state.pa.us/portal/server.pt/community/newsroom/14287?id=2375&typeid=1.
30. Second Amended Complaint, *supra* note 21 ¶ 45(k); Press Release, Pa. Dep't of Envtl. Prot., DEP Says Cabot Oil and Gas Corp. May Resume Hydro Fracking Gas Wells in Susquehanna County (Oct. 16, 2009), http://www.portal.state.pa.us/portal/server.pt/community/newsroom/14287?id=2395&typeid=1.
31. Press Release, Pa. Dep't of Envtl. Prot., *supra* note 28; Parker Waichman Alonso LLP, *supra* note 24.
32. Second Amended Complaint, *supra* note 21, ¶ 1.
33. Berish v. Sw. Energy Prod. Co., 763 F. Supp. 2d 702, 704 (M.D. Pa. 2011) (order granting motion to dismiss in part and denying in part).
34. Abrahm Lustgarten, *Science Says Methane in Pa. Water Is from Drilling, Not Natural Causes*, ProPublica (Nov. 9, 2010), http://www.propublica.org/article/science-says-methane-in-pa.-water-is-from-drilling-not-natural-causes#pa_correx (discussing a Susquehanna County woman's claim that she had methane in her water as early as the 1960s, in Clifford Krauss & Tom Zeller, *When a Rig Moves In Next Door*, N.Y. Times, Nov. 7, 2010, at BU1, *available at* http://www.nytimes.com/2010/11/07/business/energy-environment/07frack.html?pagewanted=1&_r=2&sq=Dimock%20and%20gas%20drilling&st=cse&scp=1).
35. *Id.*; Press Release, Pa. Dep't of Envtl. Prot., DEP Secretary Issues Open Letter to Citizens of Susquehanna County Community Impacted by Ongoing Gas Migration Issues (Oct. 19, 2010), http://www.portal.state.pa.us/portal/server.pt/community/newsroom/14287?id= 14827&typeid=1.
36. Press Release, Pa. Dep't of Envtl. Prot., *supra* note 35.
37. Rendell & Hanger, *supra* note 16.
38. Laura Legere, *Cabot and DEP Clash over Dimock Water Contamination*, Scranton Times-Trib., Sept. 29, 2010, http://thetimes-tribune.com/news/cabot-and-dep-clash-over-dimock-water-contamination-1.1035426#axzz1AUFyBbLu (estimating cost at $10.5 million); Press Release, Pa. Dep't of Envtl. Prot., *supra* note 35 (estimating cost at $11.8 million).
39. Legere, *supra* note 38.
40. Press Release, Pa. Dep't of Envtl. Prot., *supra* note 28 (announcing that each family would receive a sum equal to twice the value of its property or $50,000, whichever was higher). It is likely that some families will use the money to pay off their mortgages and move elsewhere. *See* Bateman, *supra* note 19 (describing one resident who had previously expressed a desire to move but could not do so because he could neither sell his house in Dimock nor afford a new house on top of his existing mortgage).
41. *See* Laura Legere, *Dimock Residents See 'Dirty Tricks' in Cabot Document*, Daily Rev., Dec. 18, 2010, http://thedailyreview.com/news/dimock-residents-see-dirty-tricks-in-cabot-document-1.1079058 (explaining that the DEP settlement did not require Dimock residents to abandon their lawsuit).
42. *Hydraulic Fracturing 101*, *supra* note 10.
43. Bureau of Oil & Gas Mgmt., Pa. Dep't of Envtl. Prot., Chemicals Used by Hydraulic Fracturing Companies in Pennsylvania for Surface and Hydraulic Fracturing Activities (2010), *available at* http://www.dep.state.pa.us/dep/deputate/minres/oilgas/new_forms/marcellus/Reports/Frac%20list%206-30-2010.pdf; *In Focus: What's in the Fluids?*, Halliburton, http://www.halliburton.com/public/projects/pubsdata/Hydraulic_Fracturing/fluids_disclosure.html (last visited Nov. 3, 2011). As a result of new Wyoming regulations in 2010, gas companies have had to disclose more chemicals used in fracking. *See* Mike Soraghan, *Wyo. Natural Gas Fracking Rules Point the Way for Public Disclosure of Chemicals Used*, N.Y. Times, Dec. 20, 2010, http://www.nytimes.com/gwire/2010/12/20/20greenwire-wyo-natural-gas-fracking-rules-for-point-the-w-18753.html; Amy Mall, *Wyoming's Hydraulic Fracturing Chemical Disclosure Rules Lead the Way*, Nat. Resources Def. Council (Oct. 21, 2010), http://switchboard.nrdc.org/blogs/amall/in_arecent_denver_post_columnd.html.
44. Office of Research & Dev., EPA, *supra* note 9, at 1; *Hydraulic Fracturing 101*, *supra* note 10
45. Office of Research & Dev., EPA, *supra* note 9, at 1; *Hydraulic Fracturing 101*, *supra* note 10.
46. Office of Research & Dev., EPA, *supra* note 9, at 1; *Hydraulic Fracturing 101*, *supra* note 10.
47. Office of Research & Dev., EPA, *supra* note 9, at 2 (estimating that 15% to 80% of fracking fluid is recovered); Radisav D. Vidic, Univ. of Pittsburgh, Presentation at Temple University Marcellus Shale Summit: Sustainable Water Management for Marcellus Shale Development 9 (Mar. 18, 2010), *available at* http://www.temple.edu/environment/NRDP_pics/shale/presentations_TU-summit/Vidic-Temple-2010.pdf (estimating that 10% to 40% of fracking fluid is recovered).
48. *See A Fluid Situation: Typical Solution Used in Hydraulic Fracturing*, Energy in Depth, http://www.energyindepth.org/frac-fluid.pdf (last visited Jun. 29, 2011).

sary to fracture one horizontal well in a shale formation,"[49] meaning that a driller must use tens of thousands of gallons of hazardous chemicals in fracking a single well, and cannot recover much of the fluid.[50]

The driller must then dispose of the recovered fluid, or "flowback water," by using one of several methods: underground injection, treatment and discharge to surface waters, disposal on land, or reuse for additional fracking.[51] Each of these disposal options comes with its own set of challenges. First, injecting flowback water into the ground requires a large amount of capital and an EPA permit that is difficult to obtain.[52] Second, the treatment and discharge option is problematic because the salt content of flowback water may be too high for publicly owned treatment works ("POTWs") to effectively handle.[53] Regulators must also determine whether levels of radioactive material in the fluid are low enough for POTWs to process adequately.[54] Finally, reuse of the fluid for additional fracking is difficult because the fluid must be treated before being reused.[55] When accidents occur during the disposal process, pollution of rivers, streams, and fisheries can result.[56] To properly dispose of flowback water, drillers and regulators must make difficult choices between these imperfect alternatives.

2. Fracking's Direct Effect on Drinking Water Is Unconfirmed, but Accidents Still Can Occur Due to Improper Well Construction

As seen in Dimock, fracking's effect on drinking water is a great source of concern.[57] In 2004, while studying the safety of fracking in coalbed methane ("CBM") wells, including the process's effect on drinking water, EPA found

> no confirmed cases [of drinking water well contamination] that are linked to fracturing fluid injection into CBM wells or subsequent underground movement of fracturing fluids. Further, although thousands of CBM wells are fractured annually, EPA did not find confirmed evidence that drinking water wells have been contaminated by hydraulic fracturing fluid injection into CBM wells.[58]

EPA terminated the 2004 study after "Phase I" because it concluded that further investigation was unwarranted.[59]

Although proponents of fracking frequently refer to this study when arguing that fracking is safe,[60] for a variety of reasons, this study does not conclusively confirm that fracking is safe. First, the study focused only on CBM drilling rather than on shale bed drilling.[61] This difference is important because CBM is found much closer to the surface than shale gas,[62] meaning that its effect on aquifers may be significantly different. Second, the study itself may have been flawed in significant ways. After its publication, the study came under fire from critics within EPA who argued that "based on the available science and literature, EPA's conclusions [were] unsupportable," questioned the impartiality of the study's Peer Review Panel, and claimed that "EPA did not investigate pathways for unwanted methane migration."[63]

Since that study, fracking has been suspected as the cause of drinking water contamination in many areas of the United States.[64] Other studies outside of EPA have cast doubt on the

49. Office of Research & Dev., EPA, *supra* note 9, at 2. This large quantity of water has to come from somewhere—usually local streams, aquifers, and other surface sources. *See* Bureau of Oil & Gas Regulation, N.Y. State Dep't of Envtl. Conservation, *supra* note 12, § 6.1.1.7, at 6-7 to -8 (describing the potential environmental impacts of water withdrawals for fracking).
50. *See* Office of Research & Dev., EPA, *supra* note 9, at 2.
51. *Id.*
52. *See* Vidic, *supra* note 47, at 16 (discussing "substantial capital investment" required for underground injection wells and explaining that "[n]o new injection wells have been permitted").
53. *Id.* at 17.
54. *See* Ohio Dep't of Natural Res., Ohio Hydraulic Fracturing State Review 18 (2011), *available at* http://www.dnr.state.oh.us/Portals/11/oil/pdf/stronger_review11.pdf ("[The Ohio Environmental Protection Agency] is working with [the Ohio Department of Health] on monitoring of wastewater for [naturally occurring radioactive material] and other constituents as part of accepting wastewaters at POTWs. A test of POTW treatment of flowback water is underway.").
55. Vidic, *supra* note 47, at 18–20.
56. *E.g.*, Mocarsky, *supra* note 16 (describing a spill of several thousand gallons of flowback water, which was discharged into a creek in the Tioga River watershed after a pump failed); Sabrina Shankman, *Pennsylvania's Gas Wells Booming—but So Are Spills*, ProPublica (Jan. 27, 2010), http://www.propublica.org/article/pas-gas-wells-booming-but-so-are-spills-127 (discussing several accidents involving flowback water spills that resulted in fish kills); *see* EPA, Opportunity for Stakeholder Input on EPA's Hydraulic Fracturing Research Study: Study Design 3 tbl.1 (2010), *available at* http://www.epa.gov/tp/pdf/discussion-document-study-design.pdf (describing potential surface and ground water impacts of storage, disposal, treatment, and recycling of wastewater).
57. *See* Bateman, *supra* note 19; Parker Waichman Alonso LLP, *supra* note 24..
58. Office of Ground Water & Drinking Water, EPA, EPA 816-F-04-017, Evaluation of Impacts to Underground Sources of Drinking Water by Hydraulic Fracturing of Coalbed Methane Reservoirs; National Study Final Report 1 (June 2004), *available at* http://www.epa.gov/ogwdw/uic/pdfs/cbmstudy_attach_uic_final_fact_sheet.pdf.
59. Hannah Wiseman, *Untested Waters: The Rise of Hydraulic Fracturing in Oil and Gas Production and the Need to Revisit Regulation*, 20 Fordham Envtl. L. Rev. 115, 128 (2009).
60. *See, e.g.*, *Hydraulic Fracturing*, Interstate Oil & Gas Compact Commission, http://www.iogcc.state.ok.us/hydraulic-fracturing (last visited Nov. 2, 2011) ("In 2004 . . . [t]he EPA concluded that the injection of hydraulic fracturing fluids poses little or no threat to underground sources of drinking water."); *Regulation and Safety*, *supra* note 17 ("In 2004, the EPA . . . found that several factors . . . minimize the potential risks associated with hydraulic fracturing. . . . [T]he EPA concluded that no hazardous chemicals were found in fracturing fluids, and that hydraulic fracturing does not create pathways for fluids to travel between rock formations to affect the water supply."); *A Look Back: HF, SDWA, and Recent Efforts by States to Fight Back*, Energy in Depth, http://www.energyindepth.org/PDF/timeline.pdf (last visited Nov. 3, 2011) ("EPA releases its final report on the use of hydraulic fracturing in coalbed methane operations; reasserts that hydraulic fracturing poses "no threat" to drinking water.").
61. Wiseman, *supra* note 59, at 141; *see* Abrahm Lustgarten, *The Hidden Danger of Gas Drilling*, Bus. Wk., Nov. 24, 2008, at 77, 79, *available at* http://www.businessweek.com/magazine/content/08_47/b4109000334640.htm (quoting one of the 2004 EPA study's original authors: "It was never intended to be a broad, sweeping study.").
62. *See The Geology of Natural Gas Resources*, U.S. Energy Info. Admin. (Feb. 14, 2011), http://www.eia.gov/todayinenergy/detail.cfm?id=110.
63. Letter from Weston Wilson, EPA Employee, to Senator Wayne Allard, Senator Ben Nighthorse Campbell, and Representative Diana DeGette 1, 11, 13–14 (Oct. 8, 2004), *available at* http://www.earthworksaction.org/pubs/ Weston.pdf.
64. *See, e.g.*, Div. of Mineral Res. Mgmt., Ohio Dep't of Natural Res., Report on the Investigation of the Natural Gas Invasion of Aquifers in Bainbridge Township of Geauga County, Ohio 3–7 (2008), *available at* http://www.dnr.state.oh.us/Portals/11/bainbridge/report.pdf (Geauga County, Ohio); Abrahm Lustgarten, *Digging at Mystery of Methane in Wells*, Denver Post, Apr. 22, 2009, at 1A, *available at* http://www.denverpost.com/news/ci_12195167 (Garfield County, Colorado); Abrahm Lustgarten, *EPA:*

safety of the fracking process. A scientific study commissioned by New York City concluded that fracking "increase[s] the likelihood of the migration of hazardous chemicals . . . and infiltration into overlying groundwater, watershed streams, reservoirs, and tunnels."[65] A State University of New York at Buffalo study has found that fracking "causes uranium that is naturally trapped inside Marcellus shale to be released."[66]

In contrast, a study by the New York State Department of Environmental Conservation found that drinking water contamination was unlikely because of the large vertical separation between underground aquifers and shale deposits.[67] In Pennsylvania, as recently as April 2010, DEP maintained that "[t]here has never been any evidence of fracking ever causing direct contamination of fresh groundwater in Pennsylvania or anywhere else."[68] However, DEP has also warned that improper well construction can cause contamination, as it allegedly did in Dimock.[69]

Fracking can be characterized as a low-risk activity when wells are constructed properly,[70] but given that the process is new and the geology involved is extremely complex,[71] it is difficult determine what constitutes "proper construction" in every situation. As seen in Dimock, the consequences of improper well construction can be severe.

In 2009, while testifying before a congressional subcommittee, EPA Administrator Lisa Jackson addressed the need for the Agency to take a second look at fracking.[72] Less than a year later, in response to a congressional request, EPA announced the beginning of a new fracking study.[73] Although the study is still in progress,[74] the Agency has already identified "[c]ontaminants of concern to drinking water [that] include fracturing fluid chemicals and degradation products and naturally occurring materials in the geologic formation (e.g. metals, radionuclides) that are mobilized and brought to the surface during the hydraulic fracturing process."[75] It will be some time before the scientific questions surrounding fracking have satisfactory answers. Because of this uncertainty—coupled with the real possibility of improper well construction, as seen in Dimock—scientists and governments should not conclusively deem fracking to be safe.

II. The Federal Statutory and Regulatory Void Surrounding Fracking

A. *Fracking Fluid and Other Oil- and Gas-Related Wastes Are Exempt from Regulation Under RCRA*

Congress enacted RCRA in 1976 to regulate and manage hazardous waste.[76] In 1980, Congress created a temporary provision exempting "drilling fluids, produced waters, and other wastes associated with the exploration, development, or production of crude oil or natural gas or geothermal energy" from regulation under the Act.[77] Congress intended the exemption to last for at least two years.[78] During the period of exemption, EPA was to conduct a study and, based on the study's results, "determine either to promulgate regulations [for oil- and gas-related wastes] . . . or that such regulations [were] unwarranted."[79] EPA completed the study in 1987,[80] and in 1988, the Agency issued its determination that regulation was unwarranted.[81]

This exemption is one component of the "regulatory void that surrounds the management of wastes associated with [oil field exploration and production] operations,"[82] and it has been a target of criticism. The 1988 EPA determination and underlying 1987 study have been criticized as politically

Chemicals Found in Wyo. Drinking Water Might Be from Fracking, ProPublica (Aug. 25, 2009), http://www.propublica.org/article/epa-chemicals-found-in-wyo.-drinking-water-might-be-from-fracking-825 (Pavillion, Wyoming); *see also* Mall, *supra* note 11, (providing an extensive list of incidents of drinking water contamination allegedly caused by fracking).

65. Hazen & Sawyer, Final Impact Assessment Report: Impact Assessment of Natural Gas Production in the New York City Water Supply Watershed 49 (2009), *available at* http://www.nyc.gov/html/dep/pdf/natural_gas_drilling/12_23_2009_final_assessment_report.pdf.
66. Press Release, State Univ. of N.Y. at Buffalo, 'Fracking' Mobilizes Uranium in Marcellus Shale, UB Research Finds (Oct. 25, 2010), http://www.buffalo.edu/news/fast-execute.cgi/article-page.html?article=118850009 ("Even though at these levels, uranium is not a radioactive risk, it is still a toxic, deadly metal . . . . We need a fundamental understanding of how uranium exists in shale.").
67. Bureau of Oil & Gas Regulation, N.Y. State Dep't of Envtl. Conservation, *supra* note 12, § 6.1.5.2 (explaining that aquifers are found at depths of less than 1,000 feet while fracture zones are found at depths greater than 2,000 feet, and the intervening layers have low permeability). For additional factors making drinking water contamination unlikely, see *id.* § 6.1.11.
68. Bateman, *supra* note 19.
69. Press Release, Pa. Dep't of Envtl. Prot., *supra* note 35.
70. *See* Bureau of Oil & Gas Regulation, N.Y. State Dep't of Envtl. Conservation, *supra* note 12, § 6.1.5.1 (estimating probability of fracking fluid reaching aquifer at "fewer than 1 in 50 million wells" when wells are properly constructed).
71. *See* Vello A. Kuuskraa & Scott H. Stevens, Advanced Res. Int'l, Inc., Worldwide Gas Shales and Unconventional Gas: A Status Report 2 (2009), *available at* http://www.rpsea.org/attachments/articles/239/ KuuskraaHandoutPaperExpandedPresentWorldwideGasShalesPresentation.pdf ("[T]he geologic setting of unconventional gas is several orders more complex and challenging than for conventional gas.").
72. *Interior, Environment, and Related Agencies Appropriations for 2010: Hearings Before the Subcomm. on Interior, Env't, and Related Agencies of the H. Comm. on Appropriations*, 111th Cong. 395 (2009) (statement of Lisa Jackson, Administrator, EPA) ("I do think that [fracking] is well worth looking into. . . . I think the last time EPA spoke on this was October of 2007 when, at that point, EPA's position was that there was no need for any additional concern. I think it is probably time to look at that again.").
73. Press Release, EPA, EPA Initiates Hydraulic Fracturing Study: Agency Seeks Input from Science Advisory Board (Mar. 18, 2010), http://yosemite.epa.gov/opa/admpress.nsf/e77fdd4f5afd88a3852576b3005a604f/ba591ee790c58d30852576ea004ee3ad!opendocument.
74. *Hydraulic Fracturing*, EPA, http://water.epa.gov/type/groundwater/uic/class2/hydraulicfracturing/index.cfm (last visited Jan. 31, 2011) (projecting that EPA will have initial study results in late 2012 and publish a report in 2014).
75. Office of Research & Dev., EPA, *supra* note 9, at 2.
76. *See* Resource Conservation and Recovery Act (RCRA) of 1976 § 2, 42 U.S.C. § 6901 (2006).
77. Sold Waste Disposal Act Amendments of 1980 § 7, 42 U.S.C. § 6921(b)(2)(A) (2006).
78. *Id.* ("[Oil- and gas-related wastes are] subject only to existing State or Federal regulatory programs in lieu of this subchapter until at least 24 months after [the date of enactment] . . . .").
79. 42 U.S.C. § 6921(b)(2)(B). Any such regulations would "take effect only when authorized by Act of Congress." § 6921(b)(2)(C).
80. Regulatory Determination for Oil and Gas and Geothermal Exploration, Development and Production Wastes, 53 Fed. Reg. 25,446, 25,448 (July 6, 1988) (also stating that EPA did not begin the study until after the Alaska Center for the Environment sued EPA in 1985).
81. *Id.* at 25,447, 25,456. *See* Wiseman, *supra* note 16, at 245–46.
82. Cox, *supra* note 15, at 2.

motivated,[83] and some have petitioned EPA to reconsider.[84] Still, the 1980 exemption of oil- and gas-related wastes and EPA's 1988 determination that regulation under RCRA is unwarranted remain the law of the land today.[85]

B. Fracking Is Exempt from Regulation Under the Safe Drinking Water Act (SDWA), Except When Diesel Fuel is Used as a Fracking-Fluid Additive

In 2003, while EPA was conducting its study of fracking in CBM drilling,[86] the Agency signed an agreement with three large fracking companies in which the companies agreed to voluntarily eliminate the use of diesel fuel in fracking fluids.[87] Like the EPA study that was released the following year,[88] this agreement applied only to CBM drilling and did not mention shale.[89] When the study was released in 2004, it discussed the potential danger of the use of diesel fuel in fracking[90] but still downplayed the threat posed by CBM fracking overall.[91] To justify this, EPA pointed to the 2003 voluntary diesel elimination agreement and stated that those companies "no longer use diesel fuel as a hydraulic fracturing fluid additive . . . ."[92] However, this may not be true; since the agreement was signed in 2003, at least one of the three companies has violated the agreement, which does not impose any fines or other penalties.[93]

The Safe Drinking Water Act ("SDWA") prohibits "any underground injection . . . which is not authorized by a permit issued by the State"[94] and provides that "no rule may be promulgated which authorizes any underground injection which endangers drinking water sources."[95] After the Eleventh Circuit Court of Appeals held in 1997 and 2001 that fracking was an "underground injection" and must be regulated under SDWA,[96] Congress responded in 2005 by specifically exempting fracking from SDWA.[97] However, the use of diesel fuel in fracking fluid is not subject to the exemption and is still considered an "underground injection."[98] In January 2011, Congress told EPA that twelve companies had used diesel fuel in fracking fluids after 2005, in apparent violation of the statute.[99]

C. Oil- and Gas-Related Activities and Substances Are Exempt from Regulation Under Other Federal Statutes

Although the above RCRA and SDWA provisions are the main examples of fracking's exemption from federal regulation, several other federal statutes contain their own exemptions and exclusions for different elements of the natural gas exploration process. These statutes include the Clean Water Act;[100] the Comprehensive Environmental Response,

83. Amy Mall et al., Natural Res. Def. Council, Drilling Down: Protecting Western Communities from the Health and Environmental Effects of Oil and Gas Production 22–23 (2007), *available at* http://www.nrdc.org/land/use/down/down.pdf ("EPA staff recommended that some hazardous oil and gas wastes be regulated, but they were overruled by senior agency officials . . . . At the time, the assistant to the EPA's then director of hazardous site control told a reporter, 'This is the first time . . . in the history of environmental regulation of hazardous wastes that the EPA has exempted a powerful industry from regulation for solely political reasons, despite a scientific determination of the hazardousness of the waste.'" (citation omitted)); Ian Urbina, *Pressure Stifles Efforts to Police Drilling for Gas*, N.Y. Times, Mar. 4, 2011, at A1, *available at* http://www.nytimes.com/2011/03/04/us/04 gas.html?ref=waterpollution ("E.P.A. officials told [the author of the 1987 study] that her findings were altered because of pressure from the Office of Legal Counsel of the White House under Ronald Reagan.").
84. Letter from Amy Mall, Senior Policy Analyst, Natural Res. Def. Council, and Diane Donnelly, Legal Intern, Natural Res. Def. Council, to Lisa Jackson, Adm'r, EPA 2, 6–7 (Sept. 8, 2010), *available at* http://docs.nrdc.org/energy/files/ene_10091301a.pdf.
85. *See Crude Oil and Natural Gas Waste*, EPA, http://www.epa.gov/osw/nonhaz/industrial/special/oil/ (last updated July 27, 2011).
86. *See supra* notes 58–60 and accompanying text.
87. Memorandum of Agreement Between EPA and BJ Servs. Co., Halliburton Energy Servs., Inc., and Schlumberger Tech. Corp.: Elimination of Diesel Fuel in Hydraulic Fracturing Fluids Injected into Underground Sources of Drinking Water During Hydraulic Fracturing of Coalbed Methane Wells 2, 5 (Dec. 12, 2003) [hereinafter MOA, Elimination of Diesel Fuel], *available at* http://www.epa.gov/ogwdw000/uic/pdfs/moa_uic_hyd-fract.pdf.
88. *See supra* notes 58–60 and accompanying text.
89. MOA, Elimination of Diesel Fuel, *supra* note 87, at 2.
90. Office of Ground Water & Drinking Water, EPA, *supra* note 12, § 7.2, at 7-3.
91. *Id.* § 7.4.
92. *Id.* § 7.2 at 7-3. EPA also indicated that the three companies that signed the 2003 diesel agreement accounted for "approximately 95 percent of the hydraulic fracturing projects in the United States." *Id.*
93. Mike Soraghan, *Oilfield Company Failed to Report Fracking Violations to EPA -- Documents*, N.Y. Times, Mar. 23, 2010, http://www.nytimes.com/gwire/2010/03/23/23greenwire-oilfield-company-failed-to-report-fracking-vio-34193.html (reporting that BJ Services admitted to violating the agreement); Mike Soraghan, *Two Oil-Field Companies Acknowledge Fracking with Diesel*, Greenwire (Feb. 19, 2010), http://www.eenews.net/public/ Greenwire/2010/02/19/1 (explaining that BJ Services and Halliburton both admitted to using diesel fuel in fracking fluid, but Halliburton claimed that its use of diesel fuel did not violate the 2003 agreement because the agreement applied only to CBM, not to other unconventional sources).
94. Safe Drinking Water Act (SDWA), 42 U.S.C. § 300h(b)(1)(A) (2006).
95. *Id.* § 300h(b)(1)(B).
96. Legal Envtl. Assistance Found. v. EPA (*LEAF I*), 118 F.3d 1467, 1478 (11th Cir. 1997) (holding that fracking must be regulated by the State of Alabama under the provisions of SDWA), *superseded by statute*, Energy Policy Act of 2005, Pub. L. No. 109-58, 119 Stat. 594; Legal Envtl. Assistance Found. v. EPA (*LEAF II*), 276 F.3d 1253, 1265 (11th Cir. 2001) (upholding the Alabama regulations promulgated after the first LEAF decision), *cert. denied*, 537 U.S. 989 (2002), *superseded by statute*, Energy Policy Act of 2005, Pub. L. No. 109-58, 119 Stat. 594.
97. Energy Policy Act of 2005, Pub. L. No. 109-58, § 322, 119 Stat. 594, 694 (codified at 42 U.S.C. § 300h(d) (2006)). While the bill was being debated in 2005, amendments proposed by Representatives Diana DeGette and Hilda Solis, which would have preserved some federal oversight of fracking, failed in committee. H.R. Rep. No. 109-215, pt. 1, at 491 (2005). In the Senate, Senator Jim Jeffords introduced a separate bill that would have subjected fracking to SDWA's provisions. S. 1080, 109th Cong. (2005); *see* 151 Cong. Rec. 5533–37 (2005) (statement of Sen. Jim Jeffords). The Fracturing Responsibility and Awareness of Chemicals (FRAC) Act, which would undo the SDWA exemption, has been introduced in both the House and the Senate. H.R. 1084, 112th Cong. (2011); S. 587, 112th Cong. (2011).
98. 42 U.S.C. § 300h(d) ("The term 'underground injection' . . . excludes . . . the underground injection of fluids or propping agents (*other than diesel fuels*) pursuant to hydraulic fracturing operations . . . ." (emphasis added)).
99. Letter from Rep. Henry A. Waxman, Rep. Edward J. Markey, & Rep. Diana DeGette, to Lisa Jackson, Adm'r, EPA 1, 5 (Jan. 31, 2011), *available at* http://democrats.energycommerce.house.gov/sites/default/files/documents/Jackson.EPADieselFracking.2011.1.31.pdf; Tom Zeller, Jr., *A Gas Drilling Technique Is Labeled a Violation*, N.Y. Times, Feb. 1, 2011, at B1, *available at* http://www.nytimes.com/2011/02/01/business/energy-environment/01gas.html?_r=2&hp.
100. "[M]ining operations or oil and gas exploration, production, processing [and] treatment operations [and] transmission facilities" are exempt from the Clean Water Act's permitting requirements for stormwater runoff. 33 U.S.C. § 1342(*l*)(2) (2006). EPA has determined that this exemption extends to oil- and gas-related construction. Amendments to the National Pollutant Discharge Elimination System (NPDES) Regulations for Storm Water Discharges, 71 Fed. Reg. 33,628, 33,630 (June 12, 2006); *see also* Natural Res.

Compensation, and Liability Act ("CERCLA");[101] and the National Environmental Policy Act ("NEPA").[102] In all of these cases, some oil- and gas-related activities and wastes have been exempted from federal regulation, leaving responsibility to state and local governments,[103] and, as seen in the sections that follow, to the courts.

III. Theories of Liability That Have Been Applied to Oil- and Gas-Related Drilling Activities Including Fracking

With the immediate future of federal regulation of fracking still uncertain, the common law offers several ways for affected landowners to recover for environmental damage from fracking.[104] Theories of trespass, private nuisance, and negligence all may be applicable to cases involving fracking,[105] but each of these common law theories presents its own set of problems and challenges.

A. The Law of Subsurface Trespass is Unclear with Respect to Fracking and Other Underground Injections

The law of trespass is difficult to apply where oil- and gas-related activities are concerned.[106] Because fracking and most of its associated activities take place below the surface, there are several questions about whether the rule of trespass applies at all.

For the past sixty-five years, U.S. courts have applied different rules to surface and subsurface trespass: the common law *ad coelum* doctrine, which stated that ownership is the same on, above, and below the surface, "has no place in the modern world."[107] This rejection of the *ad coelum* doctrine has created a legal regime in which courts generally do not apply the law of trespass to oil and gas cases unless some harm takes place on the surface. For example, in *Coastal Oil & Gas Corp. v. Garza Energy Trust*, the Texas Supreme Court said in dicta that trespass would apply if chemicals were spilled on the surface, but held that subsurface fracking did not constitute trespass in that instance.[108] Similarly, the Kansas Supreme Court held in *Crawford v. Hrabe* that a well operator had the right to inject salt water into the ground to increase production, even without the lessor's consent, and that this injection was not a trespass.[109] In *Crawford*, as in Justice Willett's concurrence in *Garza*, the court referred to the economically beneficial nature of drilling in holding for the defendants.[110]

The law of trespass may still apply to subsurface activities in some limited situations. For example, in *Starrh & Starrh Cotton Growers v. Aera Energy*, a California court held that the migration of water from an energy company's oil-drilling activities onto cotton-growers' land was a continuing subsurface trespass.[111] Similarly, in *Beck v. Northern Natural Gas Co.*, the Tenth Circuit held that there was sufficient evidence for a lower court to conclude that the migration of gas from one subsurface formation to another was a trespass.[112]

Finding a common thread in these cases is difficult. In cases like *Crawford* and *Garza*, courts have adopted a broad interpretation of the rights of mineral lessees and allowed them to continue activities such as drainage and underground injection, due in part to their economic benefits. In other cases like *Starrh* and *Beck*, courts have held companies responsible for the consequences of water and gas migration. It is difficult to determine where the Susquehanna County cases—which contain elements of both—fit on this continuum.

Def. Council v. EPA, 526 F.3d 591, 594–99 (9th Cir. 2008) (discussing the history of stormwater runoff regulation under the Clean Water Act and vacating the EPA rule).

101. Although CERCLA contains reporting requirements for some fracking chemicals, 40 C.F.R. § 302.4 (2008); Office of Emergency Mgmt., EPA, *supra* note 21 (listing all chemicals covered by EPCRA, CERCLA, and the Clean Air Act), the Act exempts petroleum and natural gas from its definition of "hazardous substance." 42 U.S.C. § 9601(14) (2006). For a discussion of the legislative history of this exclusion, see Roger Armstrong, *CERCLA's Petroleum Exclusion: Bad Policy in a Problematic Statute*, 27 Loy. L.A. L. Rev. 1157, 1159–77 (1994).
102. NEPA requires federal agencies to prepare detailed environmental impact statements and "include [them] in every recommendation or report on proposals for legislation and other major Federal actions significantly affecting the quality of the human environment . . . ." 42 U.S.C. § 4332(C) (2006). In 2005, NEPA was amended to include a "rebuttable presumption that the use of a categorical exclusion . . . would apply if [certain activity] is conducted . . . for the purpose of exploration or development of oil or gas." Energy Policy Act of 2005 § 390, 42 U.S.C. § 15,942 (2006).
103. State and local governments have responded in a variety of different ways. *See, e.g.*, Soraghan, *supra* note 43; Maurice C. Baca, *Pittsburgh Bans Natural Gas Drilling*, ProPublica (Nov. 16, 2010), http://www.propublica.org/article/pittsburgh-bans-natural-gas-drilling; Eric Boehm, *Pennsylvania Still Only State Without Natural Gas Severance Tax*, Statehouse News Online (Oct. 21, 2010), http://statehousenewsonline.com/2010/10/21/pennsylvania-still-only-state-without-natural-gas-severance-tax/; Mary Esch, *NY 'Fracking' Ban: Governor David Paterson Orders Natural Gas Hydraulic Fracturing Moratorium for Seven Months in New York*, Huffington Post (Dec. 12, 2010, 3:34 PM), http://www.huffingtonpost.com/2010/12/13/ny-fracking-ban-david-paterson_n_795730.html; Tom Johnson, *Lawmakers Declare New Jersey a No-Fracking Zone*, NJ Spotlight (Mar. 11, 2011), http://www.njspotlight.com/stories/11/0310/2151/; Daniel Trotta & Edith Honan, *Hydraulic Fracturing, 'Fracking,' Banned in Buffalo, NY*, Huffington Post (Feb. 9, 2011), http://www.huffingtonpost.com/2011/02/09/hydraulic-fracturing-bann_n_820647.html.
104. *See, e.g.*, Second Amended Complaint, Fiorentino v. Cabot Oil & Gas Corp., *supra* note 21, ¶¶ 64–87 (stating claims for negligence, nuisance, and strict liability).
105. Strict liability is also applicable. *See infra* Part IV.
106. *See* W. Page Keeton et al., Prosser and Keeton on the Law of Torts 72 (5th ed., lawyer's ed. 1984) (discussing difficulty of applying the law of trespass where "deleterious liquids such as crude oil, salt water, gasoline, and the like" are concerned).
107. United States v. Causby, 328 U.S. 256, 260–61 & n.5 (1946).
108. Coastal Oil & Gas Corp. v. Garza Energy Trust, 268 S.W.3d 1, 11 (Tex. 2008).
109. Crawford v. Hrabe, 44 P.3d 442, 452–53 (Kan. 2002) (holding that a lessee of mineral rights has all privileges necessary for producing minerals profitably, and finding that subsurface injection was necessary in this instance).
110. *Id.*; *Garza*, 268 S.W.3d at 26–30 (Willett, J., concurring).
111. Starrh & Starrh Cotton Growers v. Aera Energy LLC, 63 Cal. Rptr. 3d 165, 174 (Ct. App. 2007).
112. Beck v. N. Natural Gas Co., 170 F.3d 1018, 1022 (10th Cir. 1999).

B. *The Doctrine of Private Nuisance Allows for Recovery for Unreasonable Conduct, but Proof of Intent May Be Difficult to Establish in a Fracking Case*

Private nuisance is the interference with "another's interest in the private use and enjoyment of land" that "is either (a) intentional and unreasonable, or (b) unintentional and otherwise actionable under the rules [of negligence or strict liability]."[113] The intent requirement in part (a) may be satisfied in ways other than specific intent. For example, in *Hughes v. Emerald Mines Corp.*, a Pennsylvania court applied private nuisance to allow landowners to recover when nearby mining operations contaminated their water wells.[114] Even without specific intent, the mining company's substantial certainty that its operations would damage nearby water supplies was enough to satisfy the requirement of intent.[115] The intent requirement can also be satisfied by the intentional continuation of an activity that was not originally intended to interfere with another's interest.[116] There are therefore three varieties of intent: specific intent, substantial certainty, and intentional continuation of an initially unintentional act.

The plaintiffs in *Hughes* were able to prove intent, but intent could be more difficult for plaintiffs to prove in fracking cases. Plaintiffs like those in Susquehanna County will of course be unable to prove *specific intent*. For example, there is likely no evidence that Cabot intended to poison Dimock's water supply from the outset. Plaintiffs will also have a difficult time showing that defendant drilling companies were *substantially certain* that their actions would cause harm. Drillers could easily point to the aforementioned studies that conclude that fracking is safe (as long as wells are drilled properly and no accidents occur)[117] to defend against accusations of substantial certainty. Without further scientific evidence favorable to plaintiffs, proving substantial certainty will be difficult. Showing that drilling companies *intentionally continued a harmful act* is possible if the plaintiffs can also show that the drillers knew they were causing the contamination and continued anyway,[118] but this introduction of knowledge as an element complicates the matter further.[119]

Intent alone, however, will not prove nuisance; the interference must also be unreasonable.[120] In determining whether the mining company ought to be held liable for the contamination, the *Hughes* court said that the "[u]tility of an act must be balanced against the bad effects resulting from that act in determining its reasonableness."[121] This reasonableness component is easier to apply to a fracking case than intent; the potential for water contamination in *Hughes* is similar to the potential that exists in places like Susquehanna County, and the economic utility of coal mining in *Hughes* parallels the utility of fracking.

C. *Applying Negligence is Problematic Because of the Difficulties of Defining Due Care and Determining Whether Exercising Such Care Will Prevent Harm*

A claim of negligence does not require proof of intent.[122] It does, however, require the plaintiff to show not only that the defendant caused the harm, but also that the defendant acted negligently in doing so.[123]

To determine whether the plaintiff has successfully overcome this additional obstacle, courts balance the severity and probability of the injury against the burden of prevention.[124] Judge Richard Posner has articulated that "[w]hen [negligence] is a workable regime, because the hazards of an activity can be avoided by being careful (which is to say, nonnegligent), there is no need to switch to strict liability."[125] To apply the negligence rule to fracking, therefore, a judge must first conclude that the dangers of fracking can be avoided through the exercise of due care by the driller. This requirement charges a court with two tasks. First, the court must define "due care" with respect to drilling, fracking, and related activities such as surface-water withdrawal, flowback-water disposal, and well construction. Second, the court must determine whether the threat of environmental damage can be avoided if drilling companies adhere to these standards of care.

Courts typically rely on expert testimony to determine the standard of care in negligence cases.[126] In 2004, a Texas court held: "Problems with drilling equipment in drilling an oil well is [sic] to be expected but cannot be the basis of a negligence cause of action. An oil well driller does not ordinarily guarantee that he will have no problems with the drill-

113. Restatement (Second) of Torts § 822 (1979).
114. Hughes v. Emerald Mines Corp., 450 A.2d 1, 8–9 (Pa. Super. Ct. 1982).
115. *Id.* at 6–7.
116. *See* Owen L. Anderson, Subsurface Trespass After *Coastal v. Garza* 30 (2009), *available at* http://groundwork.iogcc.org/sites/default/files/Owen%20Anderson%20Paper,%20Subsurface%20Trespass%20After%20Coastal%20v%20Garza.pdf.
117. *See supra* notes 67–70 and accompanying text.
118. *See* Keeton et al., *supra* note 106, at 625 & n.68 (citing Burr v. Adam Eidemiller, Inc., 126 A.2d 403 (Pa. 1956)).
119. *See id.* at 185 & n.9 (citing Gobrecht v. Beckwith, 135 A. 20, 22 (N.H. 1926)) (illustrating that a requirement of knowledge may impose a duty to "investigate and find out," depending on the nature of the activity and the defendant's relationship to others). Scientific uncertainty therefore makes intentional continuation of a harmful act difficult to prove, just as it makes substantial certainty difficult to prove.
120. *See* Restatement (Second) of Torts § 822(a) (1979).
121. Hughes v. Emerald Mines Corp., 450 A.2d 1, 7 (Pa. Super. Ct. 1982) (concluding that defendant mining company's conduct was unreasonable and holding the company liable).
122. *Compare* Restatement (Second) of Torts § 166 (1979) (intent is a required element of trespass, unless the trespasser is engaged in an "abnormally dangerous" activity), *with id.* § 281 (no requirement of intent to prove negligence).
123. *Id.* § 281(b); *e.g.*, United States v. CDMG Realty Co., 96 F.3d 706, 722 (3d Cir. 1996) ("[Plaintiff] has identified evidence that would justify a factfinder's conclusion that contaminants were dispersed . . . . Nevertheless, . . . [plaintiff] must show not only that the soil investigation caused the spread of contaminants but also that the investigation was conducted negligently.").
124. United States v. Carroll Towing Co., 159 F.2d 169, 173 (2d Cir. 1947) ("[I]f the probability be called P; the injury, L; and the burden, B; liability depends upon whether B is less than L multiplied by P: i. e., whether B < PL.").
125. Ind. Harbor Belt R.R. Co. v. Am. Cyanamid Co., 916 F.2d 1174, 1177 (7th Cir. 1990).
126. *See* Gerrity Oil & Gas Corp. v. Magness, 946 P.2d 913, 919–20 (Colo. 1997); Pioneer Natural Res. USA, Inc. v. W.L. Ranch, Inc., 127 S.W.3d 900, 907 (Tex. App. 2004) (citing Broders v. Heise, 924 S.W.2d 148, 149, 152-53 (Tex. 1996)).

ing equipment when drilling a well."[127] In other words, some complications and accidents are expected. To borrow Judge Posner's words, the Texas court's holding casts serious doubt on whether "the hazards of [the] activity can be avoided by being careful."[128] The complex geology involved in unconventional shale drilling makes the argument for a negligence standard even more tenuous.[129]

IV. Strict Liability and the "Abnormally Dangerous Activity" Doctrine

When the doctrine of strict liability applies, a plaintiff need not prove that the defendant breached a duty of care; she need only prove that the defendant's actions—however reasonable—caused damage.[130] In the United States, the rule of negligence is generally applicable, while strict liability is limited to "abnormally dangerous activit[ies]."[131] The "abnormally dangerous activity" doctrine is set forth in the Restatement (Second) of Torts:

> (1) One who carries on an abnormally dangerous activity is subject to liability for harm to the person, land or chattels of another resulting from the activity, although he has exercised the utmost care to prevent the harm.
>
> (2) This strict liability is limited to the kind of harm, the possibility of which makes the activity abnormally dangerous.[132]

Judges consider the following factors when determining whether an activity is abnormally dangerous:

> (a) existence of a high degree of risk of some harm to the person, land or chattels of others;
>
> (b) likelihood that the harm that results from it will be great;
>
> (c) inability to eliminate the risk by the exercise of reasonable care;
>
> (d) extent to which the activity is not a matter of common usage;
>
> (e) inappropriateness of the activity to the place where it is carried on; and
>
> (f) extent to which its value to the community is outweighed by its dangerous attributes.[133]

Because there is doubt about whether it is possible to avoid the dangers of fracking simply by exercising due care,[134] strict liability remains a viable option for plaintiffs. Wyoming has long applied strict liability standards to *all* oil and gas drilling,[135] while Kansas and Louisiana courts have categorically determined that drilling is not abnormally dangerous.[136] No state has specifically singled out fracking as abnormally dangerous.

A. *Strict Liability is a Viable Cause of Action in Fracking Lawsuits*

In *Fiorentino v. Cabot Oil & Gas*, the ongoing lawsuit in Dimock, the plaintiffs have included strict liability among their causes of action, alleging that the dangerous nature of the chemicals used in fracking fluid are abnormally dangerous.[137] Cabot filed a motion to dismiss the strict liability cause of action for failure to state a claim upon which relief may be granted.[138] Cabot's argument was that "the Superior Court of Pennsylvania has held, as a matter of law, that petroleum-related storage and transmission activities are not abnormally dangerous or ultra hazardous."[139] The plaintiffs contended that there was no precedent "pertain[ing] to the *drilling and operation* of gas wells"[140] and that "the instant activities are nothing like those considered in the Pennsylvania cases Defendants cite."[141] The judge agreed with the plaintiffs and did not dismiss the cause of action for strict liability.[142] In the other Susquehanna County

case, *Berish v. Southwestern Energy Production Co.*, the court came to the same conclusion and said that "since the determination of whether or not an activity is abnormally dangerous is fact-intensive, courts often wait until discovery is complete before making this determination."[143]

For the time being, courts are declining to address the viability of strict liability during pretrial motions. Instead, they prefer to wait until after discovery. Although the judges in these cases could still dismiss the strict liability claims later, their willingness to wait until after discovery shows that their determinations will be based on the relevant facts, not on an initial determination that strict liability is inappropriate in an entire class of cases.

127. *Pioneer*, 127 S.W.3d at 907.
128. *Ind. Harbor Belt R.R.*, 916 F.2d at 1177.
129. *Cf.* Kuuskraa & Stevens, Advanced Res. Int'l, Inc., *supra* note 71, at 2.
130. Restatement (Second) of Torts § 519 (1979).
131. *Id.*
132. *Id.*
133. *Id.* § 520.
134. *See supra* Part III.C.
135. *See* Hull v. Chevron, U.S.A., Inc., 812 F.2d 584, 589 (10th Cir. 1987) (citing Pan Am. Petroleum Corp. v. Like, 381 P.2d 70, 73 (Wyo. 1963)) ("Wyoming law recognizes that the drilling of an oil and gas well is an ultrahazardous activity, a dangerous activity.").
136. Ainsworth v. Shell Offshore, Inc., 829 F.2d 548, 550 (5th Cir. 1987); Williams v. Amoco Prod. Co., 734 P.2d 1113, 1116 (Kan. 1987).
137. Second Amended Complaint, *supra* note 21, ¶¶ 84–87 ("The hazardous chemicals and combustible gases used, processed, and stored by Defendants are of a toxic and hazardous nature capable of causing severe personal injuries and damages to persons and property coming in contact with them, and therefore are ultra hazardous and abnormally dangerous.").
138. Memorandum of Law in Support of Defendants' Motion to Dismiss Plaintiff's Second Amended Complaint at 1, Fiorentino v. Cabot Oil & Gas Corp., No. 3:09-cv-02284-TIV, 2010 WL 2286902.
139. *Id.* at 16–17. Cabot relied on *Melso v. Sun Pipe Line Co.*, 576 A.2d 999, 1003 (Pa. Super. Ct. 1990) (refusing to apply strict liability for pipeline under residential development), and *Smith v. Weaver*, 665 A.2d 1215, 1220 (Pa. Super. Ct. 1995) (holding that strict liability does not apply to the operation of underground storage tanks).
140. Plaintiffs' Memorandum of Law in Opposition to Defendants' Motion to Dismiss at 9, *Fiorentino*, No. 3:09-cv-02284-TIV, 2010 WL 2666301.
141. *Id.* at 10.
142. *Fiorentino*, 750 F. Supp. 2d 506, 516 (M.D. Pa. 2010) (order granting motion to dismiss in part and denying in part).
143. Berish v. Sw. Energy Prod. Co., 763 F. Supp. 2d 702, 705 (M.D. Pa., 2011) (order granting motion to dismiss in part and denying in part).

B. Fracking Is Abnormally Dangerous, and Strict Liability Should Be Applied for Environmental Damage Associated with the Process

"[S]trict liability is limited to the kind of harm, the possibility of which makes the activity abnormally dangerous."[144] In the context of fracking, this element of strict liability doctrine can be interpreted to include a wide variety of environmental damage, especially water contamination. The possibility of that sort of damage is precisely what makes fracking dangerous and controversial.[145]

This element of the doctrine also means that other types of harm unrelated to fracking are not actionable under a strict liability theory.[146] For example, if a person broke her leg while at a gas well site, strict liability would not apply because that harm has nothing to do with the dangers of fracking.[147]

1. The Harm Attributable to Fracking Is Significant Both in Magnitude and in Likelihood.

In determining whether fracking is abnormally dangerous, a court will evaluate whether the activity presents "a high degree of risk of some harm to the person, land or chattels of others."[148] The court will also consider the "likelihood that the harm that results from it will be great."[149] The harm "must be major in degree, and sufficiently serious in its possible consequences to justify holding the defendant strictly responsible for subjecting others to an unusual risk."[150]

Sections 520(a) and (b) of the Restatement require an evaluation of both the magnitude and likelihood of the potential harm.[151] In the case of fracking, the magnitude has the potential to be significant, given the potentially harmful nature of some of the chemicals used in fracking fluid,[152] and the possibility of radionuclides being released into public water.[153] Without clean drinking water, some residential real estate in Dimock has lost virtually all of its value.[154]

The harm is also made more likely by the complex geological challenges that must be addressed before a well can be fracked safely.[155] There is evidence that the oil and gas industries are aware of a likelihood of drilling accidents, because they do not typically guarantee that equipment will not fail.[156] The situation in Susquehanna County is not unique,[157] and the accidents and spills there illustrate the real possibility of improperly constructed wells.

2. Fracking's Risks Cannot Be Eliminated by Using Reasonable Care

In order to move beyond negligence and consider strict liability, there must be some risk of harm even when reasonable care is taken.[158] This leads to another question: What is reasonable care? Shale fracking is a relatively new process, and if the many environmental violations committed in Pennsylvania in a short period are any indication,[159] companies are still struggling to define reasonable care when it comes to fracking. Although some of the reported contamination incidents may involve acts of negligence (which is to say the absence of reasonable care),[160] existing research suggests that it may be possible for migration of methane, discharge of flowback water, and contamination of aquifers to occur even when wells are fracked and drilled properly.[161] Furthermore, the fact that drillers do not guarantee that no accidents will occur[162] suggests that it is impossible to prevent all accidents even when reasonable care is exercised.

3. Fracking Is Not Yet a Common Usage of the Land in Most Areas of the Marcellus Region, and May Also Be Inappropriate to the Place Where It is Conducted

The Restatement next asks whether the activity in question is "a matter of common usage."[163] "Common usage" means "customarily carried on by the great mass of mankind or by many people in the community."[164] The example given in the Restatement's comments is driving a car:

> [A]utomobiles have come into such general use that their operation is a matter of common usage. This, notwithstanding the residue of unavoidable risk of serious harm that may result even from their careful operation, is sufficient to prevent their use from being regarded as an abnormally dangerous activity. On the other hand, the operation of a tank . . . is not yet a usual activity for many people, and

144. Restatement (Second) of Torts § 519(2) (1979).
145. *See supra* Part I.
146. *See* § 519 cmt. e.
147. *Cf. id.*
148. *Id.* § 520(a).
149. *Id.* § 520(b).
150. *Id.* § 520 cmt. g.
151. *Id.* § 520(a)–(b).
152. *See supra* Part I.A.
153. *See* Ohio Dep't of Natural Res., *supra* note 54, at 18; John Collins Rudolf, *Federal Officials Say They'll Examine Fracking Practices*, N.Y. Times (Mar. 3, 2011), http://green.blogs.nytimes.com/2011/03/03/federal-officials-say-theyll-examine-fracking-practices/; Press Release, State Univ. of N.Y. at Buffalo, *supra* note 66.
154. Bateman, *supra* note 19.
155. *See* Kuuskraa & Stevens, Advanced Res. Int'l, Inc., *supra* note 71, at 2.
156. *See* Pioneer Natural Res. USA, Inc. v. W.L. Ranch, Inc., 127 S.W.3d 900, 907 (Tex. App. 2004). *See generally Documents: Natural Gas's Toxic Waste*, *supra* note 24 (publishing over one thousand pages of state, federal, and corporate documents that discuss fracking's potential risks).
157. *See supra* note 64 and accompanying text.
158. Restatement (Second) of Torts § 520(c) (1979); *see also* Ind. Harbor Belt R.R. Co. v. Am. Cyanamid Co., 916 F.2d 1174, 1177 (7th Cir. 1990) ("Sometimes, however, a particular type of accident cannot be prevented by taking care . . . .").
159. *See* Mocarsky, *supra* note 16.
160. *E.g.*, Kathie O. Warco, *Fracking Truck Runs off Road; Contents Spill*, Washington Observer-Rep., Oct. 21, 2010, http://www.observer-reporter.com/or/localnews/10-21-2010-fracking-truck-rolls.
161. *See* Hazen & Sawyer, *supra* note 65, at 39–46 .
162. *See* Pioneer Natural Res. USA, Inc. v. W.L. Ranch, Inc., 127 S.W.3d 900, 907 (Tex. App. 2004).
163. Restatement (Second) of Torts § 520(d) (1979).
164. *Id.* § 520 cmt. i.

> therefore the operation of such a vehicle may be abnormally dangerous.[165]

Drilling, fracking, and operating natural gas wells is not an activity carried out by "the great mass of mankind," and it is not performed "by many people in the community." Because shale fracking in geological areas such as the Marcellus is still in its early stages, it probably has not yet "come into . . . general use," at least not to the extent that automobiles have.[166]

A judge must also consider whether the activity is "inappropriate[] . . . to the place where it is carried on."[167] The Restatement's comments clarify: "Even a magazine of high explosives . . . does not necessarily create an abnormal danger if it is located in the midst of a desert area."[168] It follows from this comment that if fracking were taking place in an area far from human settlement, with no potential to contaminate drinking water supplies, a judge may not consider the activity abnormally dangerous. If the activity took place in a highly developed area, such as a major city, a judge may be more likely to find abnormal danger. An area like Susquehanna County, which is settled but rural, falls in between the two extremes, so a judge's use of discretion is less easy to predict.

4. Fracking's Economic Benefits Do Not Outweigh Its Environmental and Public Health Risks

Finally, a judge must consider the "extent to which [the activity's] value to the community is outweighed by its dangerous attributes."[169] This question has received a great deal of attention from judges and scholars who argue in favor of relaxing regulation and liability for fracking due to the potential benefits to the U.S. economy.[170] Once again, the Restatement's comments are instructive:

> [T]he interests of a particular town whose livelihood depends upon such an activity as manufacturing cement may be such that cement plants will be regarded as a normal activity for that community notwithstanding the risk of serious harm from the emission of cement dust. . . . Thus in Texas and Oklahoma, a properly constructed oil or gas well, at least in a rural area, is not regularly regarded as abnormally dangerous, while a different conclusion has been reached in Kansas and Indiana."[171]

Because areas like northeastern Pennsylvania do not historically have large amounts of oil or gas drilling, they are more similar to "Kansas and Indiana" than to "Texas and Oklahoma." Although the gas industry has brought a welcome influx of jobs and investment to many areas of rural Pennsylvania, the industry is still in its infancy, and it is too early to conclude that the region depends on fracking in the way the Restatement describes.

5. Considering All of the Restatement Factors Together, Fracking Is Abnormally Dangerous

Overall, fracking meets the definition of "abnormally dangerous activity." According to the Restatement's comments, "it is not necessary that each of [the six factors in section 520] be present, especially if others weigh heavily,"[172] and the weight of the factors is to be determined by the court.[173] Pennsylvania courts have used these sections of the Restatement in a number of cases, and the federal courts in *Fiorentino* and *Berish* have announced their preference for the Restatement rules.[174] However, no case in the state has determined whether the doctrine applies to fracking.[175] "Any one of [the six factors] is not necessarily sufficient of itself in a particular case, and ordinarily several of them will be required for strict liability. On the other hand, it is not necessary that each of them be present, especially if others weigh heavily."[176]

As discussed above, there is doubt about whether shale gas drilling and fracking can be performed safely or that Dimock-like harm can be avoided, even when gas companies exercise reasonable care.[177] Further, fracking may be neither common nor essential enough to exempt it from strict liability.[178]

V. Comparison of Alternatives

A. Statutory Versus Common Law Solutions

Many authors, advocates, and policymakers have suggested changes to the statutes and regulations governing fracking.[179] However, the common law also has a role to play in rem-

165. *Id.*
166. *See id.*
167. *Id.* § 520(e).
168. *Id.* § 520 cmt. j.
169. *Id.* § 520(f).
170. *See* Crawford v. Hrabe, 44 P.3d 442, 453 (Kan. 2002) (discussing the "economically beneficial" nature of the conduct and ruling in the driller's favor); Coastal Oil & Gas Corp. v. Garza Energy Trust, 268 S.W.3d 1, 26–30 (Tex. 2008) (Willett, J., concurring) (discussing the economic importance of fracking at length before concluding that the law of trespass should not apply); Wes Deweese, *Fracturing Misconceptions: A History of Effective State Regulation, Groundwater Protection, and the Ill-Conceived FRAC Act*, 6 Okla. J. L. & Tech 49, 53 (2010) ("Hydraulic fracturing is a key ingredient to a more secure and viable energy future for the U.S. For that reason it is a game changer that should be encouraged to develop.").
171. Restatement (Second) of Torts § 520 cmt. k (1979).
172. *Id.* § 520 cmt. f.
173. *Id.* § 520 cmt. *l.*
174. *See* Berish v. Sw. Energy Prod. Co., 763 F. Supp. 2d 702, 705 (M.D. Pa. 2011) (order granting motion to dismiss in part and denying in part) ("In determining whether strict liability for an abnormally dangerous activity should apply, the Pennsylvania courts, in a number of cases, have adopted Sections 519 and 520 of the Restatement (Second) of Torts."); Fiorentino v. Cabot Oil & Gas Corp., 750 F. Supp. 2d 506, 512 (M.D. Pa. 2010) (order granting motion to dismiss in part and denying in part) (quoting Banks v. Ashland Oil Co., 127 F. Supp. 2d 679, 680 (E.D. Pa. 2001)) (noting that Pennsylvania's common law in this area is "less than fully settled" but that the Superior Court has adopted Sections 519 and 520 "in several cases").
175. *Fiorentino*, 750 F. Supp. 2d at 512 (order granting motion to dismiss in part and denying in part) ("Pennsylvania courts have only affirmatively concluded that *storage and transmission* of gas and petroleum products are not abnormally dangerous activities, and have not decided whether gas-well *drilling and operation* are the same.").
176. Restatement (Second) of Torts § 520 cmt. f (1979).
177. *See supra* Parts III.C, IV.B.1–2.
178. *See supra* Part IV.B.3–4.
179. *See supra* notes 61, 63, 83–84, 97–99 and accompanying text.

edying environmental harm caused by fracking and fills two important gaps left by statutory regimes.

First, it is important to consider that there are two broad categories of damage that can be caused by fracking in the Marcellus. On a larger scale, the aggregate effect of fracking operations on major watersheds such as the Delaware, Hudson, Ohio, and Susquehanna Rivers could affect the availability of clean water for millions of people.[180] On a smaller scale, discrete accidents in sparsely populated places like Susquehanna County have rendered local water supplies unusable.[181]

Generally speaking, statutory remedies redress large-scale damage more effectively than small-scale damage, because statutory fines and penalties are paid to state or federal agencies, not paid directly to the affected parties.[182] On the other hand, awards of damages at common law go directly to the affected parties. In the Susquehanna County example, the affected residents' goal is to be made whole and to be compensated for the damage done to their property,[183] but they are not likely to accomplish that goal if Cabot merely pays a fine to DEP.

Second, the common law allows parties to make their own value judgments about different courses of action. For example, if companies determine that the benefits of fracking outweigh the likely damages, they can simply continue fracking and pay damages for any harm they cause. Companies can also settle lawsuits out of court or indemnify themselves against tort liability, dealing with the possibility of harm in contractual agreements up front. These solutions allow companies to continue extracting gas from the shale bed while preserving the property rights and financial security of the property owners. While this feature of the common law does not redress large-scale damage effectively, it does ensure that individual property owners in places like Susquehanna County are fairly compensated for the damage they suffer.

Compliance with statutes, on the other hand, is not optional. This very characteristic makes statutes effective tools for preventing large-scale damage and improving overall environmental quality, but in the case of the individual property owner in an area with widespread drilling, where prevention is difficult and the main focus is on compensation for damage already done,[184] the common law is the better tool.

B. Negligence vs. Strict Liability

A strict liability standard has several advantages over a negligence standard. Because strict liability does not include the additional step of determining whether the defendant was negligent or breached a duty, it is less reliant on the particular facts of a case and does not depend on proof of the defendant's negligent conduct to enable recovery.[185] Because fewer specific facts need to be alleged, applying strict liability would lessen the administrative cost of suit and encourage more parties to seek relief in the first place. Uniformity and accuracy of judicial decisions would also improve.

Another advantage of strict liability over negligence is that it will discourage excessive risk on the part of oil and gas companies. Because the drilling companies are in better positions than landowners to know the risks of fracking and mitigate the dangers, society may prefer to hold them strictly liable instead of forcing the landowners to prove that the companies were negligent.

VI. Conclusion

Hydraulic fracturing in shale beds is an abnormally dangerous activity in the Marcellus Shale region and should be treated as such by state courts. Subjecting natural gas companies to strict liability would provide an incentive for the industry to adhere to more stringent environmental controls, would help prevent disasters like those in Susquehanna County, Pennsylvania, and would expedite the compensation of victims. In conjunction with stronger federal regulations, the application of a strict liability standard would effectively reduce environmental harm.

180. *See, e.g.*, Hazen & Sawyer, *supra* note 65, at 49–51.
181. *See supra* Part I.A.
182. *E.g.*, Oil & Gas Act, 58 Pa. Cons. Stat. § 601.601 (2011) ("All fines, civil penalties, permit and registration fees collected under this act are hereby appropriated to the Department of Environmental Resources to carry out the purposes of this act.").
183. *See supra* Part I.A.
184. In order to prevent *all* accidents from occurring, fracking would need to be banned entirely. *E.g.*, Baca, *supra* note 103; Trotta & Honan, *supra* note 103. If even a single accident occurs, landowners will likely seek compensation.
185. *See supra* note 127 and accompanying text.