

# BALANCING HYDRAULIC FRACTURING'S ENVIRONMENTAL AND ECONOMIC IMPACTS: THE NEED FOR A COMPREHENSIVE FEDERAL BASELINE AND THE PROVISION OF LOCAL RIGHTS

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## I. INTRODUCTION

Hydraulic fracturing, or “hydrofracking,” describes the process wherein fluid is pumped underground at extremely high pressure to drive out oil or natural gas.<sup>1</sup> Although first developed in the 1940s, hydrofracking did not begin to revolutionize the U.S. energy-extraction industry until 1998, when, for the first time, it was used in conjunction with horizontal drilling.<sup>2</sup> This combination of technologies provided for resource extraction from previously uneconomical shale basins—dubbed “unconventional” reserves<sup>3</sup>—prompting a rapid proliferation in the number of natural gas wells constructed across the United States.<sup>4</sup> For example, in Pennsylvania’s Marcellus shale formation alone, 196 wells were drilled in 2008, 763 in 2009,<sup>5</sup> 1,386 in 2010,<sup>6</sup> and an astronomical 3,500 are projected by

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1. 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, 115 (2009).

2. The first coupling of hydrofracking and horizontal drilling occurred in 1998 in Texas’s Barnett Shale play. PHILIPPE A. CHARLEZ, *ROCK MECHANICS: PETROLEUM APPLICATIONS* 239 (Editions Technip, 2d ed. 1997). See also Emily C. Powers, *Fracking and Federalism: Support for an Adaptive Approach that Avoids the Tragedy of the Regulatory Commons*, 19 *J.L. & POL’Y* 913, 919 (2011).

3. Sarah K. Adair et al., *Considering Shale Gas Extraction in North Carolina: Lessons from Other States*, 22 *DUKE ENVTL. L. & POL’Y F.* 257, 261 (2012).

4. William J. Sutherland et al., *Horizon Scan of Global Conservation Issues for 2011*, 26 *TRENDS IN ECOLOGY & EVOLUTION* 10, 14 (2011).

5. Kara Brasier & Melissa Ward, *Accelerating Activity in the Marcellus Shale: An Update on Wells Drilled and Permitted*, *PENN. ST. COLL. AGRIC. SCI: PENN. ST. EXTENSION* (May 16, 2010), <http://extension.psu.edu/naturalgas/news/2010/05/accelerating-activity>.

2020.<sup>7</sup> The practice of hydraulic fracturing is expanding so hurriedly that even residents of urbanized areas are subject to the possibility of “twenty-four hour drilling disrupting the tranquility” of their backyards.<sup>8</sup>

Currently, a schism exists between energy lobbyists: one extreme believes that natural gas provides the key to America’s energy future; the other clamors that hydrofracking should be completely eradicated because of its potential to cause environmental degradation. Because of America’s increasing demand for energy, policymakers need to find a middle ground, allowing for increased energy production while minimizing environmental risk. This paper argues that the federal government is the best entity to govern this tension between increasing extraction and environmental protectionism.

Part II provides a brief technical description of hydrofracking. Part III reviews the historical evolution of hydrofracking law in an effort to better frame the current state of energy policy. Part IV explores the environmental concerns associated with hydrofracking; Part V evaluates its economic benefits. Lastly, Part VI argues for a comprehensive, federal regulatory baseline to govern hydraulic-fracturing policy, supplemented by local rights that can extend beyond this baseline.

## II. WHAT IS HYDROFRACKING?

Hydrofracking has revolutionized the energy industry by allowing drillers to reach previously inaccessible oil and gas deposits.<sup>9</sup> Using the coupling of hydrofracking and horizontal drilling, widely dispersed oil and gas reserves can be extracted from tight, low-

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6. *Marcellus Shale—Appalachian Basin Natural Gas Play: New Research Results Surprise Everyone on the Potential of this Well-Known Devonian Black Shale*, GEOLOGY.COM, <http://geology.com/articles/marcellus-shale.shtml> (last visited Feb. 7, 2013).

7. Sutherland, *supra* note 4, at 14.

8. Timothy Riley, *Wrangling with Urban Wildcatters: Defending Texas Municipal Oil and Gas Development Ordinances Against Regulatory Takings Challenges*, 32 VT. L. REV. 349, 354 (2007). In the Barnett Shale region of Texas, new homeowners often purchase property without being cognizant of the fact that drilling companies can re-enter their property and re-stimulate the well for production. The “core area” of the Barnett formation, the Newark East Field, lies beneath the densely populated Wise, Denton, Tarrant, and Dallas counties. *Id.*

9. Jason Obold, *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, 475–76 (2012). In 2008, the Texas Supreme Court noted that “[t]he success of the Barnett Shale production zone has spurred efforts to produce gas in many other areas and geological formulations that were previously considered unrecoverable or uneconomic.” *Coastal Oil & Gas Corp. v. Garza Energy Trust*, 268 S.W.3d 1, 32 (Tex. 2008) (citation omitted).

permeability geologic areas.<sup>10</sup> Fluid cocktails are injected into the subsurface at extremely high pressures, which causes the already-existing fracture networks to expand and also creates new fissures. This expanded fracture network gives previously trapped hydrocarbons an avenue to reach the wellbore.<sup>11</sup> The contents of the fluid cocktail differ depending upon the precise geology of the area and the hydrocarbon to be extracted, but water and sand are two primary ingredients for any given fracturing operation, and are usually supplemented by various solvents, including hydrochloric acid or diesel fuel.<sup>12</sup>

The process of injecting the fracking fluid stimulates the cracking of the subsurface geology. Next, the sand (or a similar substance) flows into the cracks and props them open—the substance, when used in this way, is referred to as a “proppant”<sup>13</sup>—providing a longer duration for the desired hydrocarbon to reach the wellbore.<sup>14</sup> Approximately nine to thirty-five percent of the fracking fluid flows back up the wellbore—referred to as the “flowback”—for around two weeks after the initial fracturing.<sup>15</sup> The rest of the fracking fluid remains in the earth’s subsurface.<sup>16</sup>

### III. AN OVERVIEW OF HYDROFRACKING LAW AND POLICY

#### A. *The Energy Policy Act of 2005 and the “Halliburton Loophole”*<sup>17</sup>

The Energy Policy Act of 2005<sup>18</sup> exempted hydrofracking from the majority of the existing environmental regulatory framework.<sup>19</sup>

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10. Wiseman, *supra* note 1, at 122.

11. Obold, *supra* note 9, at 478.

12. Wiseman, *supra* note 1, at 118.

13. *Id.* Proppants are “granular substances injected into the formation to hold or ‘prop’ open coal formation fractures,” typically sand. OFFICE OF GROUND WATER & DRINKING WATER, ENVTL. PROT. AGENCY, EVALUATION OF IMPACTS TO UNDERGROUND SOURCES OF DRINKING WATER BY HYDRAULIC FRACTURING OF COALBED METHANE RESERVOIRS 4-1 (2004), available at [http://fracfocus.org/sites/default/files/publications/evaluation\\_of\\_impacts\\_to\\_underground\\_sources\\_of\\_drinking\\_water\\_by\\_hydraulic\\_fracturing\\_of\\_coalbed\\_methane\\_reservoirs.pdf](http://fracfocus.org/sites/default/files/publications/evaluation_of_impacts_to_underground_sources_of_drinking_water_by_hydraulic_fracturing_of_coalbed_methane_reservoirs.pdf).

14. Wiseman, *supra* note 1, at 118–19.

15. Powers, *supra* note 2, at 920.

16. *Id.*

17. Elisabeth N. Radow, *Homeowners and Gas Drilling Leases: Boon or Bust?*, 83 N.Y. ST. B.J. 10, 12 (2011) (explaining that the exemption from federal environmental regulation for hydrofracking is “commonly known as the Halliburton loophole”).

18. Energy Policy Act of 2005, PUB. L. NO. 109-58, 119 STAT. 594 (2005).

19. Powers, *supra* note 2, at 938–39.

Congress stated that the hydrofracking exemption would increase the country's potential to reach the goal of energy independence,<sup>20</sup> but critics remain skeptical as to the legislature's true motivation for the exemptions.<sup>21</sup> In fact, the skepticism regarding the exemptions for hydrofracking was so pervasive that certain "dubious provisions" in the 2005 Energy Policy Act became known as the "Halliburton loophole."<sup>22</sup>

President George W. Bush created the National Energy Policy Development Group less than three weeks after taking office, and appointed Vice President Dick Cheney to chair the task force.<sup>23</sup> The group held dozens of meetings discussing energy policy, only one of which involved the participation of environmental interest groups.<sup>24</sup> Its ultimate recommendations "were greatly influenced, [and] often directly drafted, by [the oil and gas] industry."<sup>25</sup> Emails revealed that the group "adopted verbatim" numerous American Petroleum Institute (API) suggestions.<sup>26</sup> These heavily industry-influenced recommendations, coming from the National Energy Policy Development Group, formed the basis for the Energy Policy Act of 2005, fostering the skepticism previously mentioned.<sup>27</sup>

Section 322 of the Energy Policy Act of 2005 amended the Safe Drinking Water Act (SDWA)—which purports to protect public water supplies from hazardous substances and underground injection—to exclude "the underground injection of natural gas for purposes of storage"<sup>28</sup> and "the underground injection of fluids or

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20. *Id.*

21. See, e.g., Editorial, *The Halliburton Loophole*, N.Y. TIMES, Nov. 2, 2009, at A28 available at <http://www.nytimes.com/2009/11/03/opinion/03tue3.html?scp=1&sq=halliburton+loophole&st=nyt> (noting that one of the provisions in the 2005 Energy Act was "dubbed the Halliburton Loophole").

22. See *id.* (claiming that the "dubious provisions" were "inserted at the behest of—you guessed it—then-Vice President Dick Cheney, a former chief executive of Halliburton"). On March 17, 1949, the first two commercial hydrofracking jobs were performed by Halliburton. Carl T. Montgomery & Michael B. Smith, *Hydraulic Fracturing: History of an Enduring Technology*, 62 J. PETROLEUM TECH. 26, 27 (2010), available at <http://www.spe.org/jpt/print/archives/2010/12/10Hydraulic.pdf>.

23. Obold, *supra* note 9, at 483. The group was dominated by the energy industry, with the primary members coming from energy companies such as Exxon, Enron, and lobbyists from the American Petroleum Institute. Eric Dannenmaier, *Executive Exclusion and the Cloistering of the Cheney Energy Task Force*, 16 N.Y.U. ENVTL. L.J. 329, 331 (2008).

24. Dannenmaier, *supra* note 23, at 331.

25. *Id.*

26. *Id.*

27. Obold, *supra* note 9, at 483–84.

28. 42 U.S.C. § 300h(d)(1)(B)(i) (2006).

propping agents (other than diesel fuels) pursuant to hydraulic fracturing operations related to oil, gas, or geothermal production activities.”<sup>29</sup> Section 322 overturned an opinion in which the Eleventh Circuit held that Part C of the SDWA required the Environmental Protection Agency (EPA) to regulate hydraulic fracturing activities.<sup>30</sup> Additionally, the Energy Policy Act “effectively exempted wellpad construction activities associated with hydrofracking from the National Pollutant Discharge Elimination System (NPDES) under the [Clean Water Act],”<sup>31</sup> because the CWA exempts “[s]tormwater runoff from oil, gas, and mining operations” from permitting requirements.<sup>32</sup>

Because many states choose not to regulate hydrofracking pursuant to the SDWA even when diesel is used in the fracking fluid, the SDWA fails to provide any meaningful environmental protection for fracturing operations in much of the United States.<sup>33</sup> However, in 2003, BJ Services Co., Halliburton Energy Services, Inc., and Schlumberger Technology Corp. voluntarily agreed with the EPA to remove diesel fuel from the fracturing fluids “injected into coalbed methane production wells in underground sources of drinking water,” but did not agree to remove diesel fuel from other operations.<sup>34</sup>

Even before Congress enacted the Energy Policy Act of 2005, hydrofracking was exempt from the Resource Conservation and Recovery Act (RCRA),<sup>35</sup> which regulates hazardous-waste disposal, and from reporting requirements for toxic substances pursuant to the Emergency Planning and Community Right-to-Know Act of 1986

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29. 42 U.S.C. § 300h(d)(1)(B)(ii) (2006).

30. *Legal Envtl. Assistance Found., Inc. v. U.S. Envtl. Prot. Agency*, 118 F.3d 1467, 1478 (11th Cir. 1997).

31. Powers, *supra* note 2, at 939.

32. 33 U.S.C. § 1342(l)(2) (2006).

33. For example, “regulations applicable in Louisiana (like those in most states) have never been used to regulate fracturing, even when the fracking fluid contains diesel.” Keith B. Hall, *Hydraulic Fracturing: What are the Legal Issues?*, 59 LA. B.J. 250, 251 (2012).

34. Rebecca Jo Reser & David T. Ritter, *State and Federal Legislation and Regulation of Hydraulic Fracturing*, 57 *ADVOC. (TEX.)* 31, 31 (2011), available at [http://www.litigationsection.com/downloads/Advocate\\_Vol57\\_Winter2011.pdf](http://www.litigationsection.com/downloads/Advocate_Vol57_Winter2011.pdf).

35. 42 U.S.C. § 6921(b)(2)(A) (2006) (“Notwithstanding the provisions of paragraph (1) of this subsection, drilling fluids, produced waters, and other wastes associated with the exploration, development, or production of crude oil or natural gas or geothermal energy shall be subject only to existing State or Federal regulatory programs in lieu of this subchapter.”). The EPA then fully exempted wastes associated with the production of crude oil, natural gas, and geothermal energy in 1988. *Regulatory Determination for Oil and Gas and Geothermal Exploration, Development and Production Wastes*, 53 *Fed. Reg.* 25,446, 25,447 (July 6, 1988) (codified at 40 C.F.R. § 261.4 (2010)).

(EPCRA).<sup>36</sup> In addition, the EPA “will not aggregate air emissions from the various operations that occur on a wellpad, and the agency has exempted pollutants emitted by surface waste, like fracking fluid, from stationary source regulation” under the Clean Air Act (CAA).<sup>37</sup> With these numerous environmental exemptions, and with technological advances allowing for more efficient production, the United States has witnessed an explosion of hydrofracking: production of natural gas was level between 1996 and 2006, but once “fracking suddenly caught on . . . output has climbed steadily.”<sup>38</sup>

### *B. Current Federal Oversight of Hydrofracking*

Even with hydrofracking’s widespread environmental exemptions,<sup>39</sup> it does not completely escape federal oversight. For example, states still must comply with the CWA’s water-quality standards, and they still must satisfy the CAA’s national ambient air quality standards.<sup>40</sup>

Specifically, the CWA provides federal oversight for the disposal of wastewater through sewer systems of publicly owned treatment facilities, as these mechanisms for disposal are “navigable waters” of the United States.<sup>41</sup> However, the Supreme Court’s current understanding of “navigable waterways,” opined in Justice Kennedy’s concurrence in *Rapanos v. United States*,<sup>42</sup> dictates that jurisdiction under the CWA only arises if a “significant nexus” exists between federal navigable waters and an affected groundwater connection.<sup>43</sup> Because most of hydrofracking’s probable impacts on groundwater are hard to trace to navigable waters—it is currently very difficult to assess the amount and direction that the fracking fluid travels within

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36. Hannah Wiseman, *Regulatory Adaptation in Fractured Appalachia*, 21 VILL. ENVTL. L.J. 229, 250 n.125 (2010).

37. Powers, *supra* note 2, at 940–41.

38. Mark Perry, *U.S. Natural Gas Production Hits All-Time High*, REAL CLEAR ENERGY (July 5, 2011), [http://www.realclearenergy.org/articles/2011/07/05/us\\_natural\\_gas\\_production\\_at\\_all\\_time\\_high\\_106236.html](http://www.realclearenergy.org/articles/2011/07/05/us_natural_gas_production_at_all_time_high_106236.html). Additionally, although Mark Perry does not point to this correlation, it is important to note hydrofracking’s rapid increase beginning in 2006 and the passage of the Energy Policy Act of 2005.

39. See *supra* text accompanying notes 18–38.

40. Powers, *supra* note 2, at 940.

41. See Reser & Ritter, *supra* note 34, at 32.

42. 547 U.S. 715, 759 (2006).

43. Powers, *supra* note 2, at 940.

the subsurface—satisfying the “significant nexus” requirement for the underground injection of fluids is nearly impossible.<sup>44</sup>

Even though hydrofracking is exempted from the definition of “underground injection” within the SDWA,<sup>45</sup> § 1431(a) provides the EPA with authority to “take such actions [deemed to be] necessary in order to protect [public] health . . . [n]otwithstanding any other provision[s] of this subchapter,” which includes hydrofracking’s explicit exemptions specified in 42 U.S.C. § 300h(d)(1)(B).<sup>46</sup> For example, § 1431(a) permits the EPA to compel companies to provide a potable water replacement for those possessing polluted personal water wells, to install explosivity meters, to mandate the surveying and sampling of all domestic wells within a circumscribed area, to take soil samples, and to eliminate gas flow pathways that could reach aquifers or other potential water supplies.<sup>47</sup>

For air quality, EPA’s regulation of fracking is rooted in the 2010 consent decree resulting from *WildEarth Guardians v. Jackson*.<sup>48</sup> That decree, issued by the D.C. Circuit, required the EPA to regulate air emissions of oil and gas facilities “under CAA section 112(f)(2)” by January 31, 2011.<sup>49</sup> Pursuant to the court’s holding, the EPA is requiring new source performance standards for volatile organic compounds and sulfur dioxide for new and existing wells.<sup>50</sup> Additionally, the EPA is suggesting that for natural gas processing plant valves, there should be a tightening of what constitutes a “leak.”<sup>51</sup>

Although the EPA is currently working on a framework of federal permitting guidelines for fracking operations using diesel fuels,<sup>52</sup> the oil and gas industry has indicated that they may contest

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44. *Id.* at 940 n.169.

45. See 42 U.S.C. § 300h(d)(1)(B) (excluding from the definition of underground injection “the underground injection of natural gas for purposes of storage” and “the underground injection of fluids or propping agents . . . pursuant to hydraulic fracturing operations”).

46. See 42 U.S.C. § 300i(a) (2006) (excluding “the underground injection of natural gas for purposes of storage” and “the underground injection of fluids or propping agents (other than diesel fuels) pursuant to hydraulic fracturing operations . . .”).

47. See Reser & Ritter, *supra* note 34, at 35–36 (discussing the EPA’s rights under the SDWA).

48. Consent Decree, *WildEarth Guardians v. Jackson*, Case 1:09-cv-00089-CK (D.D.C. Feb. 4, 2010), available at <http://www.jacksonkelly.com/jk/pdf/C2110376.PDF>.

49. *Id.* at 3–4.

50. *Id.*

51. *Id.*

52. The EPA has authority to regulate underground injection of diesel pursuant to 42 U.S.C. § 300h(d)(1)(B)(ii) (2006).

future EPA regulations for being “overly broad.”<sup>53</sup> Likewise, some states, such as North Dakota, have expressed concerns that EPA’s forthcoming rules might overburden states and provide an impediment to the thriving natural gas economy, and have indicated that they might bring suit if the EPA finalizes the regulations.<sup>54</sup> North Dakota’s reaction to potential federal oversight is indicative of current regulation of hydrofracking in many states throughout the country—big oil and gas companies drill with minimal environmental regulations,<sup>55</sup> and widespread industry opposition will render meaningful change deeply challenging.

### *C. Major Proposed Federal Legislation: The FRAC Act*

In response to growing concerns about the environmental impacts of fracking and increasing public awareness of the lack of regulatory oversight governing hydrofracking,<sup>56</sup> in 2009 the Fracturing Responsibility and Awareness of Chemicals Act (FRAC Act) was proposed for debate in both the House of Representatives<sup>57</sup> and the Senate.<sup>58</sup> The bill was reintroduced in 2011, again in both the House<sup>59</sup> and Senate,<sup>60</sup> but Congress has yet to act affirmatively on the proposal.<sup>61</sup> The FRAC Act would overhaul the current regulatory scheme overseeing hydrofracking by repealing its exemption in the

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53. Sorrell E. Negro, *Fracking Wars: Federal, State and Local Conflicts over the Regulation of Natural Gas Activities*, ZONING & PLAN L. REP. Feb. 2012, at 1, 2.

54. North Dakota’s particular concern is federal regulation that would require permitting for petroleum distillates that make-up less than one-percent of fracking fluid used in the Bakken oil shale in western North Dakota. *North Dakota Eyes Suit if EPA Pursues Broad Definition of Diesel Fracking*, INSIDE EPA WEEKLY REPORT, Nov. 11, 2011, at 30.

55. See *infra* Part VI.

56. Television shows, documentaries such as Gasland, dramatized cinema such as the impending “Promised Land,” and newspaper articles have begun to publically broadcast the environmental concerns with hydrofracking. See, e.g., *Matt Damon Fracking Film Lights Up Petroleum Lobby*, NASDAQ, <http://www.nasdaq.com/video/video.aspx?vid=Matt-Damon-Fracking-Film-Lights-Up-Petroleum-Lobby-5jac00046> (last visited Feb. 11, 2013).

57. Fracturing Responsibility and Awareness of Chemicals Act of 2009, H.R. 2766, 111th Cong. (2009).

58. Fracturing Responsibility and Awareness of Chemicals (FRAC) Act, S. 1215, 111th Cong. (2009).

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

60. FRAC Act, S. 587, 112th Cong. (2011).

61. The bill in the House and Senate has the status of “Died (Referred to Committee)” as of November 20, 2012. Fracturing Responsibility and Awareness of Chemicals Act of 2011, H.R. 1084, 112<sup>th</sup> Cong. (as introduced by House, Mar. 15, 2011); FRAC Act, S. 587 112th Cong. (as introduced by Senate, Mar. 15, 2011).



SDWA and by requiring disclosure of fracturing chemicals.<sup>62</sup> This change would require the EPA to undertake the “inspection, monitoring, recordkeeping, and reporting requirements” pursuant to 42 U.S.C. § 330h(b)(1)(c), which would require all drillers to prove that their fracking fluids will not endanger potable water supplies before they could obtain an Underground Injection Control permit and begin their fracturing job.<sup>63</sup>

The disclosure portion of the FRAC Act would require distributing to the public a list of the “chemical constituents” used in fracking fluid, but not the proportions used, as those are considered “proprietary chemical formulas.”<sup>64</sup> If necessary during a public-health emergency, even the proprietary formulas would have to be disclosed (though not to the public).<sup>65</sup> The oil and gas lobby, fearful that the leaking of their trade secrets and proprietary information will diminish profits, have vehemently opposed the FRAC Act.<sup>66</sup>

#### IV. MAJOR ENVIRONMENTAL CONCERNS WITH HYDROFRACKING

Questions regarding hydrofracking’s environmental impacts have begun to radiate throughout the country, and many lawsuits over those impacts—particularly over water contamination—have been filed, asserting common law tort claims.<sup>67</sup> These growing environmental concerns are driving some states to impose moratoriums on fracking pending further research on its

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62. Reser & Ritter, *supra* note 34, at 33. The bills propose including “the underground injection of fluids or propping agents pursuant to hydraulic fracturing operations related to oil, gas, or geothermal production activities” within the definition of “underground injection” in the SDWA. H.R. 1084, § 2(a); S. 587, § 2(a).

63. Reser & Ritter, *supra* note 34, at 33.

64. H.R. 1084, § 2(b); S. 587, § 2(b).

65. “Whenever the State or the Administrator, or a treating physician or nurse, determines that a medical emergency exists and the proprietary chemical formula of a chemical used in hydraulic fracturing operations is necessary for medical treatment, the person conducting the hydraulic operations shall, upon request, immediately disclose the proprietary chemical formulas or the specific chemical identity of a trade secret chemical to the State, the Administrator or treating physician.” H. R. 1084, § 2(b); S. 587, § 2(b).

66. During 2009 and 2010 Energy in Depth, an oil and gas group backed by “some of the largest oil companies on the planet, such as Chevron, BP, Shell, and Occidental, along with the American Petroleum Institute and other trade associations” spent \$126.8 million on lobbying. *Big Oil Front Group Poured Millions into Lobby Against Fracking Regulation*, POLLUTERWATCH (Feb. 18, 2011, 8:45 AM), <http://www.polluterwatch.com/blog/big-oil-front-group-poured-millions-lobby-against-fracking-regulation>.

67. Joe Schremmer, Comment, *Avoidable “Fraccident”: An Argument Against Strict Liability for Hydraulic Fracturing*, 60 U. KAN. L. REV. 1215, 1216–17 (2012).

environmental impacts,<sup>68</sup> and driving countries such as France, Switzerland, and South Africa to enact nationwide hydrofracking bans.<sup>69</sup> This section will provide an overview of the most prominent environmental concerns related to hydrofracking: water contamination; water usage; greenhouse-gas emissions; seismic disturbance; and the loss of pristine wilderness.

### *A. Water Contamination*

In 2004, the EPA “concluded that the injection of hydraulic fracturing fluids into coalbed methane wells pose[d] little or no threat” to underground sources of drinking water.<sup>70</sup> However, because most formations fracture vertically, chemical leakage from hydrocarbon formations to above aquifers remains a major concern notwithstanding the EPA’s 2004 findings.<sup>71</sup> Furthermore, although approximately nine to thirty-five percent of the fracking flowback returns to the wellbore, the rest remains buried within the earth’s subsurface,<sup>72</sup> leading to concern that the flowback could move toward the surface, through either well-casing cracks or fissures in the rock, and contaminate local groundwater reserves and consequently, drinking water supply.<sup>73</sup>

The EPA announced that this risk of groundwater contamination is minimal because fracking fluid contains only a small concentration of toxic chemicals, effective fluid-recovery techniques can reduce the amount of fracking fluid left underground, and the rock surrounding the fractures can absorb much of what remains.<sup>74</sup> The shale strata is believed to act as an effective barrier to fluid migration because shale formations have low permeability,<sup>75</sup> and there is typically over a vertical mile of rock sitting between the horizontal fracturing zone

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68. For example, New York has a moratorium on fracking near the New York City and Syracuse watersheds, New Jersey has imposed a moratorium on hydrofracking throughout the state, and Maryland instituted a three-year moratorium. Negro, *supra* note 53, at 9.

69. *Id.*

70. Schremmer, *supra* note 67, at 1224.

71. *Id.* at 1221.

72. Powers, *supra* note 2, at 920.

73. *See id.* (writing that “[t]he rest remains below the earth’s surface and has the potential to move through cracks in well casings or the target substrate into surrounding rock and eventually to migrate into and contaminate groundwater sources for waterways and drinking supplies”).

74. Schremmer, *supra* note 67, at 1221–22.

75. *See* ENVTL. PROT. AGENCY, *supra* note 13, at ES-17 (“The low permeability of relatively unfractured shale . . .”).

and the aquifers above.<sup>76</sup> Even the fact that shale “must be hydraulically fractured to produce fluids” has been proffered as evidence that migration is not a major concern.<sup>77</sup>

The apprehension over the large proportion of the flowback remaining nestled underground is somewhat abated by the unique chemical properties of shale, as shale is generally chemically reactive with high water-content fluids.<sup>78</sup> Over-time, when the water contacts the shale, the two substances form a viscous slurry that eventually is believed to seal the fissures within the rocks, inhibiting flowback migration.<sup>79</sup> However, because the fissures are not sealed instantaneously, an avenue still exists for the fracking fluid to flow toward the surface via any vertical fissures. In geologic regions with thinner shale beds, water contamination would seem to be more likely.

A 2011 study conducted by the Nicholas School for the Environment at Duke University found “no evidence of contamination from chemical-laden fracking fluids.”<sup>80</sup> Nevertheless, methane levels were “17 times higher on average in wells located within a kilometer of active hydrofracking sites,” and the methane observed at these wells was of the type that is indicative of methane formed at high temperature and pressure deep underground—the methane typically released by drilling and hydrofracking operations.<sup>81</sup> Although it is important to realize that the data only exhibits a sizeable correlation, the study strongly suggests that drilling and hydrofracking contributes to water contamination, albeit not from the fracking fluids themselves.

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76. Schremmer, *supra* note 67, at 1222.

77. See Sy Gruza, *Will NYSDEC's Proposed Regulations Prevent the Potential Significant Adverse Impacts of Fracking?*, 42 ENVTL. L. REP. NEWS & ANALYSIS 10,331, 10,334 (2012) (“The fact that the shales must be hydraulically fractured to produce fluids is evidence that these rocks do not readily transmit fluid.”).

78. Schremmer, *supra* note 67, at 1222.

79. *Id.*

80. Tim Lucas, *Methane Levels 17 Times Higher in Water Wells Near Hydrofracking Sites*, NICHOLAS SCH. OF THE ENV'T (May 9, 2011), <http://www.nicholas.duke.edu/hydrofracking/methane-levels-17-times-higher-in-water-wells-near-hydrofracking-sites>.

81. *Id.* Wells closer to active hydrofracking sites “had a different isotopic footprint,” and were made up of thermogenic methane, “which is formed at high temperatures deep underground and is captured in gas wells during hydrofracking” as opposed to biogenic methane, which is not associated with hydrofracking and “is produced at shallower depths and lower temperatures.” *Id.*

In 2011, pursuant to CERCLA § 104(e),<sup>82</sup> which authorizes the EPA to monitor hydrofracking operations because of the nonpetroleum-based fluids used in the fracking fluid,<sup>83</sup> the EPA decided it was time to reinvestigate the connection between water contamination and hydrofracking.<sup>84</sup> The EPA inspected the alleged groundwater contamination in the Pavillion Gas Field of Wyoming, and published a draft report of its findings<sup>85</sup> (a final report is not expected until 2014).<sup>86</sup> The EPA findings differed dramatically from their 2004 conclusions.<sup>87</sup>

The 2011 draft concluded that “inorganic and organic constituents associated with hydraulic fracturing have contaminated ground water at and below the depth used for [the] domestic water supply.”<sup>88</sup> This conclusion was tempered somewhat by the distinctive geology of the Pavillion Gas Field, which consists of “thin discontinuous sandstone units” possessing “little lateral and vertical continuity to hydraulically fracture tight sandstones and no lithologic barrier (lateral continuous shale units) to stop upward vertical migration of aqueous constituents of hydraulic fracturing.”<sup>89</sup> Additionally, extending the casing below the “maximum depth of domestic wells in the area” and using more cement may help alleviate fluid migration.<sup>90</sup> Nevertheless, residents living in the area of Pavillion, Wyoming were advised to avoid drinking from their wells

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82. “Whenever the President is authorized to act pursuant to subsection (a) of this section, or whenever the President has reason to believe that a release has occurred or is about to occur, or that illness, disease, or complaints thereof may be attributable to exposure to a hazardous substance, pollutant, or contaminant and that a release may have occurred or be occurring, he may undertake such investigations, monitoring, surveys, testing, and other information gathering as he may deem necessary or appropriate to identify the existence and extent of the release or threat thereof, the source and nature of the hazardous substances, pollutants or contaminants involved . . .” 42 U.S.C. § 9604(b)(1) (2005).

83. Reser & Ritter, *supra* note 34, at 33.

84. U.S. ENVTL. PROT. AGENCY, No.600/D-11/001, DRAFT PLAN TO STUDY THE POTENTIAL IMPACTS OF HYDRAULIC FRACTURING ON DRINKING WATER RESOURCES 1 (2011).

85. U.S. ENVTL. PROT. AGENCY, DRAFT INVESTIGATION OF GROUND WATER CONTAMINATION NEAR PAVILLION, WYOMING (2011) (responding to complaints made by well owners regarding drinking water contamination by conducting a study on the contributing factors of the contamination).

86. Schremmer, *supra* note 67, at 1223.

87. See *supra* text accompanying notes 70–94 (discussing the findings of the EPA).

88. U.S. ENVTL. PROT. AGENCY, *supra* note 85, at 39.

89. *Id.*

90. *Id.* at 38.

because of the hydrocarbons detected in the water supply.<sup>91</sup> Notwithstanding the EPA's conclusion that hydrofracking was contributing to water pollution,<sup>92</sup> Matt Mead, the governor of Wyoming at the time, delayed the release of the EPA's findings so state officials and energy juggernauts<sup>93</sup> could "coordinate an 'all-out-press' against the EPA."<sup>94</sup> Wyoming's response suggests that oil- and gas-rich states may prefer to be willfully blind, prioritizing the economic benefits of hydrofracking over open disclosure and safety.

The risk of water-supply contamination is greater in regions with more "brittle" geology—rock formations already containing many faults and fractures that can "serve as conduits that facilitate migration of contaminants, methane, or pressurized fluids from deep formations towards the surface."<sup>95</sup> In water-rich states, where groundwater connections are widespread, migration is particularly problematic.<sup>96</sup> For example, because of the particular geology of the Catskill region's bedrock, hydrofracking in upstate New York could be highly dangerous to the New York City watershed.<sup>97</sup> The Catskill region contains brittle geological features and in some areas, no vertical distance exists between New York's water infrastructure and the Marcellus formation (the location of the gas to be extracted).<sup>98</sup>

As discussed above, most of the water used during fracturing remains underground, and only about nine to thirty-five percent returns to the surface.<sup>99</sup> Many states are struggling to dispose of the wastewater safely, and approaches vary by region. Although wastewater disposal is regulated nationally under the CWA and

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91. Negro, *supra* note 53, at 5.

92. U.S. ENVTL. PROT. AGENCY, *supra* note 85, at 39.

93. See, e.g., Christopher Helman, *Encana Calls B.S. on EPA's Wyoming Gas Fracking Study*, FORBES (Dec. 12, 2011), <http://www.forbes.com/sites/christopherhelman/2011/12/12/encana-calls-b-s-on-epas-wyoming-gas-fracking-study/> (calling some of Encana Oil & Gas's criticisms "downright funny in their suggestion that the agency bungled not just its testing approach, but the test samples themselves").

94. *Wyoming Pushed EPA to Delay Study on Fracking: Report*, REUTERS (May 3, 2012), <http://www.reuters.com/article/2012/05/03/us-usa-fracking-epa-idUSBRE8421K920120503>.

95. N.Y.C. DEP'T OF ENVTL. PROT., FINAL IMPACT ASSESSMENT REPORT: IMPACT ASSESSMENT OF NATURAL GAS PRODUCTION IN THE NEW YORK CITY WATER SUPPLY WATERSHED 13 (2009), available at [http://www.nyc.gov/html/dep/pdf/natural\\_gas\\_drilling/12\\_23\\_2009\\_final\\_assessment\\_report.pdf](http://www.nyc.gov/html/dep/pdf/natural_gas_drilling/12_23_2009_final_assessment_report.pdf).

96. Powers, *supra* note 2, at 925.

97. *Id.*

98. N.Y.C. DEP'T OF ENVTL. PROT., *supra* note 95, at 13–20 (describing New York's geological features).

99. Powers, *supra* note 2, at 920.

SDWA, there are a wide array of methods that satisfy the national regulatory standard. In western states the common practice is to inject the flowback into underground reservoirs.<sup>100</sup> Most eastern states do not have the proper geology for underground injection and cannot treat the waste at municipal treatment plants, so they often dispose of wastewater into lined pits or ponds.<sup>101</sup> If not done properly, this can lead to surface pollution. Indeed, due to increasing amounts of wastewater in his state's rivers, Pennsylvania Governor Tom Corbett asked the EPA to develop federal regulations for "pretreating" wastewater.<sup>102</sup> Likewise, wastewater pollution concerns led the New Jersey legislature to ban "the treatment or storage of fracking waste in the state," though the bill was vetoed by Governor Chris Christie, who instead imposed a one-year moratorium on fracking to further study the issue.<sup>103</sup>

It is important to note that groundwater contamination can also occur from poorly constructed domestic water wells.<sup>104</sup> Because drinking-water wells are not subject to the same oversight and scrutiny as corporate operations, the casing on the water wells may not extend deeply enough to protect the water supply.<sup>105</sup> These poorly designed wells can allow contaminated surface water to flow into the water well and pollute the entire underlying aquifer.<sup>106</sup> More unexpectedly, older, undisclosed wells can contribute to surface pollution because when subterranean methane pockets are released, the methane can escape to the surface—which can even take the form of a weeklong, thirty-foot methane-laced geyser.<sup>107</sup> Many water wells

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100. Negro, *supra* note 53, at 6.

101. *Id.*

102. *Id.* at 6–7.

103. Mireya Navarro, *New Jersey Senate Bans Treatment of Fracking Waste*, N.Y. TIMES (June 25, 2012, 6:31 PM), <http://green.blogs.nytimes.com/2012/06/25/new-jersey-senate-bans-treatment-of-fracking-waste/>.

104. ANTHONY ANDREWS ET AL., CONG. RESEARCH SERV., R40894, UNCONVENTIONAL GAS SHALES: DEVELOPMENT, TECHNOLOGY, AND POLICY ISSUES 26 (2009), available at [http://assets.opencrs.com/rpts/R40894\\_20091030.pdf](http://assets.opencrs.com/rpts/R40894_20091030.pdf).

105. *Id.*

106. *Id.* "In such instances, and particularly where natural gas drilling and stimulation activities are nearby, leaky surface impoundments or careless surface disposal or drilling fluids at the natural gas operation could increase the risk of contaminating the nearby water well . . ." *Id.*

107. Scott Detrow, *Perilous Pathways: How Drilling Near an Abandoned Well Produced a Methane Geyser*, NPR (Oct. 9, 2012, 8:30 AM), <http://stateimpact.npr.org/pennsylvania/2012/10/09/perilous-pathways-how-drilling-near-an-abandoned-well-produced-a-methane-geyser/>.

were created before permits were required, and therefore it is nearly impossible to be certain that a fracking site is completely well-free.<sup>108</sup> The risk of groundwater pollution is heightened because federal law exempts the construction or operation of oil and gas operations from the CWA, although states can regulate within this federal void.<sup>109</sup>

### *B. The Large Quantity of Water Required for Hydrofracking*

Lower estimates publicize that two to four million gallons of water are required to fracture a horizontal well<sup>110</sup> and higher estimates announce the number to be between four and eight million gallons.<sup>111</sup> The fact that wells can be fractured multiple times<sup>112</sup> greatly increases the amount of water used at each drilling site. Even though hydrofracking uses millions of gallons of freshwater, its water consumption is relatively minimal compared with other activities. For example, in New York, fracking is estimated to consume approximately nine billions gallons of water a year—a small fraction of the 3.8 trillion total gallons of water used annually.<sup>113</sup> However, as hydrofracking becomes more common, the strain on the water supply will rapidly become more significant.<sup>114</sup> In the Barnett Shale play, water usage increased from approximately 700-acre-feet in 2000 to more than 7,000 acre-feet in 2005.<sup>115</sup>

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108. See *id.* (Over the last 150 years, “as many as 300,000 wells have been drilled, an unknown number of them left behind as hidden holes in the ground.”).

109. See 33 U.S.C. § 1342(l)(2) (2006). For example, Pennsylvania requires a permit for “implementation of erosion and sedimentation controls, including storm water management.” ANDREWS ET AL., *supra* note 104, at 36.

110. JACQUELYN PLESS, REGULATING HYDRAULIC FRACTURING: STATES TAKE ACTION, 3 (2010), available at <http://www.ncsl.org/documents/energy/FrackingPub1210.pdf>.

111. CHARLES W. ABDALLA & JOY R. DROHAN, PENN. ST. UNIV., WATER WITHDRAWALS FOR DEVELOPMENT OF MARCELLUS SHALE GAS IN PENNSYLVANIA: INTRODUCTION TO PENNSYLVANIA'S WATER RESOURCES 3 (2010). (“Hydrofracturing a horizontal Marcellus well may use 4 to 8 million gallons of water, typically within about 1 week. However, based on experiences in other major U.S. shale gas fields, some Marcellus wells may need to be hydrofractured several times over their productive life (typically five to twenty years or more).”).

112. *Id.*

113. Gruza, *supra* note 77, at 10,333.

114. See, e.g., Michael Clark, *Texas Struggles to Manage Hydrofracking Water Use*, EARTH TIMES (Sept. 10, 2011), <http://www.earthtimes.org/energy/texas-struggles-manage-hydrofracking-water-use/1345/> (articulating that fracking in Texas “currently uses [12 billion] gallons of water per year and it is expected to climb to [39 billion] by 2030).

115. ANDREWS ET AL., *supra* note 104, at 7.

Utilizing an additional two to eight million gallons of water<sup>116</sup> in a brief period can strain existing infrastructure and threaten current water uses.<sup>117</sup> Significant water withdrawals can also have negative effects on municipal water supplies, recreational activities, utilities dependent on flowing water, and aquatic life.<sup>118</sup> Reduced stream flow, especially in times of drought, can cause degradation of carefully balanced natural habitats.<sup>119</sup> Groundwater supplies can be affected too. For example, Louisiana's Office of Conservation has received complaints from landowners that their wells are "going dry."<sup>120</sup> Because of the growing concerns regarding the public water supply, some states have recently enacted requirements that companies provide proposals for water usage before receiving a permit to begin fracturing operations.<sup>121</sup>

### C. Greenhouse Gas Emissions

Because natural gas is cleaner burning than both coal and oil, hydrofracking supporters tout natural gas as a "bridge fuel,"<sup>122</sup> and suggest that the cleaner emissions offset any negative environmental impacts. The combustion of natural gas emits nearly "two-thirds less carbon dioxide than coal and one-quarter less than oil when consumed in a typical electric power plant."<sup>123</sup> Furthermore, the combustion of natural gas "also emits less particulate matter, sulfur dioxide, and nitrogen dioxides" than both coal and oil.<sup>124</sup>

However, natural gas may not have as strong an impact on the reduction of greenhouse emissions as previously thought. A 2011 Cornell University study found that shale gas has a significantly larger greenhouse footprint than conventional gas because methane, a

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116. See *supra* text accompanying note 111.

117. PLESS, *supra* note 110, at 3.

118. *Id.*

119. Gruza, *supra* note 77, at 10,333.

120. Hall, *supra* note 33, at 251.

121. For example, "Michigan's Department of Environmental Quality enacted a rule in 2011 requiring gas companies to provide the proposed total volume of water needed for fracking operations, complete an online water withdrawal evaluation, and explain the source of their water before beginning extraction." Negro, *supra* note 53, at 6. New York's DEC regulates "the rate, timing, and location of water withdrawals through permit conditions." Gruza, *supra* note 77, at 10,333.

122. MICHAEL RATNER, CONG. RESEARCH SERV., R41543, GLOBAL NATURAL GAS: A GROWING RESOURCE 1 (2010), available at [http://assets.opencrs.com/rpts/R41543\\_20101222.pdf](http://assets.opencrs.com/rpts/R41543_20101222.pdf).

123. *Id.*

124. *Id.*



highly potent greenhouse gas, is emitted with the completion of a fracturing job.<sup>125</sup> Methane is the chief component of natural gas, and methane's global warming potential is "far greater" than that of CO<sub>2</sub>, especially in the decades following the gas's release.<sup>126</sup> In fact, over a twenty-year period, shale gas, while having fewer emissions due to the direct combustion, may have a larger greenhouse footprint than both coal and diesel oil because of fugitive methane.<sup>127</sup> It is important to note that these conclusions have been disputed by other scholars at Cornell University for "overestim[ing] the fugitive emissions associated with unconventional gas extraction."<sup>128</sup>

Nevertheless, recent greenhouse gas projections from the State Department forecast an eight percent increase in methane release between 2005 and 2020, with the greatest difference attributed to increases in fugitive methane from the natural gas sector.<sup>129</sup> Currently, the "Business as Usual" projection shows steady increases in greenhouse gas emissions through 2050,<sup>130</sup> but "shifts in the competitive relationship between natural gas and coal in electricity generation markets" could have large impacts on methane gas emissions (relatively larger in the natural gas sector) and carbon dioxide emissions (relatively larger in the coal sector).<sup>131</sup>

#### *D. Seismic Disturbance*

Structural geologists are concerned that the subsurface interference associated with hydrofracking could lead to earthquakes by triggering unintended seismic disturbances.<sup>132</sup> Seismic disturbance is a larger concern in already seismically active areas and fault zones, as subsurface disruption in these areas is more likely to trigger earthquakes.<sup>133</sup> Of even more concern, subsurface interference could

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125. Robert Howarth, *Climate Impacts of Shale Gas Development*, CORNELL UNIV. (Apr. 19, 2012), available at <http://www.eeb.cornell.edu/howarth/Marcellus.html>.

126. Reser & Ritter, *supra* note 34, at 38.

127. Howarth, *supra* note 125. See also Reser & Ritter, *supra* note 34, at 38. ("[T]he footprint of shale gas is at least 20% greater than coal, and perhaps more than twice as great on the 20-year horizon and is comparable to coal when compared over 100 years.")

128. Tim Boersma & Corey Johnson, *The Shale Gas Revolution: U.S. and EU Policy and Research Agendas*, 29 REV. POL'Y RES. 570, 573 (2012).

129. U.S. DEPT. OF STATE, U.S. CLIMATE ACTION REPORT 79 (2010).

130. *Id.* at 77.

131. *Id.* at 84.

132. See Powers, *supra* note 2, at 925 (stating that "subsurface interference could . . . trigger earthquakes").

133. Eli MacKinnon, *Strange Dallas Earthquakes Might be Caused by Fracking*, MOTHER NATURE NETWORK (Oct. 2, 2012, 2:10 PM), <http://www.mnn.com/earth-matters/energy/stories/>

fissure pre-existing subsurface-fault zones, allowing gas migration into aquifers.<sup>134</sup>

According to Dr. Cliff Frohlich, a senior research scientist at the University of Texas's Institute for Geophysics, "it is possible that some of these earthquakes have a natural origin . . . but it is implausible that all are natural," as there has been a clustering of the earthquakes witnessed in the Barnett Shale region within two miles of disposal wells.<sup>135</sup> The underground injection of wastewater is believed to be causing the newfound seismic activity.<sup>136</sup> Before 2008, Dallas, which sits near the active drilling sites of the Barnett shale play, never recorded an earthquake stronger than a magnitude three, but the city has experienced an earthquake of this magnitude every subsequent year, with the exception of 2010.<sup>137</sup> Arkansas has also recently witnessed an uptick in seismic activity, and because of the correlation witnessed between seismic activity and underground injection of wastewater, "the Arkansas Oil and Gas Commission has imposed an emergency moratorium on the drilling of new injection wells . . . ."<sup>138</sup>

### *E. Loss of Pristine Wilderness*

In 2011, New York's Department of Environmental Conservation issued a Revised Draft Supplemental Generic Environmental Impact Statement,<sup>139</sup> which stated that exposing environmentally sensitive areas to the potential adverse impacts of

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strange-dallas-earthquakes-might-be-caused-by-fracking ("Faults are everywhere. A lot of them are stuck, but if you pump water in there, it reduces friction and the fault slips a little."); see Terrence Henry, *How Fracking Disposal Wells are Causing Earthquakes in Dallas-Fort Worth*, NPR (Aug. 6, 2012, 2:52 PM), <http://stateimpact.npr.org/texas/2012/08/06/how-fracking-disposal-wells-are-causing-earthquakes-in-dallas-fort-worth/> ("The problem, according to the new study by Dr. Cliff Frohlich, senior research scientist at the University's Institute for Geophysics, is that some of those disposal wells around Dallas-Fort Worth are also on fault lines.").

134. See N.Y.C. DEP'T OF ENVTL. PROT., *supra* note 95, at 13 (the fluids follow the "path of least resistance" and are "forced upward toward the surface").

135. Henry, *supra* note 133.

136. *Id.*

137. MacKinnon, *supra* note 133.

138. Campbell Robertson, *Arkansas Quake is its Most Powerful in 35 Years*, N.Y. TIMES (Mar. 1, 2011), [http://www.nytimes.com/2011/03/01/us/01earthquakes.html?\\_r=1&hp&r=1&](http://www.nytimes.com/2011/03/01/us/01earthquakes.html?_r=1&hp&r=1&).

139. See generally N.Y. STATE DEP'T OF ENVTL. CONSERVATION, REVISED DRAFT SUPPLEMENTAL GENERIC ENVIRONMENTAL IMPACT STATEMENT ON THE OIL, GAS AND SOLUTION MINING REGULATORY PROGRAM (2011), available at <http://www.dec.ny.gov/data/dmn/rdsgeisfull0911.pdf>.

hydrofracking is one of “the most significant” possible impacts.<sup>140</sup> As discussed above, the use of water for hydrofracking, especially if the practice becomes even more common,<sup>141</sup> could disturb carefully balanced ecosystems by disrupting stream flow or lake storage.<sup>142</sup> Consequently, New York prohibits hydrofracking in the Forest Preserve land of the Adirondacks and Catskills.<sup>143</sup>

When the EPA visited an operation in Colorado, researchers witnessed “areas where patches of grass and trees were turning brown and dying” in areas that “previously had prolonged normal soil conditions.”<sup>144</sup> Improperly managed fracturing operations can exacerbate the problems created by surface pollution.<sup>145</sup> For example in 2009, an operation in the Marcellus Shale, Pennsylvania, only 150 miles northwest of New York City, sent nearly 8,000 gallons of fracking fluid into the wilderness because of failed pipe connections.<sup>146</sup> The fluid contained LGC-35 CBM, a potentially carcinogenic lubricant; although tests conducted by the Pennsylvania Department of Environmental Protection concluded that the concentration of the carcinogen was not high enough to be harmful.<sup>147</sup> Conversely, private experimentation found that there were toxins in the drinking water, including ethylene glycol, propylene glycol, and toluene in the well water of “almost everybody” living in the area of the spill.<sup>148</sup> A larger spill, or a spill with a higher concentration of dangerous chemicals, could be disastrous to the surrounding ecosystem and to human health.

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140. Gruza, *supra* note 77, at 10,333.

141. *See, e.g.* Sutherland, *supra* note 4, at 14 (discussing the projected increase of wells in the Marcellus region).

142. *See supra* text accompanying notes 117–121.

143. *See generally* N.Y. STATE DEP'T OF ENVTL. CONSERVATION, *supra* note 139.

144. U.S. ENVTL. PROT. AGENCY, EVALUATION OF IMPACTS TO UNDERGROUND SOURCES OF DRINKING WATER BY HYDRAULIC FRACTURING OF COALBED METHANE RESERVOIRS, EPA 816R04003 App. A-2-4, A-11-14 (2004).

145. *See* Obold, *supra* note 9, at 481 (stating that improperly managed fracking operations lead to surface pollution).

146. Wes Deweese, *Fracturing Misconceptions: A History of Effective State Regulation, Groundwater Protection, and the Ill-Conceived FRAC Act*, 6 OKLA. J.L. & TECH. 49, 7 (2010), available at <http://www.law.ou.edu/sites/default/files/files/FACULTY/2010okjoltrev49.pdf>.

147. *See id.* (stating that the “concentrations of the chemical in the fracturing fluid were found to be so diluted that they were harmless”).

148. *Toxic Fracking Chemicals Found in Pennsylvania Drinking Water*, HERALD DISPATCH (Sept. 16, 2010), <http://www.herald-dispatch.com/news/briefs/x1988164152/Toxic-fracking-chemicals-found-in-Pennsylvania-drinking-water>.

## V. ECONOMIC BENEFITS OF HYDROFRACKING

### A. *The Significance of Shale Gas*

A 2010 assessment of the world's remaining energy supplies, conducted by the Federal Institute for Geosciences and Natural Resources and the German Mineral Resources Agency,<sup>149</sup> concluded that approximately 406 billion tons of hydrocarbons remain that can be extracted with existing technology at an economically practicable cost.<sup>150</sup> The International Energy Agency determined that, in 2009 alone, 8.353 billion tons were used globally, and therefore, at this rate of consumption, current economically recoverable energy reserves would only last approximately forty-eight years.<sup>151</sup> Seventy-one billion of the 406 billion tons of recoverable hydrocarbons are locked in unconventional reserves that require advanced drilling technologies such as hydrofracking.<sup>152</sup> Domestically, “[n]atural gas consumption currently comprises about 23% of the total energy consumption,”<sup>153</sup> and possible increases in demand from retiring coal power plants<sup>154</sup> and increasing residential and industrial uses<sup>155</sup> might increase natural gas's importance in America's energy framework. Without major technological advancements in renewable, alternative energy sources that would allow for the complete avoidance of unconventional hydrocarbon extraction, hydrofracking may be necessary as conventional energy reserves begin to dwindle.

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149. See generally FED. INST. FOR GEOSCIENCES & NAT. RES., ANNUAL REPORT, RESERVES, RESOURCES AND AVAILABILITY OF ENERGY RESOURCES 81, 86 (2010), available at [http://www.bgr.bund.de/EN/Themen/Energie/Downloads/annual\\_report\\_2010\\_en.pdf?\\_\\_blob=publicationFile&v=3](http://www.bgr.bund.de/EN/Themen/Energie/Downloads/annual_report_2010_en.pdf?__blob=publicationFile&v=3).

150. *Id.*

151. Obold, *supra* note 9, at 475.

152. See *id.* (writing that “unconventional hydrocarbons require more advanced drilling technologies both to reach the reserve and to pull the oil or gas to the surface”).

153. Gruza, *supra* note 77, at 10,332.

154. Some experts have “estimated that within 15 years coal might account for 35-40% of U.S. power generation compared to 48-50% today.” Jonathan Bailey & Henry Lee, *North American Oil and Gas Reserves: Prospects and Policy*, (Harvard Kennedy Sch., Working Paper No. 12-039, 2012), available at [http://papers.ssrn.com/sol3/papers.cfm?abstract\\_id=2148702](http://papers.ssrn.com/sol3/papers.cfm?abstract_id=2148702) &[http://papers.ssrn.com/sol3/papers.cfm?abstract\\_id=2148702](http://papers.ssrn.com/sol3/papers.cfm?abstract_id=2148702).

155. For example, see Matthew L. Wald, *An Airline Fleet Fueled by Natural Gas*, N.Y. TIMES BLOG (Oct. 25, 2012, 10:44 AM), <http://green.blogs.nytimes.com/2012/10/25/an-airline-fleet-fueled-by-natural-gas/>, for an article about Qatar Airlines opening an airport that will pump airline fuel derived from natural gas.

### *B. Does Hydrofracking Provide a Meaningful Economic Stimulus?*

Hydrofracking can prove immensely profitable to economically depressed areas, as struggling landowners receive a bounty for the extraction rights, and jobs pertaining to the operation flow into the area.<sup>156</sup> Because the profits from leasing land for hydrofracking go entirely to the individual whose land is leased, and because the pollution costs associated with hydrofracking are borne by the entire surrounding community—a classic economic negative externality<sup>157</sup>—individuals may lease their land for hydrofracking even when the costs to the community outweigh the benefits.<sup>158</sup> However, because permitting hydrofracking can enable economically depressed areas (with sizeable natural-gas reserves) to realize infrastructure improvements, such as improved roads and new agricultural machinery,<sup>159</sup> the negative externality often fails to be accounted for during the decision-making process. In the Marcellus region, in 2008 alone, fracking operations were valued at \$2.3 billion, estimated to have produced more than 29,000 jobs, and connected to a \$240 million increase in state and local tax revenue.<sup>160</sup> As the number of sited wells increases,<sup>161</sup> these benefits will undoubtedly increase as well.

However, the economic benefits of hydrofracking are often overstated. First, a sizable portion of the money does not flow into the region: estimates show that only fifty-one percent of the land in the Marcellus is owned by local residents.<sup>162</sup> Second, nearly forty

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156. Leasing a single acre can provide the landowner with \$180,000 in royalties a year. Powers, *supra* note 2, at 927.

157. An externality is a “consequence or side effect of one’s economic activity, causing another to benefit without paying or to suffer without compensation.” BLACK’S LAW DICTIONARY (9th ed. 2009). More specifically, a negative externality is an “externality that is detrimental to another, such as water pollution created by a nearby factory.” *Id.*

158. Pollution, or the possibility of pollution discounted by the percentage of its likelihood, is considered a negative externality because the social costs are far greater than the costs experienced by the individual making the decision. Because the rational landowner will theoretically lease his land up to the point where the benefit of leasing is greater than the cost of leasing to himself, the individual landowner does not necessarily consider the costs to others when making the decision, and therefore land may be leased for hydrofracking where the total costs (including social costs) exceed the benefits of the transaction.

159. Boersma & Johnson, *supra* note 128, at 572.

160. Gruza, *supra* note 77, at 10,332.

161. *See supra* text accompanying notes 5–7.

162. TIMOTHY W. KELSEY ET AL., MARCELLUS SHALE EDUC. & TRAINING CTR., ECONOMIC IMPACTS OF MARCELLUS SHALE IN PENNSYLVANIA: EMPLOYMENT AND INCOME IN 2009 4 (2011), available at <http://www.shaletec.org/docs/EconomicImpactFINALAugust28.pdf#zoom=75> (“According to our analysis, approximately 51

percent of the workers used are not from the region.<sup>163</sup> Third, existing socioeconomic separations are amplified due to hydrofracking because those who financially benefit from leasing their land can afford to relocate, leaving behind any potential environmental impacts or health hazards to their former neighbors who did not receive the financial windfall.<sup>164</sup>

Fourth, rapid population and economic growth in “too short a time can prove disastrous.”<sup>165</sup> According to the “boomtown” or “social disruption” model, as population flourishes, existing infrastructure is incapable of meeting demand for necessary public services, such as public schooling, retail inventories, housing, medical care, and even recreational opportunities required for a positive quality of life.<sup>166</sup> The decreased quality of life leads to a dissatisfied workforce for hydrofracking operations or other local businesses, and the “social upheaval and malaise” leads to a decrease in private investment outside of the hydrofracking operation.<sup>167</sup> Moreover, in small towns that are transforming into “natural gas towns,” local governments “seldom have adequate resources or the experienced staff required to research the issues that arise or preventatively allocate resources to deal with expected problems before they occur.”<sup>168</sup> In fact, at “growth rates higher than 15%,” institutional breakdowns are described as “typical.”<sup>169</sup>

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percent of the land in Marcellus counties is owned by residents within the county, 25 percent is owned by someone living elsewhere in Pennsylvania, and 7.7 percent is owned by people living outside of Pennsylvania. The remaining 17 percent is owned by the public sector, primarily the Commonwealth.”).

163. Boersma & Johnson, *supra* note 128, at 572.

164. See Powers, *supra* note 2, at 928 n.161. (discussing how potential pollution can lead to the over-utilization of hydrofracking).

165. Matthew T. Dubois, *The Natural Gas Explosion: Boom of Bust for New York's Economy and Environment?* 8 (unpublished manuscript), available at [http://law.buffalo.edu/Academic\\_Programs\\_And\\_Research/submenu/conEvironLaw/dubois12.pdf](http://law.buffalo.edu/Academic_Programs_And_Research/submenu/conEvironLaw/dubois12.pdf).

166. Jeffrey Jacquet, *Energy Boomtowns & Natural Gas: Implications for Marcellus Shale Local Governments & Rural Communities* 7 (The N.E. Reg'l Ctr. for Rural Dev., Working Paper No. 43, 2009), available at <http://nercrd.psu.edu/Publications/rdppapers/rdp43.pdf>.

167. See Dubois, *supra* note 165, at 9 (“The social upheaval and malaise drives [off] private investors and prevents investment in commerce, housing, or other private sector needs. The inadequacy of public and private sector services feeds back into the cycle, degrading the quality of life and destabilizing the workforce, which leads in turn to a reduction in services.”).

168. *Id.* at 9–10.

169. *Id.* at 10.

Whereas the state profits from an increase in taxes,<sup>170</sup> these boomtowns experience short-term economic benefits and subsequent recessions when the drilling construction phase is completed and the production phase, which requires much less labor and local resources, begins.<sup>171</sup> These economic downturns are worsened by local investment predicated on the idea that the short-term economic benefits of hydrofracking will continue.<sup>172</sup> In a 2009 Penn State University study, “[a]lmost all of the boomtown communities that were researched during [the] 1970s and early 1980s went through a severe economic downturn as the construction . . . was completed.”<sup>173</sup> The boom-and-bust cycle may be exacerbated in less gas-rich areas where the construction-withdrawal cycle is much shorter.

On the other hand, the practice of hydrofracking has affected domestic energy prices,<sup>174</sup> in part because the increased supply of gas is decreasing the demand for other fuel sources as industry begins to switch to natural gas as a power source. AT&T recently vowed to convert its 76,000-vehicle fleet to run on natural gas.<sup>175</sup> Furthermore, many, including T. Boone Pickens, have suggested that hydrofracking can help lead the United States to energy independence, and therefore they support tax incentives for the conversion to natural gas vehicular infrastructure.<sup>176</sup>

## VI. WHICH GOVERNMENTAL ENTITY SHOULD REGULATE HYDROFRACKING

### A. *Should Hydrofracking Regulation be Left to the States?*

Some argue that because hydrofracking is a localized activity with few interstate impacts, hydrofracking regulation should be

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170. See Gruza, *supra* note 77, at 10,332 (discussing hydrofracking’s relationship to increased state taxes in the Marcellus region).

171. Dubois, *supra* note 165, at 11.

172. See *id.* (discussing that local “investments are often predicated upon projected growth rates that make the erroneous assumption that the initial natural gas well construction phase will continue indefinitely”).

173. Jacquet, *supra* note 166, at 24.

174. Inflation adjusted U.S. electricity prices have dropped from approximately thirteen cents per kilowatt-hour in 1990 to just below twelve cents. See *Inflation Adjusted Average U.S. Electricity Prices Graph*, INFLATIONDATA.COM, <http://inflationdata.com/articles/wp-content/uploads/2012/07/Inflation-Adjusted-Electricity.jpg> (last visited Feb. 2, 2013).

175. Leah Harnack, *Ending our Oil Dependence*, MASS TRANSIT (Nov. 23, 2010), <http://www.masstransitmag.com/article/10207824/ending-our-oil-dependence>.

176. *Id.*

reserved for the states.<sup>177</sup> For instance, as previously mentioned,<sup>178</sup> migration of gas into drinking water presents more risks in areas that are relatively water-rich, more geologically brittle, and have a higher degree of groundwater connectivity. Because states have differing geologies and needs, regulation is better left to the different states.<sup>179</sup> This argument is misguided for several reasons.

First, whereas shale is relatively resistant to underground fluid migration,<sup>180</sup> intrastate extraction can lead to interstate environmental problems, as pollutants flow downstream or seep into aquifers spanning multiple states.<sup>181</sup> Pollutants can reach aquifers in multiple ways, such as through poorly designed water wells<sup>182</sup> or via seismic activity that cracks pre-existing fault lines.<sup>183</sup> Concerns with interstate pollution are heightened in regions with more groundwater connectivity and non-fracking-related seismic activity. Second, geologists are experts at rock formations and therefore, whether a geologist works for a given state or for the federal government, he or she will be equally capable at studying the land formations and deciding upon a proper baseline or minimum threshold that states can then build upon. Additionally, national standards do not necessarily need to be equivalent to one-size-fits-all regulation. For example, requirements could differ by rock permeability or by vertical distance from potable water. Third, although socioeconomic situations of states differ, because of the negative externalities associated with pollution and concerns regarding intertemporal decision-making, state legislation balancing short-term economic gains and long-term environmental costs will lead to suboptimal results. This topic is discussed in greater detail below.<sup>184</sup>

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177. See Powers, *supra* note 2, at 953 (calling hydrofracking a “land-based activity without any obvious interstate impacts”).

178. See *supra* text accompanying notes 73–77.

179. See Powers, *supra* note 2, at 954 (stating that “given the extensive private property interests involved in hydrofracking, local geographic, socioeconomic, geological, and hydrological differences make state regulation arguably more appropriate”).

180. See *supra* text accompanying notes 95–98.

181. For example, the Ogallala Aquifer spans eight states (South Dakota, Nebraska, Wyoming, Colorado, Kansas, Oklahoma, New Mexico, and Texas) and environmental groups have raised concern that hydrofracking could “jeopardize the integrity of the Ogallala Aquifer,” on which many farmers depend. Tim Carpenter, *Hydrofracking Exposes Controversy in Kansas*, TOPEKA CAPITAL J. (Sept. 5, 2011, 2:06 PM), <http://cjonline.com/news/2011-09-05/hydrofracking-exposes-controversy-kansas>.

182. See *supra* text accompanying notes 104–106.

183. See *supra* text accompanying note 134.

184. This topic is discussed in greater detail *infra* Part VI.B.



Because many sectors of the oil and natural gas industry were exempted from environmental regulations with the Energy Policy Act of 2005,<sup>185</sup> one could argue that the “Halliburton loophole” provides evidence that the federal government is incapable of comprehensive federal legislation. However, the federal government has proven capable of comprehensive federal environmental regulation before. The federal government already has sweeping environmental regulations in place, such as the CWA, SDWA, CAA, and CERCLA. For example, the EPA and Transportation Department already regulate greenhouse gas emissions for automobiles pursuant to the CAA.<sup>186</sup> Because of methane’s potency as a greenhouse gas,<sup>187</sup> the EPA should remove the natural gas industry’s exemption from the CAA aggregating policies,<sup>188</sup> and aggregate emissions that occur from drilling operations. As California can set its own vehicular emissions standards, other states should similarly be waived from preemption if they wish to increase environmental protections.<sup>189</sup> Furthermore, there is no reason why the environmental impacts of coal mining should be scrutinized more carefully by the federal government than those of natural gas exploration.<sup>190</sup>

Moreover, the federal government’s previous failure to get involved in the hydrofracking debate is partly attributable to Dick Cheney’s actions as the chair of the national Energy Policy Development Group.<sup>191</sup> If the federal government were to establish a comprehensive federal hydrofracking baseline in the future, one would hope that they would choose a person with a more neutral mindset to chair the task force. Because of the negative publicity afforded to the “Halliburton loophole,” it is unlikely that such a biased chair would be picked the second time around. With a more

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185. *See supra* Part III.A.

186. John M. Broder, *U.S. Issues Limits on Greenhouse Gas Emissions from Cars*, N.Y. TIMES (Apr. 1, 2010), [http://www.nytimes.com/2010/04/02/science/earth/02emit.html?\\_r=0](http://www.nytimes.com/2010/04/02/science/earth/02emit.html?_r=0).

187. *See supra* text accompanying notes 122–128.

188. *See supra* text accompanying note 37.

189. In 2009, the EPA granted California “a waiver of Clean Air Act preemption to enforce its greenhouse gas emission standards” after the waiver was originally denied in 2005. California State Motor Vehicle Pollution Control Standards; Notice of Decision Granting a Waiver of Clean Air Act Preemption for California’s 2009 and Subsequent Model Year Greenhouse Gas Emission Standards for New Motor Vehicles, 74 Fed. Reg. 32,744, 32,744 (July 8, 2009), available at <http://www.gpo.gov/fdsys/pkg/FR-2009-07-08/pdf/E9-15943.pdf>.

190. *See generally* *Strict Regulations Govern Coal Mining*, AM. COAL FOUND., <http://www.ket.org/trips/coal/agsmm/agsmmregs.html> (last visited Feb. 4, 2013) (discussing the strict regulations governing coal mining).

191. *See supra* text accompanying notes 21–27.

impartial chair, federal action will be less biased and more able to overcome the barriers preventing efficient state balancing of the tension between energy and environmental issues.

Many gas-rich states, as well as gas-industry lobbyists, argue that state regulation is adequate because fracking operations have presented few problems and unnecessarily imposing federal regulation would burden the industry by increasing costs of permitting and slowing production.<sup>192</sup> However, this argument ignores the potentially significant long-term environmental costs that come with hydrofracking. Whereas pollutants in small doses may do little harm, as pollutants aggregate, there may be a more cognizable, long-term impact. Indeed, the EPA, in its most recent evaluation of hydrofracking in Pavillion, Wyoming in 2011, discussed previously, concluded that hydrofracking had led to pollution of the water supply—providing bona fide evidence that hydrofracking can contribute to environmental degradation. Because the EPA only made this conclusion very recently, other incidences of pollution will likely be attributed to hydrofracking in the coming years as more studies are conducted and pollution aggregates in the water supply. After all, the EPA's stance on hydrofracking changed dramatically from 2004 (when the agency concluded that fracking posed little threat to the environment) to 2011 (when the EPA concluded that fracking had contaminated the Wyoming water supply).

#### *B. The Federal Government Should be the Entity Charged with Setting Baseline Standards*

Individuals have a strong tendency to discount heavily—and therefore undervalue—future outcomes when compared to immediate impacts.<sup>193</sup> Intertemporal discounting has a strong impact on the clash between economic and environmental interests. In political elections, the immediacy of hydrofracking's perceived economic impacts will lure political fervor when compared to the more nebulous environmental costs. For several reasons, the federal government will be better than other levels of government at

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192. MARY TIEMANN, CONG. RESEARCH SERV., SAFE DRINKING WATER ACT (SDWA): SELECTED REGULATED AND LEGISLATIVE ISSUES 24 (2010), available at [http://assets.opencrs.com/rpts/RL34201\\_20100727.pdf](http://assets.opencrs.com/rpts/RL34201_20100727.pdf).

193. See generally Dilip Soman et al., *The Psychology of Intertemporal Discounting: Why are Distant Events Valued Differently from Proximal Ones?*, 16 *MARKETING LETTERS* 347 (2005), available at <http://faculty.som.yale.edu/ShaneFrederick/Marketing%20Letters.pdf> (discussing and explaining intertemporal discounting).

safeguarding against the problems of intertemporal and intergenerational decision-making.

The federal environmental bureaucracy is farther removed from the electorate and therefore the federal government will be less pressured than local governments by the perceived economic benefits of specific drilling proposals. For example, in rural areas where the citizenry clamors for more drilling and less environmental regulation because of the perceived economic boost, local legislators will have little choice but to succumb to the population's wishes if they desire reelection. This pressure will likely be felt even if hydrofracking operations pose a threat to the long-term economic health of an area, as suggested by the social disruption model.<sup>194</sup> The federal government is more insulated from these pressures, because states more concerned with the environmental impacts of hydrofracking—such as those posing statewide moratoriums—will provide support for environmental regulation. For example, congressional Democrats are currently pressuring the EPA to continue research on the connection between hydrofracking and water contamination.<sup>195</sup> Having both sides of the issue heard will help buttress against bias in any direction. Whereas federal regulatory agencies are also susceptible to political pressure,<sup>196</sup> the federal government will feel less pressure because of the political make-up of the legislature. Rasmussen reported that in August 2012, 37.6% of the United States identified as Republican and 33.3% as Democrat,<sup>197</sup> but many states tend to have political inclinations that are less balanced than the United States as a whole.

In general, state and local governments are “particularly vulnerable to industry and union pressures.”<sup>198</sup> Industrial interest groups, such as the energy companies supporting hydrofracking, tend to be more vocal than their counterparts because they have a large

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194. See *supra* text accompanying notes 165–81.

195. John C. Rudolf, *Pressure Grows for Answers on Fracking*, N.Y. TIMES (Mar. 2, 2011), <http://green.blogs.nytimes.com/2011/03/02/pressure-grows-for-answers-on-fracking/>.

196. See e.g., Press Release, U.S. House of Rep. Energy & Commerce Committee, Facing Bipartisan Congressional Pressure, EPA Finally Clears Offshore Permits (Jan. 13, 2012), <http://energycommerce.house.gov/press-release/facing-bipartisan-congressional-pressure-epa-finally-clears-offshore-permits> (announcing that the EPA finally conceded under bipartisan pressure and granted permits for exploration in Alaska's Chukchi Sea after a five-year bureaucratic delay).

197. *Partisan Trends*, RASMUSSEN REP. (Sept. 1, 2012), [http://www.rasmussenreports.com/public\\_content/politics/mood\\_of\\_america/partisan\\_trends](http://www.rasmussenreports.com/public_content/politics/mood_of_america/partisan_trends).

198. Richard B. Stewart, *Pyramids of Sacrifice? Problems of Federalism in Mandating State Implementation of National Environmental Policy*, 86 YALE L.J. 1196, 1213 (1977).

economic stake in any prescribed regulation, and therefore will be willing to spend significant amounts of money to avoid increased regulation or pollution-control costs.<sup>199</sup> Those fighting for increased environmental regulation tend to have less of a monetary stake in the outcome, and therefore local government is likely to place less emphasis on environmental concerns.

The disproportionate pressures felt by state and local governments are intensified because of a collective action problem—opposition to environmental degradation is shared among the masses, with each individual having a small personal interest in environmental quality, and facing formidable transaction costs associated with expressing that interest. In contrast, industrial interest groups have large, concentrated interests, so coordination is less of a problem.<sup>200</sup> The “tragedy of the commons”<sup>201</sup> from the field of economics and the “social loafing”<sup>202</sup> phenomena from social psychology prescribe that individuals are less likely to act (or refrain from acting) when their individual actions would have a miniscule impact on the outcome of a larger group. For example, the aggregating effects of methane gas on climate change are experienced by everyone, but each individual fracturing operation has minimal costs to any particular individual on the margin. Over time, once all drilling operations are aggregated, the amount of methane in the atmosphere can have dramatic effects.<sup>203</sup>

The federal government is the better entity to solve collective action problems because they are better shielded from strong local political pressures and have the ability to assess the entire nation’s present and future interests.<sup>204</sup> The nexus between energy extraction

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199. *See id.*

200. *See id.*

201. The tragedy of the commons “describes how individual actors are driven by short-term self-interest to pollute a commonly held resource even where each individual knows the group’s collective actions will eventually destroy or seriously damage it.” Powers, *supra* note 2, at 931.

202. Social loafing is defined as “the tendency of individual group members to reduce their work effort as groups increase in size when performance is needed in a group.” J. DAN ROTHWELL, IN *MIXED COMPANY: COMMUNICATING IN SMALL GROUPS* 83 (3d ed. 1997). This applies to the hydrofracking context because the group of those that may be affected by the possible environmental impacts of hydrofracking are spread over the entire population, while those receiving a large profit from the fracturing operation are smaller in number.

203. *See supra* text accompanying notes 126–128. Climate change may start having more noticeable impacts on society, as most of the models from the Intergovernmental Panel on Climate Change project exponential growth patterns. INTERGOVT. PANEL ON CLIMATE CHANGE, *CLIMATE CHANGE 2007: THE PHYSICAL SCIENCE BASIS* 66–80 (2007), available at [http://www.ipcc.ch/pdf/assessment-report/ar4/wg1/ar4\\_wg1\\_full\\_report.pdf](http://www.ipcc.ch/pdf/assessment-report/ar4/wg1/ar4_wg1_full_report.pdf).

204. Powers, *supra* note 2, at 932.

and environmental degradation is especially influenced by these economic and psychological phenomena because environmental concerns are less noticeable on the margin. In other areas, such as labor or social-welfare policies, those adversely affected by any pro-industry regulations will have more of a voice, because cognizable effects will tend to be more clustered in urban areas (rather than rural areas as with hydrofracking) and employment and health concerns may be more relatable and invoke more empathy. Everyone might become sick or fall on hard times, but not everyone will be affected by the water quality in Pavillion, Wyoming or the diminution of pristine wilderness in Colorado.

One of the major arguments in favor of federal regulation when environmental and industrial interests clash is the “race-to-the-bottom” paradigm<sup>205</sup>—the theory that if the federal government fails to get involved, states will lower regulations in order to attract business inside their borders.<sup>206</sup> Because states will be forced to compete, environmental regulations will be lowered to suboptimal levels.<sup>207</sup> However, because hydraulic fracturing operations are not zero-sum, one might expect the “race-to-the-bottom” to have a smaller impact, if any, because rational companies will drill wherever the marginal revenue of the action exceeds the marginal cost—wherever a profit can be made. The chief decisions regarding where to drill are (a) where is the gas located and (b) whether the gas can be extracted at a profit.

Theoretical economics aside, empirical evidence suggests that state officials may unnecessarily lower standards to attract industry because of political pressure.<sup>208</sup> Especially in a weak economy, or in any area experiencing some level of unwanted underemployment, the economy tends to be the most important political issue.<sup>209</sup> As

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205. See Powers, *supra* note 2, at 932–33 (explaining that “[t]he ‘race-to-the-bottom’ paradigm has also been used to defend federal intervention in environmental issues.”).

206. *Id.* at 933.

207. One way to simplify the “race-to-the-bottom” problem in the hydrofracking context is to view each state as a perfect substitute for another state. If one state has lower environmental regulations, then it will be more profitable to drill there and that state will experience all of the economic benefits of hydrofracking. Because of this, states will continue to lower their regulation in order to avoid losing the economic benefits of hydrofracking.

208. For a more in-depth discussion on the race-to-the-bottom, see generally Kirsten H. Engel, *State Environmental Standard-Setting: Is There a “Race” and Is It “To the Bottom”?*, 48 HASTINGS L.J. 271 (1997).

209. See, e.g., Joe V. Kanel, *Exit Polls: Top Issues for Voters*, CNN (Nov. 6, 2012, 7:43 PM), <http://politicalticker.blogs.cnn.com/2012/11/06/exit-polls-top-issues-for-voters> (describing that in

discussed above, the electorate is likely to favor short-term economic benefits compared to nebulous, long-term environmental costs. Moreover, pollution, which when aggregated can have severe impacts, can be hard to notice on the margin.<sup>210</sup>

The “free-rider problem” also suggests that states might not factor in pollution costs that fall outside their borders (even if caused within the state), and therefore state governance worsens the pollution negative-externality. Examples of interstate pollutants are greenhouse gas emissions from fugitive methane and water contamination that can cross state lines. Therefore, current state legislators might feel more compelled to lower regulations out of fear of political backlash if the public perceives not doing so as unwanted inaction. The federal bureaucracy, in providing a regulatory baseline for all states, would be insulated from these pressures.

Even in New York, a gas-rich state with relatively more regulations than its peers, hydrofracking faces “underprotection” due to inadequate enforcement capacity and “its failure to anticipate cumulative impacts.”<sup>211</sup> For example, New York’s regulatory scheme has proven incapable of ensuring that fracking flowback is sufficiently clean to meet SDWA and RCRA requirements.<sup>212</sup> Hydrofracking regulation should reside with the federal government because of its better ability to alleviate the “race-to-the-bottom” and collection-action problems, and because if left to state governance, underprotection is likely (due to political trade-offs and cognitive barriers to more effective decision-making). Notably, the governor of Wyoming delayed the release of the EPA’s findings in the Pavillion study in order to “coordinate an ‘all-out-press’ against the EPA,”<sup>213</sup> suggesting that states are failing to adequately balance economic benefits and environmental costs.

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the 2012 presidential election, “early exit poll results [showed that] the economy [was] the number one issue on voter’s minds”).

210. “Stock” pollution refers to the amalgamation of pollutants that the environment cannot readily absorb. With each additional pollutant, it will be hard to perceive the difference on the margin, however, amassing substantial pollutants can have severe impacts. See Kenneth R. Szulczyk, *Lecture #5 – Pollution: Precautionary Principle*, [http://www.oocities.org/szulczyk/lessons/environmental\\_05.html](http://www.oocities.org/szulczyk/lessons/environmental_05.html) (last visited Mar. 29, 2013).

211. See Powers, *supra* note 2, at 954 (explaining that “an analysis of New York’s experience with hydrofracking to date suggests that state primacy may well result in underprotection and even hamper production activity”).

212. *Id.*

213. *Wyoming Pushed EPA to Delay Study on Fracking*, *supra* note 94.

*C. However, Local Governments Should Have the Ability to Zone Out Fracking*

Many municipalities and counties have decided to ban hydrofracking completely,<sup>214</sup> and whether the local governments have the ability to do so legally depends on the state's regulatory framework.<sup>215</sup> For example, in 2011, Morgantown, West Virginia banned hydrofracking within a mile of city limits. However, this ban was struck down as being preempted by state law, as the industry is regulated exclusively by the West Virginia Department of Environmental Protection, which had issued a permit for the operation.<sup>216</sup>

Currently, preemption battles are underway in New York as well,<sup>217</sup> with New York's lower courts, unlike those in West Virginia, tending to uphold municipal bans of hydrofracking. Proponents of preemption (that is, of preventing local fracking bans in New York) argue that "the [l]egislature's intent [was] to streamline energy development in the state and protect the economic rights of property owners who seek to cash in on their underground natural resources."<sup>218</sup> However, supporters of a municipality's ability to ban fracking argue that "the law preempts local governments from regulating how oil and gas companies operate"; the purpose is regulating the process to keep it safe, not to unilaterally decide where to drill.<sup>219</sup> In 1987, the Court of Appeals of New York decided in *Frew Run Gravel Products, Inc. v. Town of Carroll*<sup>220</sup> that "[s]tricter local standards" for mining activities "would be consistent with the statute's over-all aim of protecting the environment."<sup>221</sup> Pursuant to the court's decision in *Frew Run*, in *Anschutz Exploration Corp. v.*

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214. For example, in the Marcellus region, dozens of municipalities, including Buffalo, Ithaca, Geneva, Pittsburgh, and Cresson, have banned hydrofracking. Negro, *supra* note 53, at 10.

215. *Id.*

216. See generally *N.E. Natural Energy, LLC v. Morgantown, WV*, No. 11-c-411 (Monongalia Cty. Cir. Ct. Aug. 12, 2011) (order granting summary judgment).

217. For example, Dryden has passed zoning laws banning hydrofracking, but the ban is being contested in court. Negro, *supra* note 53, at 10.

218. Peter Mantius, *Dryden and Middlefield Fracking Bans Tested*, D.C. BUREAU (Nov. 11, 2011), <http://www.dcbureau.org/201111116473/natural-resources-news-service/dryden-and-middlefield-fracking-bans-tested.html>.

219. *Id.*

220. 524 N.Y.S.2d 25 (N.Y. Sup. Ct. 1987).

221. *Id.* at 133.

*Town of Dryden*,<sup>222</sup> a local court recently decided that the Town of Dryden, New York had the power to ban hydrofracking through zoning laws.<sup>223</sup> Similarly, the Town of Middlefield's ban of hydrofracking was upheld in *Cooperstown Holstein Corp. v. Town of Middlefield*,<sup>224</sup> because New York's supersession clause<sup>225</sup> does not preempt a municipality from "enacting land use regulation within the confines of its jurisdiction."<sup>226</sup> Currently, some states with less clearly defined municipal roles are considering whether or not to pass legislation that would prohibit municipal banning of hydrofracking.<sup>227</sup>

Many of these local battles over hydrofracking policy can be attributed to the fact that, with the Energy Policy Act of 2005, the federal government stepped away from hydrofracking regulation, leaving regulation over the majority of the drilling operation solely to the states. Federal governmental regulation could provide for municipal rights and grant local governments the legal authority to place moratoriums on hydrofracking. As discussed previously, many states may have implemented energy policies that fail to adequately balance the benefits of hydrofracking with the long-term environmental costs (for example, many states have failed to regulate fracking fluid containing diesel pursuant to the SDWA).<sup>228</sup> Concern over hydrofracking's environmental impacts is mounting, and the effects of a statewide failure to assess accurately the costs of hydrofracking should not be thrust upon unwilling municipalities.

A frequent argument proffered for preemption, and against municipal control, is that providing municipalities with the power to zone-out hydrofracking will lead to NIMBYism.<sup>229</sup> However, NIMBYism in the hydrofracking context is not necessarily bad, as the most likely effect would be to push hydrofracking away from more

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222. 940 N.Y.S.2d 458, 461 (N.Y. Sup. Ct. 2012).

223. *Id.* at 474.

224. 943 N.Y.S.2d 722 (N.Y. Sup. Ct. 2012).

225. N.Y. Envtl. Conserv. Law § 23-0303(2) (McKinney 2011) ("The provisions of this article shall supersede all local laws or ordinances relating to the regulation of the oil, gas and solution mining industries . . .").

226. *Cooperstown Holstein*, 943 N.Y.S.2d at 730.

227. For example, Pennsylvania just passed legislation expressly preempting "local ordinances and enactments purporting to regulate oil and gas well operations regulated by this chapter." S.B. 1100, Reg. Sess. (Pa. 2011); H.B. 1950, Reg. Sess. (Pa. 2011)

228. *See supra* text accompanying notes 33–34.

229. NIMBY stands for "not in my backyard; *See* Michael Burger, "It's Not Easy Being Green": Local Initiatives, Preemption Problems, and the Market Participant Exception, 78 U. CIN. L. REV. 835, 889 (2010) (describing NIMBYism as a common reason for preemption in the environmental context).



urban areas (which tend to have a more diversified economy) to more rural areas (which tend to have more of a resource-based economy and will therefore be more welcome to drilling operations).<sup>230</sup> Using a purely utilitarian lens,<sup>231</sup> if the benefits of hydrofracking are assumed similar in rural and urban areas,<sup>232</sup> and there are assumed to be less pollution costs in rural areas because of the less dense population, then fracking would return more social profit in more rural areas. Municipalities in rural areas should be afforded this choice as well, and as long as the overwhelming majority does not decide to ban drilling (which is unlikely because many localities advocate for the economic impact of hydrofracking and more residents of New York currently support hydrofracking than oppose the practice),<sup>233</sup> then America will not be thrust into a national energy crisis. After all, before the hydrofracking explosion began in 2006, hydrofracking did not constitute a major portion of domestic energy production. Nevertheless, local governments are unlikely to have a significant effect on the national energy supply, as the majority of rural regions are unlikely to zone-out hydrofracking completely, and therefore natural gas will still be injected into the national energy supply.

Furthermore, one of the main benefits attributed to hydrofracking, localized economic growth, will not come to fruition if a municipality decides to zone out hydrofracking. If a municipality conducts its own cost-benefit analysis, and decides that the estimated costs are higher than the estimated benefits, then the municipality should have the power to ban hydrofracking. If the municipality views the fracturing operation as a net loss, then there is no localized economic benefit accrued—economic concerns encompass more than

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230. See Powers, *supra* note 2, at 946 n.204 (describing that in the natural gas context, zoning “provides a limited tool” and that most fracking will “occur in rural, rather than municipal areas”).

231. It is important to note that utilitarianism should not be used as the only consideration, regulators and decision makers should also consider environmental justice and socioeconomic concerns.

232. This is an over-simplification as the benefits will depend on factors going to the profitability of the well, such as the amount of the resource being extracted and the ease of extraction.

233. See, e.g., Associated Press, *Poll: More Support Hydrofracking than Oppose in NY*, PRESSCONNECTS.COM (Dec. 6, 2012, 9:07 AM), <http://www.pressconnects.com/viewart/20121206/NEWS10/312060032/Poll-more-support-hydrofracking-than-oppose-NY> (last visited Dec. 10, 2012) (finding that in New York, “42 percent support hydrofracking” and another “36 percent oppose it”).

mere monetary concerns.<sup>234</sup> Accordingly, municipalities should have more tools and should be able to increase environmental regulation (on top of what is mandated at the state or federal level). After all, some of “the most sophisticated and effective regulations of shale drilling” have been implemented by local governments.<sup>235</sup> Consequently, municipalities should be vested with the power to regulate noise and light pollution.<sup>236</sup> This would allow hydrofracking to occur, while helping to mitigate the pollution externality. All of the arguments favoring stronger municipal regulation apply equally to state governments.

## VII: CONCLUSION: ENFORCEMENT MUST ALSO BE IMPROVED

Drafting comprehensive federal hydrofracking regulations is not the only step required to mitigate the environmental impacts and health concerns associated with hydrofracking. Enforcement must also be increased. The Penn Environment Research and Policy Center discovered that “of the 4,596 fracking sites operating in Pennsylvania between 2008 and 2011, companies violated environmental laws 3,355 times.”<sup>237</sup> Because the fines are not substantial enough to act as an effective deterrent, companies view them as a simple business expense, leaving landowners to suffer the “decimated property values,” polluted air, and contaminated water left behind after a violation.<sup>238</sup> In fact, having fines that are too small might actually increase the undesirable behavior. Having the fine takes the framing of the decision out of a moral setting and into

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234. See generally Peter Lewin, *Pollution Externalities: Social Cost and Strict Liability*, 2 CATO J. 205 (1982), <http://webcache.googleusercontent.com/search?q=cache:http://www.cato.org/pubs/journal/cj2n1/cj2n1-6.pdf> (describing “the neoclassical social-cost approach to problems of pollution.”).

235. Reser & Ritter, *supra* note 34, at 34. Various municipalities in Texas have regulated “setbacks, well locations, green completions, closed loops systems, compressor locations, pipelines, waste disposal, truck traffic and noise regulation.” *Id.*

236. For example, Collier Township in Pennsylvania sets minimum ambient noise levels dependent on the time of day and the stage of the operation.

Prior to the commencement of Oil or Gas Well drilling activities, or in the case of other mineral removal, the actual commencement of mining activity, no construction activities involving excavation of, alteration to or repair work on any access road to the site of the mineral removal or upon an Oil or Gas Well site, other site of mineral removal, shall be performed during the hours of 7:00 p.m. to 7:00 a.m.

COLLIER TOWNSHIP, PA., ORDINANCE 592 § 1703.29.r (2011).

237. Frances Beinecke, *Fracking Operations Run Roughshod over Pennsylvania Homeowners*, NRDC STAFF BLOG (Sept. 26, 2012), [http://switchboard.nrdc.org/blogs/fbeinecke/fracking\\_operations\\_run\\_roughs.html](http://switchboard.nrdc.org/blogs/fbeinecke/fracking_operations_run_roughs.html).

238. *Id.*

monetary one, which may cause a corporation to engage in a cost-benefit analysis, and when the fines are too small, decrease environmental compliance.<sup>239</sup> Because the energy industry titans are not often looked upon as moral bastions, larger monetary fines or criminal sanctions, depending on the violation, should be imposed.<sup>240</sup>

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239. For example, in a study conducted in Haifa, Israel, economists found that the occurrence of parents picking up their children late more than doubled once a small monetary fine was imposed for tardiness. For the study, see Uri Gneezy & Aldo Rustichini, *A Fine is a Price*, 29 J. LEGAL STUD. 1 (2000).

240. If no fines were in place, it is unlikely that morals would effectively govern hydrofracking without any form of tangible penalties.