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Assessing the Risks and Benefits of Hydraulic Fracturing

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I. INTRODUCTION

It is generally understood that production rates in wells decline as the energy and pressure in the reservoir is depleted by production. The rate of decline is predictable, but can be affected by extraneous events not associated with depletion such as mechanical failures, perforation[1], tubing[2] or water intrusion.[3] As a result, the energy industry often relies on well stimulation techniques, such as fracing, to increase well production.

The process of fracing creates vertical fractures in the rock through the high-pressure injection of fluid.[4] The fractures created by fracing operations may extend several hundred feet into the surrounding rock formation[5] and allow fluid to flow from the boundaries of the reservoir toward the wellbore[6].[7]

In summary, fracing changes the pattern of flow within the reservoir and makes well production easier. This stimulation method is effective when applied to hard rock formations such as limestone and sandstone once production declines.[8] However, fracing may also be applied during initial well construction when operators suspect that the well may not produce at an economical rate.[9] Initial well fracturing is particularly helpful in coal-bed methane operations where "tight formation . . . shave little natural permeability but contain economic

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[1] Perforation is "a hole shot in the casing or liner and cement to allow oil and/or gas to flow" from the surrounding rock structures "into the well." NORMAN J. HYNE, NONTECHNICAL GUIDE TO PETROLEUM GEOLOGY, EXPLORATION, DRILLING, AND PRODUCTION 509 (2d ed. 2001).

[2] Tubing is a small diameter "steel tubular that is used in a well to conduct the produced fluids up the well." *Id.* at 541.

[3] MARTIN S. RAYMOND & WILLIAM L. LEFFLER, OIL AND GAS PRODUCTION IN NONTECHNICAL LANGUAGE 216 (2006).

[4] NORMAN J. HYNE, NONTECHNICAL GUIDE TO PETROLEUM GEOLOGY, EXPLORATION, DRILLING, AND PRODUCTION 422–26 (2d ed. 2001).

[5] RAYMOND & LEFFLER, *supra* note 3, at 216, 218.

[6] Wellbore is a "hole made by a drilling rig" made for the purpose of exploring for or extracting a natural resource. HYNE, *supra* note 1, at 546.

[7] RAYMOND & LEFFLER, *supra* note 3, at 216.

[8] *Id.* at 217.

[9] *Id.*

reserves of gas or oil."[10] Recently, fracing has been utilized to make the exploration of the United States' vast shale reserves feasible.

Fracing gained significant attention for holding both the promise of energy independence for the U.S. and for its observed environmental harm. However, the increase in the exploration of shale reserves has brought this process closer to populated regions, making its impact more greatly felt by local communities. Shale reserve exploration and production creates tension between two critical natural resources in these towns: low carbon fuel and water. In fact, shale exploration by hydraulic fracing highlights the tension between our national energy and environmental policies.

II. HISTORY OF FRACING

Fracing developed as early as the 1860s when liquid nitroglycerin was used to stimulate shallow, hard rock wells in the Northeastern United States.[11] The nitroglycerin broke up oil-bearing formations and increased initial flow and ultimate oil recovery from wells.[12] In 1947, Stanolid Oil performed the first experimental fracing treatment of rock formation in the Hugoton gas field in Grant County, Kansas.[13] Shortly thereafter, J.B. Clark of Stanolid Oil published a paper describing the benefits of the new technology.[14] In 1949, Stanolid received a patent and the exclusive right to utilize the technology, which was eventually sold to Halliburton Oil Well Cementing Company ("HOWCO").[15]

Within the first year of receiving its license, HOWCO treated 332 wells with fracing increasing production of each well by an average of seventy-five percent.[16] HOWCO's fracing operations increased to over three thousand wells per month by the mid-1950s.[17] Initial fracing

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[10] *Id.* at 218.
[11] Carl T. Montgomery & Michael B. Smith, *Hydraulic Fracturing: History of an Enduring Technology*, J. PETROLEUM TECH. 26, 27 (Dec. 2010).
[12] *Id.*
[13] *Id.*
[14] *Id.*
[15] *Id.*
[16] *Id.*
[17] *Id.*

operations were performed with gelled or refined crude oils, which were inexpensive at the time; however, the industry eventually transitioned to utilizing water as the main fracturing fluid.[18] Pan American Petroleum Corporation (now BP) performed the first 1.5-million-pound fracing job in October of 1968.[19]

The 1970s brought fracing technology innovations that enhanced the viscosity of gelled water-based fracturing fluids for higher temperature wells. This led to fracing operations requiring less gelling agents.[20] By 2008, more than 50,000 fracing stages[21] were completed worldwide at a cost between $6,000 and $6,000,000.[22] More recently, "ultra clean gelling agents" were developed based on surfactant-association chemistry.[23] These unique chemical mixtures are typically considered proprietary; as a result, most large fracing operators maintain the confidentiality of their gelling agent composition, which has led to recent objections to fracing.[24]

Although fracing has been utilized practiced by the oil and gas industry for over 50 years, technological advances have increased the scope of fracing operations so that each treatment now averages 60,000 gallons of fluid and 100,000 pounds of propping agent,[25] with the largest known project exceeding one million gallons of fluid and five million pounds of proppant.[26]

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[18] *Id.* at 28.
[19] *Id.* at 27.
[20] *Id.* at 28.
[21] A well may be fraced multiple times at different depths; the industry refers to these depths as "stages." HYNE, *supra* note 1 at 426.
[22] Montgomery & Smith, *supra* note 11, at 27.
[23] *Id.* at 28.
[24] Letter from EPA to Hydraulic Fracturing Industry, *available at* http://water.epa.gov/type/groundwater/uic/class2/hydraulicfracturing/upload/HFvoluntaryinformationrequest.pdf (last visited Sept. 5, 2011). *See also* Mike Soraghan, *Halliburton Announces Ecofriendly Fracking Fluid, More Disclosure*, N.Y. TIMES, Nov. 15, 2010, http://www.nytimes.com/gwire/2010/11/15/15greenwire-halliburton-announces-ecofriendly-fracking-flu-80875.html?pagewanted=all (acknowledging that the information requested is confidential business information).
[25] *See infra* note 37 and accompanying text.
[26] Montgomery & Smith, *supra* note 11, at 28.

III. VALUE OF FRACING

A well's profitability is largely dependent on stimulation treatment because production rate is significant to the economics of the well.[27] In fact, production rate, or the number of barrels produced at the site, is the principal determinant of a well's value.[28] Although there is value in a well's proven reserves, profitability of a project will depend more on how fast the well can be produced rather than the size of the reserves.[29] It is estimated that fracing increases US recoverable oil reserves by at least 30% and of gas reserves by 90%.[30] In fact, many current fields of production would not exist without fracing.[31]

Although fracing has numerous applications, it is typically associated with the production of natural gas. Some estimates suggest that, through the use of fracing, the U.S. has nearly 1,750 trillion cubic feet ("Tcf") of recoverable natural gas and 200 Tcf of proven reserves.[32] These reserves have become increasingly important to the U.S. as the country seeks to develop its energy independence in an environmentally conscious manner. Natural gas is often described as a clean fuel because it emits less carbon dioxide per joule delivered than either coal or oil.[33] Additionally, natural gas produces fewer pollutants than other hydrocarbon fuels.[34] Coupled with increased production rates attributed to

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[27] CHARLES F. CONAWAY, THE PETROLEUM INDUSTRY: A NONTECHNICAL GUIDE 160 (1st ed. 1999).

[28] *Id.*

[29] *Id.* A well is produced once the actual fluid rises from the well.

[30] *Id.* at 28.

[31] Montgomery & Smith, *supra* note 11, at 32 ("Many fields would not exist today without hydraulic fracturing. In the US, these include the Sprayberry trend in west Texas; Pine Island field, Louisiana; Anadarko basin; Morrow wells, northwestern Oklahoma; the entire San Juan basin, New Mexico; the Denver Julesburg basin, Colorado; the east Texas and north Louisiana trend, Cotton Valley; the tight gas sands of south Texas and western Colorado; the overthrust belt of western Wyoming; and many producing areas in the northeastern US.").

[32] Thomas E. Kurth, et al., *Law Applicable to Hydraulic Fracturing in the Shale States* (July 8, 2010), http://haynesboone.com/law_applicable_to_hydraulic_fracturing/.

[33] EPA, *Natural Gas* (Dec. 28, 2007), http://www.epa.gov/cleanenergy/energy-and-you/affect/natural-gas.html.

[34] *Id.*

fracing, natural gas is often described as a "bridge fuel" which will help the U.S. move closer to a "clean energy" future.

IV. HOW DOES FRACING WORK?

Performing a frac job requires as many as twenty-four pump trucks.[35] Liquid storage trucks deliver fracturing fluids and proppants to the site.[36] Proppants are "small, uniform sand grains or equally sized plastic pellets" mixed into the frac fluid and carried into the fractures.[37] Frac fluids are comprised of low-gravity oils (such as diesel fuel), water and a variety of chemicals that thicken the mixture to allow it to withstand high subsurface temperatures of the earth.[38] Sometimes the liquid is comprised of water and dissolved carbon dioxide or nitrogen.[39] Once the well is perforated, pump trucks are attached to the wellhead by a series of pipes and manifolds and begin to simultaneously pump fracing fluids into the wellbore, gradually increasing the pressure in the wellbore until the pressure exceeds the fracture gradient of the rock.[40] At this point the pressure drops abruptly, indicating that fracture was successful.[41]

Once the fracture is created, it "begins to propagate away from the wellbore . . . [and] it is held open by the pressure created by the pump truck continuing to pump fluid into the well."[42] Proppant is then introduced into the fracing fluid and into the well.[43] When the pump trucks stop pumping and release pressure in the well, fractures naturally begin to heal. However, the proppants that migrate into the fractures create temporary channels for fluids to flow to the wellbore.[44] In fracing operations conducted on limestone or dolomite, which are mainly comprised of calcium carbonate, acids are used instead of proppants.[45]

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[35] RAYMOND & LEFFLER, *supra* note 3, at 216–17.
[36] *Id.*
[37] *Id.*
[38] *Id.*
[39] *Id.*
[40] *Id.*
[41] *Id.* at 218–19.
[42] *Id.* at 219.
[43] CONAWAY, *supra* note 27, at 162.
[44] RAYMOND & LEFFLER, *supra*, note 3, at 219; CONAWAY, *supra* note 27, at 162.
[45] RAYMOND & LEFFLER, *supra*, note 3, at 219; CONAWAY, *supra* note 27, at 161–62.

The acid partially dissolves the surface of the fractures "creating irregular, etched intervals through which fluid or gas can flow after the pressure is released and the fracture closes."[46] A typical well is stimulated several times during its producing life as the proppant is crushed and the fractures heal.

Between 25% and 75% of frac fluids pumped into the ground are recovered or produced from the well.[47] The unaccounted for percentage is believed to remain underground, potentially seeping into the surrounding rock formation. For example, in an operation utilizing four million gallons of fracing fluid, approximately three million gallons will likely be produced by or recovered from the well while one million gallons will be unaccounted for. The three million gallons of fluid produced or recovered from the well are generally considered toxic,[48] as they may contain naturally occurring heavy metals and radioactive materials from the surrounding rock bed.[49] Fracing companies handle the return fluid by either placing it in containment ponds or temporary on-site storage tanks while awaiting transport to local sewage plants, or after limited on-site treatment, re-injecting the water back into the well.[50] Either storage option leads to potential spills, and as contended by many communities surrounding fracing operations, environmental contamination.[51] Some communities also attribute water contamination, earthquakes and increased air pollution to fracing.[52]

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[46] RAYMOND & LEFFLER, *supra* note 3, at 219; CONAWAY, *supra* note 27, at 162.

[47] EPA Office of Research and Dev., *Draft Plan to Study the Potential Impacts of Hydraulic Fracturing on Drinking Water Resources* 36 (Feb. 2011), *available at* http://water.epa.gov/type/groundwater/uic/class2/hydraulicfracturing/upload/HFStudyPlanDraft_SAB_020711-08.pdf.

[48] Because each company keeps its fluid formula confidential, nobody actually knows what toxins potentially exist in the fluid. Letter from EPA to Hydraulic Fracturing Industry, *supra* note 24.

[49] EPA Office of Research and Dev., *supra* note 47, at 30 (Table 5 shows that pursuant to initial studies, water recovered or produced from the well can contain hydrogen sulfide, aluminum, arsenic, barium, beryllium, boron, cadmium, calcium, chromium, cobalt, iron, lead, magnesium, radium 226, and radium 228).

[51] *Id.* at 37–38.

[52] Sarah Eddington, *'Fracking' Disposal Sites Suspended, Likely Linked To Arkansas Earthquakes*, HUFFPOST GREEN, March 14, 2011,

V. POLITICS, LAWS & REGULATION OF FRACING

Environmental concerns related to fracing have existed since the technique was popularized in the 1970s. However, fracing has been largely left unregulated as a result of political action and increased demand for clean, domestic sources of energy. The history of environmental legislation and the politics related to hydraulic fracturing emphasize the need for the Environmental Protection Agency ("EPA") to intervene, as it recently has, to study the effects of the activity and determine whether federal regulation of hydraulic fracturing is necessary.

A. *Safe Drinking Water Act 1974*

In 1974, Congress enacted the Safe Drinking Water Act ("SWDA") with the purpose of protecting the quality of drinking water in the United States.[53] To achieve this goal, the SDWA aimed to protect waters that were or had the likelihood of being designated for drinking use from contamination. Pursuant to the SDWA, the EPA established federal minimal standards and requirements for underground injection practices.[54] Additionally, the EPA was required to report to Congress on industry waste disposal practices.[55]

In part, the SDWA established the Underground Injection Control program ("UIC") and prohibited any "underground injection" that endangered underground drinking water sources.[56] Underground injection

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http://www.huffingtonpost.com/2011/03/06/ fracking-arkansas-earthquakes_n_831633.html.

[53] Safe Drinking Water Act of 1974, 42 U.S.C. § 300f (1974).

[54] EPA, *Basic Information About Injection Wells*, http://water.epa.gov/type/groundwater/uic/basicinformation.cfm (last visited Sept. 5, 2011).

[55] *Id.*

[56] 42 U.S.C.A. § 300h(b)(1) (2006). Underground injection "endangers drinking water sources if such injection may result in the presence in underground water which supplies or can reasonably be expected to supply any public water system of any contaminant, and if the presence of such contaminant may result in such system's not complying with any national primary drinking water regulation or may otherwise adversely affect the health of persons." 42 U.S.C. § 300h(d)(2) (2006).

was defined as the "subsurface emplacement of fluids by well injection."[57] However, throughout the 1990s, the EPA took the position that the SDWA did not apply to hydraulic fracturing because the UIC only applied to operations where the "principal function" was the injection of fluids into the ground and the principal function of fracing was in resource recovery.[58] Thereafter, the EPA left the regulation of fracing to the states.

B. *LEAF v. EPA – Agency Interpretation Challenged*

The EPA's interpretation of fracing remained unchallenged until 1995, when Alabama citizens living near coalbed methane production sites reported contaminants in their drinking water wells and petitioned the EPA for assistance through the Legal Environmental Assistance Foundation ("LEAF").[59] In their petition, LEAF requested that the EPA withdraw approval of Alabama's UIC program arguing that it was deficient because it failed to regulate hydraulic fracturing activities.[60] LEAF also alleged that hydraulic fracturing required regulation under the federal guidelines.[61] Despite objections from the landowners, the EPA denied the petition in 1995 and concluded that Alabama's implementation of its UIC Program was consistent with the requirements of the Safe Drinking Water Act[62] and EPA's UIC regulations.[63] EPA did not regulate, and did not believe it was legally required to regulate, the hydraulic fracturing of methane gas production well under its UIC Program.[64] The EPA further concluded that there was no evidence that hydraulic fracturing resulted in any underground contamination or endangerment of drinking water.[65]

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[57] *Id.* at § 300h(d)(1).
[58] Legal Envtl. Assistance Found., Inc. v. EPA, 118 F.3d 1467, 1471 (11th Cir. 1997).
[59] *Id.*
[60] Coalbed Methane Ass'n of Ala., *History of Coalbed Methane in Alabama*, http://www.coalbed.com/displaycommon.cfm?an=1&subarticlenbr=14 (last visited July 7, 2011).
[61] *Id.*
[62] 42 U.S.C. §300h, *et seq.* (2006).
[63] 40 C.F.R. pt. 145 (2010).
[64] Letter from Carol M. Browner, EPA Adm'r, to LEAD (May 5, 1995) (on file with author).
[65] *Id.*

The residents appealed the EPA's decision and in 1997, the Eleventh Circuit overruled the EPA's interpretation and instructed the agency to begin requiring states to regulate fracing under the SDWA.[66] As a result, the State Oil and Gas Board of Alabama promulgated detailed regulations addressing fracing, which were approved by the EPA in 2000.[67] LEAF again appealed the EPA's approval arguing that the section gave the state discretion related to the regulation and only applied to secondary or tertiary oil and gas recovery.[68] However, on December 21, 2001, the Eleventh Circuit in effect determined that Alabama's UIC program was in compliance with the SDWA.[69] Specifically, the Court determined that the EPA's interpretations were not arbitrary and capricious, meaning that Section 1425 of the SDWA applied to hydraulic fracturing of coalbeds, and that Alabama's UIC program constituted an "effective program to prevent endangerment of underground sources of water."[70]

C. *SDWA Challenges: First EPA Study & the Energy Task Force*

Two very different political pressures followed the second LEAF v. EPA case. The case made public the potential problems associated with fracing and communities became concerned over the potential environmental impact of widespread use of hydraulic fracturing. Others were concerned with the increased government oversight over the operations, which could potentially hinder development of national energy resources. Initially, both sides of the argument had some success. In 1999, the EPA began a study on the environmental impact of hydraulic fracturing in coalbed methane production to determine the "potential for contamination of underground sources of drinking water."[71] While in 2001, newly elected President George W. Bush convened the National

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[66] Legal Envtl. Assistance Found., Inc. v. E.P.A., 118 F.3d 1467, 1478 (11th Cir. 1997).
[67] *Id.*
[68] Legal Envtl. Assistance Found., Inc. v. E.P.A., 276 F.3d 1253, 1256 (11th Cir. 2001).
[69] *Id.* at 1253.
[70] *Id.*
[71] EPA, *Hydraulic Fracturing Background Information*, http://water.epa.gov/type/groundwater/uic/class2/hydraulicfracturing/wells_hydrowhat.cfm [hereinafter *Background Information*] (last visited Aug. 21, 2011).

Energy Policy Development Group ("Energy Task Force"), lead by Vice President Dick Cheney, who would make recommendations to the Administration regarding energy policies.

The Energy Task Force released its final report in May 2001.[72] Although lacking much detail, the report briefly discussed fracing and stressed the importance of the technique, mentioning the potential for increased environmental regulation.[73] The Energy Task Force recommended that the "President direct the Secretaries of Energy and the Interior to promote enhanced oil and gas recovery from existing wells through new technology."[74] The report made no mention of the ongoing environmental investigation by EPA and it made no recommendation regarding legislation.[75]

The EPA published its final report on fracing in July of 2004.[76] In this report, the EPA concluded that there was little to no risk of fracturing fluid contaminating underground sources of drinking water.[77] The EPA concluded that "although thousands of coalbed methane wells are fractured annually, [there was no] confirmed evidence that drinking water wells [had] been contaminated by hydraulic fracturing fluid injection into coalbed methane wells."[78] Further, the EPA report stated that the "injection of hydraulic fracturing fluids into coalbed methane wells posed

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[72] Nat'l Energy Pol'y Dev. Group, *National Energy Policy: Report of the National Energy Policy Development Group*, NAT'L ENERGY POL'Y DEV. (May 2001), *available at* http://www.wtrg.com/EnergyReport/National-Energy-Policy.pdf.

[73] *Id.* at 5–6.

[74] *Id.* at 8–15.

[75] Tom Hamburger & Alan C. Miller, *A Changing Landscape: Halliburton's Interests Assisted by White House*, L.A. TIMES, Oct. 14, 2004, *available at* http://articles.latimes.com/2004/oct/14/nation/na-frac14.

[76] EPA, *Evaluation of Impacts to Underground Sources of Drinking Water by Hydraulic Fracturing of Coalbed Methane Reservoirs*, EPA 816-R-04-003 (2004) [hereinafter *Impacts to Drinking Water*], *available at* http://water.epa.gov/type/groundwater/uic/class2/hydraulicfracturing/wells_coalbedmethanestudy.cfm.

[77] *Id.* at 7–6.

[78] *Id.*

little or no threat to [underground sources of drinking water] and [did] not justify additional study."[79]

However, the EPA concluded that diesel fuels may pose some environmental concerns when used in a fracing fluid mixture.[80] As a result, the EPA entered into a Memorandum of Agreement with three companies, Halliburton, BJ Services and Schlumberger, which oversee ninety-five percent of the projects in the U.S., to voluntarily remove diesel fuels from fracturing fluids injected into fracturing operations.[81] These companies "indicated to EPA that they [would] no longer use diesel fuel as a hydraulic fracturing fluid additive when injecting . . . for coalbed methane production."[82]

D. *Criticism of the 2004 EPA Report*

While the EPA report vindicated the fracing industry's position, it also drew criticism. An EPA scientist called the report "scientifically unsound" and accused members of the report's peer review panel of conflicts of interest.[83] These criticisms were widely heralded as proof that EPA's study could not be relied upon.[84]

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[79] *Id.* at 7–5 (noting that "the risk posed to USDWs by introduction of [fracing] chemicals is reduced significantly by groundwater production and injected fluid recovery, combined with the mitigating effects of dilution and dispersion, adsorption, and potentially biodegradation." Additionally, EPA noted that "high stress contrast between adjacent geologic strata results in a barrier to fracture propagation."). In other words, EPA concluded that fractures do not generally extend upward toward shallower ground water sources.

[80] *Background Information*, *supra* note 71; *Impacts to Drinking Water*, *supra* note 76, at 7–3.

[81] EPA, *Impacts to Drinking Water, Executive Summary*, http://epa.gov/ogwdw/uic/pdfs/cbmstudy_attach_uic_exec_summ.pdf (last visited Sept. 5, 2011).

[82] *Impacts to Drinking Water*, *supra* note 76, at 7–3.

[83] Letter from Weston Wilson, Envtl. Eng'r, EPA, to Wayne Allard, Senator, U.S. Senate, Nighthorse Campbell, Senator, U.S. Senate, and Diana DeGette, Representative, U.S. House of Representatives (Oct. 8, 2004) (on file with author), *available at* http://www.earthworksaction.org/pubs/Weston.pdf. In October 2004, an EPA environmental engineer in Denver named Weston Wilson sent a letter and report to his

E. *Energy Policy Act of 2005*

Meanwhile, the idea of exempting fracing from the SDWA gained traction in Congress. The Energy Policy Act of 2005 ("EP Act") was passed by Congress on July 29, 2005, and signed into law by President Bush on August 8, 2005.[85] The EP Act attempted to combat growing national energy problems by providing tax incentives and loan guarantees for energy production activities.[86] Additionally, the EP Act included an amendment to the SDWA, exempting from its scope "the underground injection of natural gas for the purposes of storage" and "the underground injection of fluids or propping agents (other than diesel fuels) pursuant to hydraulic fracturing operations related to oil, gas or geothermal production activities."[87]

The EP Act also provided that certain oil and gas drilling activities are "subject to a rebuttable presumption that the use of a categorical exclusion under the National Environmental Policy Act of 1969 would apply if the activity is conducted pursuant to the Mineral Leasing for the purpose of exploration or development of oil or gas . . . "[88]

In other words, the EP Act prevented EPA from regulating hydraulic fracturing under the SDWA. Additionally, the EP Act amended the SDWA Act to exclude from the definition of "pollutant" any

> "water, gas, or other material which is injected into a well to facilitate production of oil or gas, or water derived in association with oil or gas production and disposed of in a well, if the well is used either to facilitate production or for disposal purposes is approved by authority to the State in which the well is located, and

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Congressional representatives in Colorado, particularly concerned that coal beds in which fracing is conducted can occur within aquifers that are drinking water sources. *See id.*

[84] Union of Concerned Scientists, *Scientific Integrity in Policy Making: Further Investigation of the Bush Administration's Misuse of Science* (July 2004), http://www.ucsusa.org/assets/documents/scientific_integrity/scientific_integrity_in_policy_making_july_2004_1.pdf.

[85] Energy Policy Act of 2005, Pub. L. No. 109-58, 19 Stat. 594 (2005).

[86] *Id. See generally* 119 Stat. 594 (2005) (providing numerous tax incentives and loan guarantees for energy production activities).

[87] 42 U.S.C. § 300h(d)(1) (2011).

[88] *See* 42 U.S.C. § 15942(a) (2011).

if such State determines that such injection or disposal will not result in the degradation of ground or surface water resources."[89]

As a result of these exclusions, regulation of fracing returned to each state. Efforts to regulate hydraulic fracturing therefore focused on local initiatives.

F. *State Attempts to Regulate Fracing*

State efforts to regulate the fracing industry focus on two main areas of concern: industry accountability and disclosure related to the use of chemicals, and wastewater disposal and management. For instance, in Arkansas, four proposed bills seek to address local concerns related to fracing in the Fayetteville Shale. House bill 1394 seeks to protect water quality in lakes, rivers and streams by requiring gas companies to follow "best management practices" when constructing roads, pipelines, and drilling pads."[90] House bill 1395 seeks to protect "air quality in areas affected by the release of hazardous air contaminants as a result of natural gas drilling, production, and transportation."[91] House Bill 1396 would require companies to reveal the amount of water and fracing fluids utilized in each operation, including an estimate of the amount of each remaining in the well and the amount returned.[92]

The California Legislature is also considering legislation, Assembly Bill 591, which would require oil and gas exploration companies to disclose the amount of water and chemicals used during fracing operations.[93] The information acquired would be published on the Division of Oil, Gas and Geothermal Resources website.[94] The bill further requires that fracing operators ensure safe disposal of contaminated water.[95] The proposed law is designed to create a database of information

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[89] 33 U.S.C. § 1362(6) (2008).
[90] *See* H.B. 1394, 88th Reg. Sess. (Ark. 2011).
[91] H.B. 1395, 88th Reg. Sess. (Ark. 2011).
[92] H.B. 1396, 88th Reg. Sess. (Ark. 2011).
[93] Cal. A.B. 591 (approved by the assembly and currently in the California Senate).
[94] *Id.*
[95] *Id.*

for further investigation of the activity, and provide more aggressive protection to the human environment.[96]

Colorado approved regulations related to fracing in 2009.[97] Under the regulations, each fracing company is required to maintain a well-by-well chemical inventory.[98] The release of this chemical inventory is not automatic; instead, companies only need to disclose the information upon request by the Colorado Oil and Gas Conservation Commission.[99]

The Maryland House of Representatives approved two bills that, in effect, constitute a moratorium on fracing until 2013 and the completion of the proposed EPA studies. One bill requires the Maryland Department of the Environment and the Department of Natural Resources to convene on permitting requirements and appropriate changes to state law.[100] The other bill from the Senate prohibits Department of the Environment from issuing permits for well drilling in Marcellus Shale until specific conditions are met.[101]

In March of 2011, New Jersey representatives proposed a bill prohibiting "hydraulic fracturing in the State for the purpose of natural gas exploration and production."[102] The bill urges governors and state representatives in Delaware, New York and Pennsylvania to enact a moratorium on fracing until EPA concludes its study.[103] Additionally, New Jersey's Senate is considering a proposed bill prohibiting the state's

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[96] *Id.*

[97] *See e.g.*, COLO. CODE REGS. § 404-1:205(c) (2011).

[98] *Id.*

[99] COLO. CODE REGS. § 404-1:205(f).

[100] *See* Marcellus Shale Safe Drilling Act of 2011, H.B. 852, Reg. Gen. Assemb., 428th Sess. (Md. 2011).

[101] *See* Marcellus Shale Safe Drilling Act of 2011, S.B. 634, Gen. Assemb., 428th Sess. (Md. 2011).

[102] *See* S.B. 2575, 214th Leg., 1st Ann. Sess. (N.J. 2010); S.B. 2576, 214th Leg., 1st Ann. Sess. (N.J. 2010); A.B. 3313, 214th Leg., 1st Ann. Sess. (N.J. 2010); A.B. 3653, 214th Leg., 1st Ann. Sess. (N.J. 2010).

[103] *See* S.B. 2575, 214th Leg., 1st Ann. Sess. (N.J. 2010); S.B. 2576, 214th Leg., 1st Ann. Sess. (N.J. 2010); A.B. 3313, 214th Leg., 1st Ann. Sess. (N.J. 2010); A.B. 3653, 214th Leg., 1st Ann. Sess. (N.J. 2010).

representative to the Delaware River Basin Commission from supporting fracing.[104]

Governor Paterson of New York issued an executive order in December of 2010 instituting a moratorium on "high volume, horizontal hydraulic fracturing" which is expected to be lifted on July 1, 2011.[105] Given that the result of EPA's proposed studies will not be completed until 2012, it is expected that this moratorium will be extended.

As part of the ongoing debates regarding hydraulic fracing, State Representative Nikki Antonio of Ohio introduced a bill directing the Ohio Department of Natural Resources to immediately suspend permits to drill for oil or natural gas in Lake Erie.[106]

Pennsylvania serves as an excellent example of political efforts related to fracing. On October 26, 2010, then Governor Rendell signed an executive order establishing a moratorium of all oil and gas development on lands owned and managed by the Pennsylvania Department of Conservation and Natural Resources.[107] Shortly after inauguration in January 2011, Governor Corbertt rescinded the executive order, established the Marcellus Shale Advisory Commission and appointed a high profile energy executive to the position that oversees land permitting and regulation related to fracing.[108]

On June 17, 2011, Texas Governor Rick Perry signed a bill that, beginning on September 1, 2011, will require limited disclosure of

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[104] *See* S.B. 2575, 214th Leg., 1st Ann. Sess. (N.J. 2010); A.B. 3314, 214th Leg., 1st Ann. Sess. (N.J. 2010).

[105] N.Y. COMP. CODES R. & REGS. tit. 9, § 7.41 (2011).

[106] Ohio H.B. 304 (§ 1505.07(B)) (2010–11) (proposed), *available at* http://www.legislature.state.oh.us/bills.cfm?ID=129_HB_304.

[107] Edward Rendell, PENN. EXEC. ORDER NO. 2010-5 (Oct. 26, 2010), *available at* http://www.portal.state.pa.us/portal/server.pt?open=512&objID=708&PageID=224602&mode=2&contentid=http://pubcontent.state.pa.us/publishedcontent/publish/cop_general_government_operations/oa/oa_portal/omd/p_and_p/executive_orders/2010_2019/items/2010_05.html.

[108] Tom Corbett, PENN. EXEC. ORDER NO. 2011-1 (Mar. 8, 2011), *available at* http://www.portal.state.pa.us/portal/server.pt/gateway/PTARGS_0_2_785_708_0_43/http%3B/pubcontent.state.pa.us/publishedcontent/publish/global/files/executive_orders/2010___2019/2011_01.pdf.

chemicals utilized in in fracing operations.[109] Leading the way in the U.S., the Texas fracing law requires operators to disclose the amount of water and the concentration of any additive regulated by the Occupational Safety and Health Administration ("OSHA") that is used in each fracing treatment.[110] Despite its efforts at transparency, the Texas fracing law continues to afford industry protections by exempting trade secret chemicals from disclosure and requiring only limited data on chemicals not regulated by OSHA. Further, the Texas fracing law only requires disclosure for treatment of wells for which "an initial drilling permit is issued on or after the date the initial rules adopted."[111] Additionally, Texas municipalities are attempting to regulate their jurisdictions by instituting temporary moratoriums as they await the release of EPA's study.[112]

Legislation approved in Wyoming on September 15, 2010, requires companies to identify water supply wells, demonstrate wellbore integrity and report chemical use to the Oil and Gas Conservation Commission.[113] Additionally, companies must file with the commission reports showing the actual amounts of chemicals used; however, they are not required to disclose information following each stage of stimulation.[114]

Although states have discussed attempts to regulate fracing within their borders, it is unclear whether purely local efforts will accomplish

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[109] S.1049, 82 Reg. Sess. (Tex. 2011); H.B. 3328, 82 Reg. Sess. (Tex. 2011) (signed into law), http://www.capitol.state.tx.us/BillLookup/History.aspx?LegSess=82R&Bill=HB3328.

[110] *Id.* § 91.851(a)(1)(B)(i)–(ii), *available at* http://www.capitol.state.tx.us/tlodocs/82R/billtext/html/HB03328H.htm.

[111] *Id.* § 2, Subch. S, Ch. 91 of the Natural Resources Code as amended by the Act.

[112] *See generally* Chris Roark, *Flowback water spilled in west Flower Mound*, FRACKING INSIDER, http://www.flowermoundleader.com/articles/2010/03/18/news_update/771.txt. *But see* Ne. Natural Energy, LLC v. City of Morgantown, Monongalia Cnty. Cir. Ct. (Div. 1 2011) (order *available at* http://www.frackinginsider.com/litigation/a-west-virginia-state-judge/) (holding that municipal ban on fracing was preempted by state legislation and invalid) and Chris Roark, *Flowback water spilled in west Flower Mound*, FLOWER MOUND LEADER STAR, Mar. 17, 2010, *available at* http://www.courier-gazette.com/articles/2010/06/08/flower_mound_leader/news/953.txt.

[113] 30-3 WYO. CODE R. §§1(a), 12 (LexisNexis 2010).

[114] *Id.* at § 12. The statute, however, does not require that companies disclose the details of multiple stimulations. *Id.*

each state's goals. As a result, federal regulation may be necessary, at least to the extent of developing water quality and practice standards.

G. *Fracing Opposition*

As mentioned, fracing requires significant amounts of water. The water used in fracing operations is usually trucked to the site. Some of the larger frac jobs require more than one million gallons of water and over three million of pounds of propping agents per stage (as an example, if a fracing job requires six million gallons of water, it would take over 650 nine-thousand-gallon diesel tanker trucks to effectuate delivery).[115] Most fracing sites also utilize drilling rigs, pick-up trucks, tractor-trailers, liquid pumps and other heavy equipment, which are typically run on diesel fuel.[116] Along with air pollution associated with such equipment, the operations require transfer of large quantities of fluid from the delivery trucks to the pump trucks and into the wellbore. These operations increase the likelihood of spills, unintended releases and accidents. Additionally, following well production, particulate matter can be dispersed into the atmosphere from dust, natural gas flaring and gas dehydration and separation equipment.

Fracing opponents have also focused on the potential impact fracing may have on air quality. For instance, preliminary data from the upper Green River basin in Southwest Wyoming, a sparsely populated part of the country, shows that the region is experiencing air quality worse than Los Angeles.[117] Some attribute this decline in air quality to the booming

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[115] HYNE, *supra* note 1, at 425. *See generally* Joe Carroll, *Worst Drought in More Than a Century Strikes Texas Oil Boom*, BLOOMBERG, June 13, 2011, http://www.bloomberg.com/news/2011-06-13/worst-drought-in-more-than-a-century-threatens-texas-oil-natural-gas-boom.html. In the Eagle Ford, a shale play in Texas, fracing operations require up to 13 million gallons of water. This is particularly problematic when Texas is experiencing the worst drought on record.

[116] HYNE, *supra* note 1, at 425.

[117] Mead Gruver, *Wyoming Air Pollution Worse Than Los Angeles Due To Gas Drilling*, HUFFINGTON POST, Mar. 8, 2011, http://www.huffingtonpost.com/2011/03/08/wyoming-ait-pollution-gas-drilling_n_833027.html.

natural gas industry in the area.[118] Specifically, air pollution is likely caused by new well drilling, routine equipment maintenance and gas-field equipment use contributing volatile organic compounds and nitrogen oxides to ozone pollution.[119] Preliminary data showed ozone levels on March 2, 2011, as high as 124 parts per billion, two-thirds higher than EPA's maximum healthy limit of 75 parts per billion and "above the worst day in Los Angeles all last year."[120] Regional studies have been proposed in order to quantify the effects of fracing industry practices to national air quality standards and nonattainment.

In response to the increasing concerns regarding air quality and hydraulic fracing operations, WildEarth Guardians and the San Juan Citizens Alliance sued the EPA alleging that the EPA failed to enact air standards for the natural gas industry.[121] The parties entered a consent decree requiring the EPA to propose industry specific emission standards and issue a final rule by February 28, 2011.[122]

As part of its settlement, the EPA announced four proposed air emission regulations affecting the fracing industry on July 28, 2011.[123] The EPA explained,

> [S]ome of the largest air emissions in the oil and gas industry occur as natural gas wells that have been fractured are being prepared for production. During a stage of well completion known as "flowback," fracturing fluids, water, and reservoir gas come to the surface at a high velocity and volume. This mixture includes a high volume of VOCs and methane, along with air toxics such as

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[118] *Id.* Kirk Johnson, *In Pinedale, Wyo., Residents Adjust to Air Pollution*, N.Y. TIMES, Mar. 9, 2011, *available at* http://www.nytimes.com/2011/03/10/us/10smog.html?partner=rss&emc=rss.

[119] Gruver, *supra* note 117.

[120] *Id.*

[121] *See* Oil and Natural Gas Sector: New Source Performance Standards and National Emission Standards for Hazardous Air Pollutants Reviews, 76 Fed. Reg. 52743 (Aug. 23, 2011) (to be codified at 40 C.F.R. pts. 60 & 63) [hereinafter *Standards*].

[122] *Id.* at 52743 n.3.

[123] *Id.* at 52743.

benzene, ethylbenzene and h-hexane. The typical flowback process lasts from three to 10 days.[124]

As drafted, the agency would limit emissions during all stages of natural gas production and development, specifically targeting volatile organic compounds, by requiring driller to use equipment to capture emission gases.[125] The EPA estimates that using the equipment during the flowback period could reduce emissions of fractured wells by 95%.[126]

Despite rising concerns and a flurry of media attention, the number of studies focused on the environmental impacts of fracing remains limited. In June of 2009, two bills titled "Fracturing Responsibility and Awareness of Chemicals Act" ("FRAC Act") were introduced in the U.S. House and Senate.[127] The identical bills sought to amend the SDWA and allow EPA to regulate hydraulic fracturing in states that have not adopted appropriate UIC regulations.[128] Additionally, the bill would have required the fracing industry to reveal the chemicals used in frac fluids.[129] However, the 111th Congress adjourned without taking action on the FRAC Act.[130]

H. *Gasland: The Hollywood Effect*

The debate regarding fracing made its way to the headlines with the release of the documentary film "Gasland." The film, directed by Josh Fox, outlines problems associated with fracing by interviewing citizens in Colorado, Wyoming, Utah and Texas.[131] In the film, citizens report chronic health problems, air contamination and contamination of both surface and subsurface water following the development of nearby hydraulic fracturing operations.[132] In the movie, Fox interviews scientists,

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[124] EPA, *Fact Sheet* 2, *available at* http://www.epa.gov/airquality/oilandgas/pdfs/20110728factsheet.pdf.
[125] *See Standards*, *supra* note 121, at 52738.
[126] EPA, *Fact Sheet*, *supra* note 124, at 1.
[127] H.R. 2766, 111th Cong. (2009); S. 1215, 111th Cong. (2009).
[128] *Id.* H.R. 2766, 111th Cong. (2009); S. 1215, 111th Cong. (2009).
[129] *Id.* H.R. 2766, 111th Cong. (2009); S. 1215, 111th Cong. (2009).
[130] *See* H.R. 1084, 112th Cong. (2011); S. 587, 112th Cong. (2011).
[131] JOSH FOX, *Gasland* (HBO Documentaries 2011).
[132] *Id.*

politicians and gas industry executives to discuss community problems with hydraulic fracturing.[133] The film received critical praise following its release, and received the Special Jury Prize at the 2010 Sundance Film Festival among other awards[134]. In early 2011, the film was nominated for an Academy Award in the category of Best Documentary Feature and pushed fracing into the international headlines. By focusing on the human impact of hydraulic fracturing, the film opened a dialogue and popularized the topic, leading to mass protests nationally and internationally.[135]

I. *Recent Problems & International Attention*

In February 2010, the House Energy & Commerce Committee reported that two signatory companies to the Memorandum of Understanding Agreement ("Memorandum") signed in 2003 had failed in their commitment to cease diesel use and continued to use this fuel through 2007.[136] Although the violating companies reported the diesel use occurred by mistake and that it was unclear whether diesel use had occurred at locations covered by the Memorandum or SDWA, the controversy focused even more attention on the need for fracturing fluid disclosure.[137] On January 31, 2011, Representatives Henry Waxman, Edward Markey and Diana DeGette wrote a letter to EPA Administrator Lisa Jackson noting that providers had injected an estimated 32.2 million gallons of unauthorized diesel fluids in nineteen states since the signing of

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[133] *Id.*

[134] Other awards included the Big Sky Documentary Film Festival Artistic Vision Award, the Thin Line Film Festival Audience Award, the Yale Environmental Film Festival Grand Jury Prize, and the Special Jury Prize at the 2010 Sarasota Film Festival.

[135] Tara Patel, *France Vote Outlaws 'Fracking' Shale for Natural Gas, Oil Extraction*, BLOOMBERG, July 1, 2011, http://www.bloomberg.com/news/2011-07-01/france-vote-outlaws-fracking-shale-for-natural-gas-oil-extraction.html.

[136] *Waxman, Markey, and DeGette Investigation Finds Continued Use of Diesel in Hydraulic Fracturing Fluids*, COMM. ENERGY & COM., January 31, 2011, *available at* http://democrats.energycommerce.house.gov/index.php?q=news/waxman-markey-and-degette-investigation-finds-continued-use-of-diesel-in-hydraulic-fracturing-f. The Memorandum was signed by the three largest hydraulic fracturing companies: Halliburton, BJ Services and Schlumberger. *Id.*

[137] *Id.*

the Memorandum.[138] The letter notes that BJ Services injected 11.5 million gallons and Halliburton injected seven million gallons.[139] Additionally, the letter states that "[a]ccording to EPA, any company that performs hydraulic fracturing using diesel fuel must receive a permit under the Safe Drinking Water Act. We learned that no oil and gas service companies have sought—and no state and federal regulators have issued—permits for diesel fuel use in hydraulic fracturing. This appears to be a violation of the Safe Drinking Water Act. It also means that the companies injecting diesel fuel have not performed the environmental reviews required by the law."[140]

Since January of 2001, fracing has received significant media attention. For instance, fracing has received attention related its potential relationship to earthquakes in Arkansas, Louisiana and Texas.[141] Fracing was also featured on the front page of the New York Times on February 26, 2011.[142] This article discussed water disposal problems related to fracing, particularly the potential that fracing wastewater, laden with naturally occurring radioactive compounds, is processed by facilities inadequately equipped to handle these materials.[143] Additionally, the article points out that current state legislation does not entice the industry to comply, fining companies an average of $44,000 each year, less than half of the average daily profits.[144] Articles also note the effect of U.S.

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[138] *Id.*
[139] *Id.*
[140] *Id.*
[141] Sarah Eddington, *Guy Earthquake Swarm: Arkansas Mystery Quakes May Be Result Of 'Fracing' Disposal*, HUFFINGTON POST, Feb. 17, 2011, *available at* http://www.huffingtonpost.com/2011/02/17/guy-earthquake-swarm-arkansas_n_824497.html; Dan Vergano, *Texas earthquakes may be linked to wells for gas mining*, USA TODAY, Mar. 11, 2010, *available at* http://www.usatoday.com/tech/science/2010-03-11-quakes11_ST_N.htm.
[142] Ian Urbina, *Regulation Lax as Gas Wells' Tainted Water Hits Rivers*, N.Y. TIMES, Feb. 26, 2011, *available at* http://www.nytimes.com/2011/02/27/us/27gas.html.
[143] *Id.*
[144] *Id.*

news coverage abroad, noting that the United Kingdom, Canada and France have experienced similar uprisings in opposition to fracing.[145]

J. *FRAC Act 2011*

In response to heightened attention and political pressure, the FRAC Act was reintroduced in both chambers of congress on March 16, 2011.[146] The FRAC Act seeks to amend the SWDA to repeal certain exemptions granted to hydraulic fracturing. Specifically, the FRAC Act redefines underground injection to include "underground injection of fluids or propping agents pursuant to hydraulic fracturing operations related to oil or gas production activities."[147]

The FRAC Act also seeks to amend the SDWA by requiring the fracing industry to disclose to the responsible state agency "prior to the commencement of any hydraulic fracturing operations" and "not later than 30 days after the end" of any hydraulic fracturing operations "a list of chemicals intended for use in any underground injection during such operations, including identification of the chemical constituents of mixtures, Chemical Abstracts Service numbers for each chemical and constituent, material safety data sheets when available and the anticipated volume of each chemical."[148]

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[145] *See* Tim Webb, *Results of controversial 'fracing' for shale gas in UK will be kept secret*, GUARDIAN, Mar. 1, 2011, *available at* http://www.guardian.co.uk/business/2011/mar/01/fracing-shale-gas-energy-mps; Kevin Daugherty, *Minister confirms ban on fracing in Quebec*, CALGARY HERALD, Mar. 17, 2011, *available at* http://www.calgaryherald.com/technology/Minister+confirms+fracing+Quebec/4454645/story.html; John Shimkus, *France Bans Drilling, Fracing & Exploration for Shale Natural Gas*, ENERGY DIGITAL, Mar. 14, 2011, *available at* http://www.energydigital.com/sectors/oil-and-gas/france-bans-drilling-fracing-exploration-shale-natural-gas. Uprisings in France led to such discontent that the country placed a ban on fracing until June of 2011, pending parliamentary extensions. *Id.*

[146] Fracturing Responsibility and Awareness of Chemicals Act of 2011 (FRAC), S. 587, H.R. 422, 112th Cong. (2011).

[147] S. 587.

[148] *Id.*

Furthermore, the FRAC Act requires that the State make the disclosure of chemicals available to the public.[149] Additionally, where a medical emergency exists and the proprietary chemical formula used "is necessary for medical treatment, the person conducting the hydraulic fracturing operations shall . . . disclose the proprietary chemical formulas or the specific chemical identity of a trade secret chemical" to the state or the treating physician or nurse without requiring a confidentiality agreement prior to disclosure.[150]

The bill was referred to the House Subcommittee on Environment and Economy on March 21, 2011,[151] and to the Senate Committee on Environment and Public Works on March 15, 2011.[152] On April 12, 2011, the Senate Committee on Environment and Public Works held hearings with the Subcommittee on Water and Wildlife. While the FRAC Act remains in committees, it will be reviewed, deliberated, investigated and revised. Once it clears committees, it will be submitted to general debate.

In summary, hydraulic fracturing has been a victim of its own success. The technology undoubtedly increases U.S. national gas reserves by assisting in the production of otherwise uneconomical wells and by increasing production rates and yields. However, this success moved the oil and gas industry closer to more densely populated regions both nationally and internationally. In conjunction with receiving wide media attention, fracing also finds itself in the political limelight. Although fracing has previously received wide negative attention in the past, it is unclear at the moment where the wind will take the widely used technology. The wide attention received by fracing begs the question: does shale production through hydraulic fracturing create a bridge fuel or simply an environmental threat? Again, only time and scientific study of hydraulic fracturing will allow the industry and U.S. government to fully understand the overall value of hydraulic fracturing. Until these studies are complete, however, hydraulic fracturing will continue to be held in

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[149] *Id.*
[150] *Id.*
[151] Bill Summary & Status, 112th Congress (2011–12), H.R. 1084, http://thomas.loc.gov/cgi-bin/bdquery/z?d112:HR01084:@@@X|/home/LegislativeData.php|.
[152] *Id.*

suspect as the cause of many of the environmental problems observed by citizens, states and the international community.

VI. RISKS, LIABILITIES & LITIGATION

Since the beginning of 2011, the debate over hydraulic fracturing has intensified. Fracing companies increasingly find themselves targets of litigation. The litigation typically asserts fracing wells owned and operated by various defendants are responsible for drinking water contamination, physical injury to residents and other damages. To date, lawsuits allege causes of action for assault, intentional infliction of emotional distress, negligence (including gross negligence and negligence *per se*), private nuisance, public nuisance, trespass, *res ipsa loquitor*, deceptive business practices, fraud, misrepresentation, breach of contract, strict liability (including abnormally dangerous activity, design defect, and defective product) and failure to warn.[153] Suits to date seek injunctive release and damages for various injuries including decrease in property value, loss of drinking water, emotional harm, intentional infliction of emotional distress and even medical monitoring.[154] A summary of the most recent litigation related to hydraulic fracturing is included below.

A. *Colorado*

1. *Strudley v. Antero Resources Corp.,* Colo. Dist. Ct., Denver Cty., (filed Mar. 24, 2011) (No. 2011-2218)

William and Beth Strudley brought suit against Antero Resources Corporation, Calfrac Well Services and Frontier Drilling after experiencing "environmental contamination and polluting events caused by the conduct and activities of the defendants . . . who caused the releases, spills and discharges of combustible gases, hazardous chemicals and industrial wastes from their oil and gas drilling facilities . . . "[155] According to the petition, the defendants engaged in oil and gas

[153] *See infra* pp. 194–201.
[154] *Id.*
[155] Complaint at 3, Strudley v. Antero Res. Corp., Colo. Dist. Ct., Denver Cty (filed Mar. 24, 2011) (No. 2011-2218).

exploration approximately one mile from the plaintiffs' residence.[156] Plaintiffs rely on a ground water well for "drinking, bathing, cooking, washing, and other daily uses."[157] Following the beginning of the drilling operations, hydrogen sulfide, hexane, n-heptane, toluene, propane, isobutene and other toxic chemicals began contaminating the air and entered the ground and aquifer near the plaintiffs' home.[158] The chemicals also entered the plaintiffs' water well.[159] Plaintiffs allege that they were forced to flee and abandon their home as a result of the contamination[160] of their water supply, exposure to hazardous and toxic chemicals and substances, personal and physical injuries, lost value, use, and enjoyment of their residence and fear of future physical illness.[161] The plaintiffs contend that they will be required to pay costs for medical care, alternate living quarters, water testing and alternate sources of water.[162] Plaintiff's causes of action included negligence, negligence *per se*, nuisance, strict liability and trespass.[163] They also request a medical trust fund to monitor their conditions and seek compensatory and punitive damages, diminution of property value and litigation fees and costs.[164]

B. *New York*

1. *Baker, v. Anschutz Exploration Corp.*, (W.D.N.Y. March 9, 2011) (No. 6:2011cv06119)

In this case, the plaintiffs include individuals, residents and property owners of the town of Horseheads, New York.[165] They brought suit against Anschutz Exploration Corporation, Conrad Geoscience Corporation and Pathfinder Energy Services, Inc. based on negligence,

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[156] *Id.*
[157] *Id.*
[158] *Id.* at 4.
[159] *Id.*
[160] *Id.*
[161] *Id.*
[162] *Id.* at 5.
[163] *Id.* at 5–11.
[164] *Id.* at 10–11.
[165] Complaint at 4, Baker v. Anschutz Exploration Corp., (W.D.N.Y. Mar. 9, 2011) (No. 6:2011cv06119).

negligence *per se*, private nuisance, premises liability, trespass, strict liability under navigation law, strict liability based on abnormally dangerous activities, deceptive trade practices and violations of general business law, fear of developing cancer and for medical monitoring.[166]

The petition complains of environmental contamination and pollution, including releases, spills and discharges of combustible gases, hazardous chemicals and industrial wastes from various drilling facilities near the plaintiff's homes.[167] According to the petition, these environmental conditions caused the plaintiff health injuries, loss of use and enjoyment of their property, loss of quality of life, emotional distress and other damages.[168] Additionally, Plaintiffs allege that the defendants failed to meet their contractual obligations.[169]

C. *Pennsylvania*

1. *Fiorentino v. Cabot Oil & Gas Corp.*, (M.D. Pa) (No. 09-02284)

The plaintiffs in this lawsuit were residents of Dimock and Montrose, Pennsylvania, who signed leases with Cabot giving the companies[170] the right to extract natural gas from the plaintiffs' properties.[171] The plaintiffs argue that Cabot's use of fracing caused hazardous toxins to be released onto their land and into their groundwater, resulting in property damage and physical illness.[172] In addition, the plaintiffs allege they live in constant fear of future illness and suffer from emotional distress.[173] The plaintiffs filed suit on November 19, 2009,[174] charging the defendants with releases under the Pennsylvania Hazardous Sites Cleanup Act ("HSCA"),[175] negligence *per se*, private nuisance, strict

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[166] *Id.* at 22–40.
[167] *Id.* at 4.
[168] *Id.* at 4–5.
[169] *Id.*
[170] The defendant companies are Cabot Oil and Gas Corporation and Gas Search Drilling Services Corporation (collectively "Cabot").
[171] Fiorentino v. Cabot Oil & Gas Corp., 750 F.Supp.2d 506, 509 (Pa. M.D. 2010).
[172] *Id.* at 509–10.
[173] *Id.*
[174] *Id.* at 508.
[175] Hazardous Sites Cleanup Act, 35 P.A. CONS. STAT. § 6020.101 (1988).

liability, breach of contract, fraudulent misrepresentations, medical monitoring trust fund and gross negligence.[176]

On June 1, 2010, the defendants moved to strike certain allegations in the plaintiff's second amended complaint regarding their fear of future physical illness, distress damages, punitive damages and the recovery of attorneys' fees and litigation costs.[177]

The defendants also moved for the dismissal of the HSCA claim and the plaintiffs' claims for medical monitoring, strict liability and gross negligence.[178] The court granted defendants' motion concerning gross negligence based on the fact that Pennsylvania law does not recognize it as a cause of action.[179] However, the judge allowed the remaining claims to stay, including plaintiffs' request for a medical monitoring trust fund.[180]

2. *Berish v. Southwest Energy Co.*, 763 F.Supp.2d 702 (M.D. Pa. 2011)

A total of twenty-two plaintiffs, including some minor children, brought suit against Southwestern Energy Production Company for the use of hydraulic fracing and fracing fluids in their oil and gas drilling operations.[181] The plaintiffs contend the defendant's oil well is in close proximity to the plaintiffs' residences and has contaminated their well water as a result of negligent or gross negligent drilling operations, improper or insufficient cement casing and negligent or improper activities violating Pennsylvania state law.[182]

The plaintiffs argue that they suffered serious harm, including contaminated water supplies, exposure to hazardous chemicals, diminution of property value, loss of use and enjoyment of their property and physical injury manifesting in neurological symptoms.[183] Additionally, the plaintiffs claim that they live in perpetual fear of physical illness, particularly with respect to the minor children and grandchildren affected,

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[176] *Fiorentino*, 750 F.Supp.2d at 508.
[177] *Id.* at 508, 514.
[178] *Id.* at 510.
[179] *Id.* at 514.
[180] *Id.* at 516.
[181] Berish v. Sw. Energy Prod. Co., 763 F.Supp.2d 702, 703–04 (M.D.Pa. 2011).
[182] *Id.*
[183] *Id.* at 704.

and claim that they will have to continue to pay for water sampling and alternative water sources.[184] The plaintiffs raise causes of actions based on violations of the Pennsylvania Hazardous Sites Cleanup Act, 33 P.S. §§ 6020.101, *et seq.*, negligence, private nuisance and trespass.[185] They also seek to establish a medical monitoring trust fund and a preliminary and permanent injunction from continuing to engage harmful activities.[186]

3. *Zimmerman v. Atlas Energy, Inc.*, Washington County Court of Common Pleas, Pennsylvania (filed Sept. 21, 2009) (No. C-63-CV-200907564)

In *Zimmerman v. Atlas America, LLC*, George and Lisa Zimmerman sued natural gas exploration company Atlas America, LLC alleging that Atlas' fracing operation contaminated their land and water supply.[187] The Zimmermans owned a 500-acre tract in Washington County, Pennsylvania where they operated a tomato farm.[188] The Zimmermans owned the surface and water rights to the property, and Atlas owned the mineral rights.[189] Beginning in October 2008, Atlas constructed four well sites on the property. One of the wells was fraced.[190]

The Zimmermans allege Atlas used carcinogenic, poisonous and toxic chemicals during the fracing process that contaminated the surface and underlying aquifer.[191] Additionally, the fresh water well that serves their residence was alleged to have gone dry.[192] The Zimmermans complain of physiological effects including dizziness, burning of eyes and have observed dead and dying fish in the waters surrounding their property.[193] The Zimmermans sued Atlas pleading multiple causes of

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[184] *Id.* at 703–04, 706.
[185] *Id.* at 704.
[186] *Id.*
[187] Complaint at 3-4, Zimmerman v. Atlas Energy, Inc., (Ct.Cm.Pl. PA filed on Sept. 21, 2009) (No. C-63-CV-200907564).
[188] *Id.* at 2.
[189] *Id.*
[190] *Id.* at 3.
[191] *Id.* at 4.
[192] *Id.* at 8.
[193] *Id.* at 4.

action including: negligence, *res ipsa loquitor*, trespass, nuisance, fraud and misrepresentation, breach of contract, negligence per se and for injunctive relief.[194]

D. *Texas*

1. *Mitchell v. Encana Oil & Gas (USA)*, (N.D. Tex. December 15, 2010) (3:10-cv-02555)

In *Mitchell v. Encana Oil & Gas*, the plaintiff, Grace Mitchell, owns a track of land in Johnson County, Texas near the Newark East Field of the Barnett Shale.[195] According to Plaintiff Mitchell, the defendants performed drilling activities, including hydraulic fracturing, to increase the productivity of their wells.[196] Plaintiff Mitchell also believes that the defendants stored "drilling waste at sites and disposal wells near Plaintiff Mitchell's property."[197] According to Plaintiff Mitchell, soon after drilling operations began near her home, her groundwater, which is her primary source of water, became contaminated.[198] Plaintiff claims that she can no longer use her water for consumption, bathing, or washing clothes because it is now slick to the touch and smells of gasoline.[199] Testing results performed on the well ground water confirmed that the water was contaminated with various chemicals, including "c-12-C28 hydrocarbons" which are similar to diesel fuel.[200]

As a result, plaintiff filed a lawsuit alleging nuisance,[201] trespass,[202] negligence,[203] fraud[204] and strict liability based on abnormally

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[194] *Id.* at 6, 9, 10, 12, 13, 15–17.
[195] Complaint at 3, Mitchell v. Encana Oil & Gas (USA), Inc., (N.D. Tex. Dec. 15, 2010) (No. 3:10-cv-02555).
[196] *Id.*
[197] *Id.*
[198] *Id.* at 3–4.
[199] *Id.* at 4.
[200] *Id.*
[201] *Id.*
[202] *Id.* at 5.
[203] *Id.* at 6.
[204] *Id.* at 7.

dangerous activity.[205] Plaintiff seeks to recover for the loss of use of her ground water, property devaluation, intrinsic value of the water, emotional harm and mental anguish resulting from annoyance, inconvenience, anxiety and physical injury caused by the contaminated water, cost of replacement water, medical monitoring damages, remediation, nominal damages for each trespass to land and exemplary damages.[206]

On March 16, 2011, Defendant Encana Oil & Gas (USA), Inc., filed a partial motion to dismiss arguing that plaintiff Mitchell's claim based on strict liability is not a recognized cause of action under Texas law, and secondly, that plaintiff Mitchell's fraud claim should be dismissed for failure to plead facts in support of the cause of action.[207] To date, the court has not ruled on the issues raised in this motion to dismiss and the parties are engaged in lengthy discovery.

2. *Lisa Parr v. Aruba Petroleum, Inc.*, (County Court of Dallas County, Texas.Tex., Mar. 8, 2011) (No. CC-11-01650-E)

In Dallas County, Texas, plaintiff landowners sued Aruba Petroleum, Inc. and eight other oil and gas operators and service companies under multiple causes of action and legal theories including assault, intentional infliction of emotional distress, negligence, gross negligence, negligence per se, private nuisance, surface and subsurface trespass, strict liability. Plaintiffs claim injuries to their persons and property.[208]

Plaintiff owned forty acres below an area where extensive natural gas exploration and production was taking place, but there was no drilling or production actually taking place on the land plaintiffs owned.[209]

Plaintiffs complain of, inter alia, air pollution caused by vehicles and engines, construction activity, open water pits used to evaporate fluids used in drilling, venting of condensate, flaring and unintentional

[205] *Id.* at 7–8.
[206] *Id.* at 8–9.
[207] Partial Motion to Dismiss, Mitchell v. Encana Oil & Gas (USA), Inc. (N. D. Texas Mar. 16, 2011) (No. 10-cv-02555).
[208] Complaint at 1, Parr v. Aruba Petroleum, Inc., (Dallas Cnty., Tex. Mar. 8, 2011) (No. CC-11-01650-E).
[209] *Id.* at 5.

emissions.[210] Plaintiffs also allege that the defendants mishandled fracing fluids and injected toxic chemicals that migrated to the surface surrounding their land.[211] Plaintiffs claim physiological injuries including headaches, body aches, rashes, dizziness and nausea, irregular heartbeat, depression and numerous other medical conditions.[212]

E. *Future Litigation*

Despite the small number of lawsuits filed to date, it is expected that the number of lawsuits will continue to rise given the widespread media coverage of the drilling technique. As a result of the continued media frenzy, the hydraulic fracturing industry may become susceptible to political and agency intervention. If this occurs, the industry will have to defend against dual track actions including both private litigation and agency enforcement. Specifically, fracing may invoke agency action as a result of violations of the Clean Water Act, Conservation and Recovery Act, the Safe Drinking Water Act (if amended) and the Comprehensive Environmental Response, Compensation and Liability Act.

1. Resource Conservation and Recovery Act

The Resource Conservation and Recovery Act ("RCRA")[213] gives EPA the authority to control "hazardous waste from the 'cradle-to-grave' including generation, transportation, treatment, storage, and disposal of hazardous waste."[214] RCRA also sets forth procedures for the management of non-hazardous solid wastes.[215] RCRA provisions and enforcement programs include civil penalties that are assessed based on the gravity of the violation. Depending on the results of EPA's proposed study, fracing return water or produced water, could be identified as hazardous waste as regulated by RCRA. "Cradle-to-grave" regulation of

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[210] *Id.* at 11–14.
[211] *Id.* at 14–15.
[212] *Id.* at 16–17.
[213] 42 U.S.C. § 6901 *et seq.* (1976).
[214] *Summary of the Resource Conservation and Recovery Act*, EPA, *available at* http://www.epa.gov/regulations/laws/rcra.html (last visited Aug. 21, 2011).
[215] *Id.*

return and produced water could lead to increased operational costs and increased violations of RCRA.

2. Comprehensive Environmental Response, Compensation and Liability Act

The Comprehensive Environmental Response, Compensation and Liability Act ("CERCLA")[216] provides broad federal authority to respond to releases or threatened releases of hazardous substances that may endanger public health of the environment.[217] CERCLA assesses a tax on the petroleum and chemical industries, which is collected and placed in trust for the cleaning of abandoned or uncontrolled hazardous wastes cites.[218] The law authorizes two kinds of response actions: short-term removals to address releases or threatened releases that require prompt response, and long-term remediation with the goal of reducing the danger of releases of hazardous substances that are serious, but pose no imminent threat to life.[219] If the EPA's proposed study is completed and finds that hydraulic fracturing has caused or is causing releases of hazardous substances underground or above ground, there is a chance that fracing sites may be identified as Superfund sites.[220] CERCLA permits strict, joint, and several liability for violations of its provisions and allows recovery for natural resource damages.[221] This could result in extensive liabilities related to the cleanup and remediation of abandoned or existing well sites.

3. Toxic Substances Control Act

The Toxic Substances Control Act ("TSCA")[222] "provides EPA with authority to require reporting, record-keeping and testing

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[216] 42 U.S.C. § 9601 *et seq.* (1980).
[217] *CERCLA Overview*, EPA, *available at* http://www.epa.gov/superfund/policy/cercla.htm (last visited Aug. 21, 2011).
[218] *Id.*
[219] *Id.*
[220] *Id.*
[221] *Id.*
[222] 15 U.S.C. § 2620.

requirements, and restrictions relating to chemical substances and/or mixtures."[223]

On August 4, 2011, several environmental groups filed a petition against the EPA pursuant to section 21 of the TSCA, requesting the EPA enact rules to address the risk posed by the chemicals used in the fracing industry.[224] The petition specifically notes that currently, the EPA and the public "lack the information necessary to assess the potential health and environmental effects of [hydraulic fracturing] chemicals."[225] As a result, the environmental groups request that the EPA promulgate rules to facilitate the gathering of information to allow the public to "hold manufacturers, processors, and distributors of [hydraulic fracturing chemicals] accountable for the consequences of placing their products into commerce."[226] If this petition is successful, this could result in the EPA imposing extensive requirements on industry related to their highly confidential and proprietary fracturing fluids.

4. Clean Water Act

The Clean Water Act ("CWA")[227] "establishes the basic structure for regulating discharges of pollutants into U.S. waters for the purpose of regulating water quality."[228] The CWA sets rules regarding wastewater. As noted previously, hydraulic fracturing utilizes massive amounts of water that is injected into the ground.[229] The water is then either produced or returned through the well, and a large percentage of the water dissipates into the surrounding rock structures.[230] If fracing causes contaminated water to seep into surrounding water tables and sources, the fracing industry may be pursued for discharge violations under the CWA. As a

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[223] *Summary of the Toxic Substances Control Act,* EPA, *available at* http://www.epa.gov/lawsregs/laws/tsca.html (last-visited Sept. 2, 2011).
[224] Letter from Earthjustice, et. al, to Lisa P. Jackson, EPA Adm'r., 1 (Aug. 4, 2011), *available at* http://www.frackinginsider.com/Earthjustice%20TSCA%20Petition.pdf.
[225] *Id.*
[226] *Id.* at 22.
[227] 33 U.S.C. § 1251 *et seq.* (1972).
[228] *Summary of the Clean Water Act*, EPA, *available at* http://www.epa.gov/regulations/laws/cwa.html (last visited Aug. 21, 2011).
[229] *See supra* pp. 175–176.
[230] *Id.*

result, permitting related to discharges may become more difficult to obtain until water migration is more easily understood. Of note, the CWA allows for recovery for natural resource damages.

F. *Recommendations to Industry*

Although the hydraulic fracing industry touts safety, the number of complaints related to fracing operations continues to rise.[231] Lawsuits continue to be filed and more evidence is being accumulated internationally to identify the externalities of fracing.[232] Until EPA concludes its study regarding the environmental effects of hydraulic fracing, the industry would be well advised to comply with environmental regulations such as RCRA, CWA and Superfund. Additionally, the fracing industry should prepare to respond to increased private litigation by landowners (both surface and subsurface), neighbors, municipalities, water districts, water companies, users of contaminated waters and natural resources, environmental groups, states and federal agencies. Suits could potentially implicate land-owners, oil and gas exploration and production companies, manufacturers or settlers of equipment, chemicals, components, fluids, drilling, casing and cement companies and fracing service companies.

As shown by the pending litigation throughout the United States, the fracing industry may see increasing private claims related to environmental contamination, bodily injury, property damage and devaluation and even business interruption. These claims may trigger various types of insurance coverage, including commercial general liability, pollution liability, operator's extra expense, homeowners, directors and officers and professional liability policies. Where a company self-insures, they face the same exposure to private claims, increasing their risk, insurance costs and ultimately their cost of operations.

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[231] Ben Geman, *Exxon CEO to tout safety of 'fracking' at House hearing*, THE HILL E^2 WIRE, Jan. 19, 2010, http://thehill.com/blogs/e2-wire/677-e2-wire/76831-exxon-ceo-to-tout-safety-of-fracking-at-house-hearing.

[232] *See supra* pp. 192–199.

For example, fracing operations could experience incidents related to fluid spills or leakage, return water seepage from pipes, surface spills, seepage from containment ponds, or accidental spills in the transportation of the fluids. Each of these potential releases could arguably be linked to drinking water contamination and therefore on-site and offsite bodily injury and/or property claims. Other bodily injury or property claims could be associated with earthquakes, which are believed to be caused by underground re-injection of fracing wastewater.[233]

Because of the general types of "contamination" associated with fracing, several coverage questions may arise during insured operations. For one, how will the fracing industry determine when the bodily injury or property damage occurred? When should a claim be made against a policy? When were the pollution conditions or property damage discovered? Specifically, with regards to the issue of an occurrence, there are several options that could lead to different coverage results. An occurrence could be said to have happened when the individual or property was exposed to the dangerous substance, when the bodily or property injury actually began, when the injury was medically diagnosed or when the property damage could be discovered, and whether multiple items contributed to or led to the bodily injury or property damage. As a result, it is advisable that fracing companies review their policies and coverages to ensure that all policy conditions are adequately address and that coverage is afforded.

Additionally, the fracing industry should prepare to be blamed for a myriad of environmental problems until scientists and geologist are better able to define and evaluate the risk and/or extent of contamination caused by fracing fluids. Environmental litigation could be private, state, or federal actions. Until scientists have a better understanding of the potential for seepage and migration of fracing fluids, it is likely that any environmental problem seen near a fracing operation will be linked to the operation by speculation or "information and belief." The manufacturers and users of fracing fluids should also prepare for strict liability litigation,

[233] *See* Eddington, *supra* note 52.

which may implicate and require disclosure to the court of protected chemical formulas.[234]

Furthermore, depending on the composition of the fracing fluids utilized in an operation, the fracing industry may face punitive damages for having exposed communities to chemicals with "known risks."[235] If a court determines the fracing industry exposed communities to "known risks" this may create additional exposure to industry for attorney fees, suits for natural resource damage and for suits including allegations of *per se* violations of state or municipal water codes. Because of these risks, the fracing industry should attempt to gain a better understanding of their products and procedures and fracing fluid migration patterns in hopes to address and mitigate any associated risks.

In addition to acquiring a better understanding of fracing in general, the fracing industry may also mitigate the risk of litigation by understanding potential causes of actions that it may be subject to and the requisite burdens of proof. By understanding the evidence required to prove or disprove an allegation, the fracing industry may begin to formulate defense plans. Any defense plan associated with hydraulic fracing will need to consider expert testimony and advice. The industry should consider obtaining expert assistance related to geology, hydrology, land sciences and medicine to assist with developing a defense plan. These experts should be well versed in their specific area of expertise, but also have a general understanding of oil and gas exploration, production and well stimulation activities. Even if the experts are only retained for advising purposes only, it would behoove the fracing industry to obtain leading scientists that could sustain challenges by an opposing party, and ultimately, an expert that can handle and address contradictory opinions. At a minimum, the fracing industry should prepare to address this period of uncertain legal responsibility with knowledgeable expert in the field of geosciences. In other words, until EPA concludes its study of hydraulic

[234] Such litigation could lead to pursuit of market share liability against the various manufacturers of similar chemicals where chemical fingerprinting may be unavailable.

[235] *See* Jef Feeley & Sophia Pearson, *Pfizer Jury Said to Set Prempro Punitive Damages at $8 Million*, BLOOMBERG, Dec. 23, 2009, http://www.bloomberg.com/apps/news?pid=newsarchive&sid=aqJRir.wj8Qo; *Prempro Verdict Roundup*, MASS TORT LITIG. BLOG (Mar. 16, 2010), http://lawprofessors.typepad.com/mass_tort_litigation/prempro/.

fracturing, the industry should prepare for a period of uncertainty with regards to their legal responsibilities based on environmental regulation, litigation and politics by fully understanding the effects of their technology.

Additionally, the fracing industry should continue to keep a close watch on developments related to EPA's study, industry and environmental group investigations, press and public debate, new state and federal regulations, litigation by landowners, municipalities and environmental groups, industry changes and innovation and ultimately any changes in national energy and environmental policies. By closely tracking developments in the nation's environmental and energy laws and by proactively adopting defense plans, the fracing industry should be adequately prepared to defend its practices.

G. *Conclusions*

While some believe that hydraulic fracturing can serve as the key to U.S. energy independence, the scientific and political climate remains uncertain. Until the EPA, state agencies, or the natural gas industry conducts further studies, both residents near fracing sites and the natural gas industry will remain in the dark as to the ultimate value of hydraulic fracturing.

Since scientific data and information takes significant time to assimilate, regulation of the activity will remain in the hands of the operators, state governments, local municipalities and voting residents. This combination of "regulators" could have the effect of hindering development. On the other hand, the same "regulators" could allow operations which were previously only loosely controlled to continue in status quo, potentially exposing innocent residents and landowners to the toxic chemical contamination of their waters, air and properties. What is clear is that until the EPA issues its findings regarding fracing, residents, neighbors and landowners near fracing operations will continue to attribute the cause of any environmental pollution, health problems, water quality diminution and other potentially unrelated problems, on fracing. This will lead to costly litigation. Until more information is known about the effects of hydraulic fracturing, both residents and the fracing industry should advocate for and protect their respective interests.

While uncertainty will likely increase risks, and therefore costs for hydraulic fracturing, it is also clear that the U.S. is in dire need of the technology. The estimated potential energy reserves made available by fracing, money made by mineral owners, as well as the jobs and tax revenue created by fracing,[236] make the operations worth a balanced review by both the public and private sectors. As a result, both residents and operators of frac sites should conduct balanced assessments of risks and benefits to hydraulic fracturing in anticipation of EPA results.

[236] *See* Indep. Petroleum Ass'n, *The Oil & Gas Producing Industry in Your State*, 2009–10, *available at* http://www.ipaa.org/reports/docs/2009-2010IPAAOPI.pdf.