

## ENVIRONMENTAL CONCERNS OF HYDRAULICALLY FRACTURING A NATURAL GAS WELL

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### INTRODUCTION

Natural gas production from hydrocarbon-rich shale formations, i.e. “shale gas,” is the leading trend in onshore natural gas exploration and production. Previously cost prohibitive, shale gas extraction is now economically feasible due to advances in horizontal drilling and hydraulic fracturing. Hydraulic fracturing unlocks vast, previously unavailable reserves of cleaner burning natural gas.

Hydraulic fracturing is performed by high-pressure injections of water, sand, and chemicals deep underground to break up tight geological shale formations and release trapped natural gas. It is a proven way to extract more natural gas from each well. In the last 60 years, more than 1 million wells have been hydraulically fractured.<sup>1</sup> The U.S. Energy Information Administration predicts the technically recoverable unproved shale natural gas reserves to be 827 trillion cubic feet (tcf) in 2011, up 480 tcf from the Annual Energy Outlook 2010.<sup>2</sup> In 2006, a government-industry report estimated that 60 to 80 percent of the natural gas wells drilled in the next decade will require hydraulic fracturing.<sup>3</sup> From 2005 to 2010, the U.S. consumed roughly 23 tcf a year,<sup>4</sup> in which 19 tcf was produced domestically<sup>5</sup> and 4

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<sup>1</sup> See Mike Lee, *Exxon, Chevron Face Pressure on Fracturing Disclosure*, BLOOMBERG (Jan. 20, 2011), available at <http://www.bloomberg.com/news/print/2011-01-20/exxon-chevron-southwestern-facing-pressure-on-fracturing.html>.

<sup>2</sup> AEO2011 Early Release Overview, U.S. ENERGY INFO. ADMIN. (Dec. 16, 2010), available at <http://www.eia.gov/forecasts/aeo/er/pdf/0383er%282011%29.pdf>. The dramatic increase is largely due to new information that has become available with the increase of drilling activity in new and existing shale plays. Technically recoverable resources are the total amount of resources, discovered and undiscovered, thought to be recoverable with available technology, regardless of economics.

<sup>3</sup> Cathy Landry, *API publishes new guidance documents on hydraulic fracturing operations*, AM. PETROLEUM INST. (Nov. 2, 2009), <http://www.api.org/news-and-media/news/newsitems/2009/nov-2009/api-publishes-new-guidance-documents-on-hydraulic-fracturing-operations.aspx>.

<sup>4</sup> Natural Gas Consumption by End Use, U.S. ENERGY INFO. ADMIN., [http://www.eia.gov/dnav/ng/NG\\_CONS\\_SUM\\_DCU\\_NUS\\_M.htm](http://www.eia.gov/dnav/ng/NG_CONS_SUM_DCU_NUS_M.htm) (last updated Sept. 29, 2011).

tcf was imported.<sup>6</sup> Currently, the natural gas industry (“industry”) supports nearly 3 million jobs and adds \$385 billion into the U.S. economy.<sup>7</sup> These figures are expected to continue to rise.

Environmental groups describe natural gas as the “bridge fuel” to a cleaner energy future with an increasing use of renewable wind and solar energy. However, natural gas exploration and production is not without environmental risks including poor well construction practices, well blowouts, surface leaks, and insufficient wastewater recycling. Due to increased scrutiny from state and federal regulators, local communities’ direct exposure to natural gas operations, and the nation’s debate on climate change, the public has come to believe there is a high environmental risk from natural gas production.<sup>8</sup>

The U.S. has a 100-year supply of clean burning natural gas.<sup>9</sup> Drilling for natural gas is essential to our nation’s economy. Natural gas production plays a critical role in our clean energy debate because it will increase domestic energy supplies and reduce greenhouse gas (GHG) emissions. Additionally, increasing our domestic natural gas supplies reduces our dependence on foreign energy sources.

This Article explores whether the natural gas drilling process of hydraulic fracturing in shale gas formations causes drinking water contamination or creates additional environmental concerns. Section I lays the groundwork of the geology and history of shale gas and the history of hydraulic fracturing. Section II describes the drilling and hydraulic fracturing stimulation process of a natural gas well. Section III addresses federal regulation of natural gas exploration and production, followed by section IV, which surveys state regulations (Texas, New York, and Pennsylvania). Section V discusses Range Resources and the Railroad Commission of Texas versus the Environmental Protection Agency regarding the alleged contamination of a drinking water well in the Barnett Shale. Section VI delineates Congressional legislation facing hydraulic fracturing. Section VII discusses six key studies on hydraulic fracturing. Finally, Section VIII discusses

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<sup>5</sup> Natural Gas Gross Withdrawals and Production, U.S. ENERGY INFO. ADMIN., available at [http://www.eia.gov/dnav/ng/ng\\_prod\\_sum\\_dcu\\_NUS\\_a.htm](http://www.eia.gov/dnav/ng/ng_prod_sum_dcu_NUS_a.htm) (last updated Sept. 29, 2011).

<sup>6</sup> U.S. Natural Gas Exports by Country, U.S. ENERGY INFO. ADMIN., available at [http://www.eia.gov/dnav/ng/ng\\_move\\_expc\\_s1\\_a.htm](http://www.eia.gov/dnav/ng/ng_move_expc_s1_a.htm) (last updated Sept. 29, 2011).

<sup>7</sup> *Natural Gas Is America’s New Energy Frontier*, AM. PETROLEUM INST., <http://www.api.org/oil-and-natural-gas-overview/exploration-and-production/natural-gas/new-energy.aspx> (last visited Feb. 14, 2012) [hereinafter *America’s New Energy Frontier*].

<sup>8</sup> See Testimony of Bob Perciasepe Deputy Administrator U.S. Environmental Protection Agency Before the Subcommittee on Water and Wildlife Committee on Environment and Public Works United States Senate (Apr. 12, 2011), available at [http://epa.gov/ocir/hearings/testimony/112\\_2011\\_2012/2011\\_0412\\_bp.pdf](http://epa.gov/ocir/hearings/testimony/112_2011_2012/2011_0412_bp.pdf) (last updated Feb. 7, 2012).

<sup>9</sup> *America’s New Energy Frontier*, *supra* note 7, at 1.

the environmental concerns facing hydraulic fracturing and the industry's response to such concerns.

## I. WHAT IS SHALE GAS?

### A. *Geology*

Shale gas is natural gas produced from shale formations that act as both the reservoir and the source for natural gas.<sup>10</sup> Shale gas is primarily a dry gas composed of methane; however, a few shale formations produce wet gas.<sup>11</sup> Shale is fine-grained sedimentary rock that forms when silt and clay-sized mineral particles, called "mud," are compacted.<sup>12</sup> Shale is deposited as mud in low-energy environments, such as tidal flats and deep water basins, placing shale in the mudstone category of sedimentary rock.<sup>13</sup> Shale is distinguished from other mudstone by its fissile and laminated qualities.<sup>14</sup> "Fissile" means the rock easily breaks into thin pieces along laminations and "laminated" means it is made up of many thin layers.<sup>15</sup> These qualities are due to tabular clay grains lying flat as sediments accumulate, resulting in mud with thin laminar bedding that solidifies into thinly-layered shale rock.<sup>16</sup> The very fine clay mineral grains and layers of sediment cause the rock to have limited horizontal permeability and extremely limited vertical permeability.<sup>17</sup> Shale gas is classified as an unconventional natural gas reservoir because of its low permeability.

Natural gas reservoirs are classified as conventional or unconventional. Conventional natural gas reservoirs exist in sands and carbonates, such as limestone and dolomite, where gas is contained in interconnected pore spaces that allow flow to the wellbore.<sup>18</sup> In conventional natural gas reservoirs, natural gas freely moves between the pores that create permeable flow throughout the reservoir.<sup>19</sup> Unconventional natural gas reservoirs contain low-permeability formations such as coal and shale. Natural gas is usually sourced from the reservoir

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<sup>10</sup> U.S. DEP'T OF ENERGY, MODERN SHALE GAS DEVELOPMENT IN THE UNITED STATES: A PRIMER, 14 (Apr. 2009) [hereinafter MODERN SHALE GAS], *available at* [http://fossil.energy.gov/programs/oilgas/publications/naturalgas\\_general/Shale\\_Gas\\_Primer\\_2009.pdf](http://fossil.energy.gov/programs/oilgas/publications/naturalgas_general/Shale_Gas_Primer_2009.pdf).

<sup>11</sup> *Id.*

<sup>12</sup> *Shale*, GEOLOGY.COM, <http://geology.com/rocks/shale.shtml> (last visited Oct. 5, 2011).

<sup>13</sup> MODERN SHALE GAS, *supra* note 10, at 14.

<sup>14</sup> *Id.*

<sup>15</sup> *Id.*

<sup>16</sup> *Id.*

<sup>17</sup> *Id.*

<sup>18</sup> *Id.* at 15.

<sup>19</sup> *Id.*

rock itself, except for tight gas sandstone and carbonates.<sup>20</sup> Coal formations exist near the surface and may be underground sources of drinking water.<sup>21</sup> To get natural gas out of the coal and shale formations, horizontal drilling and hydraulic fracturing is used to crack the dense rock structure and create ribbon-thin passageways for natural gas to flow. Each type of formation presents a different level of expense and difficulty to procure the natural gas. Despite the difficulties, shale gas vastly increases our nation's available natural gas supply.

### *B. Shale Gas in the U.S.*

Shale gas exists across most of the U.S. The most active shales are the Barnett Shale, the Fayetteville Shale, the Haynesville-Bossier Shale, the Marcellus Shale, the Woodford Shale, the Antrim Shale, and the New Albany Shale.<sup>22</sup> Each shale gas basin presents a unique challenge for exploration and production. This Article will focus on the two most active shales: the Barnett Shale and the Marcellus Shale.

Texas has long been known for its large-scale natural gas activities. Today, the new major play is the Barnett Shale.<sup>23</sup> The Barnett Shale covers around 5,000 square miles surrounding Fort Worth, Texas.<sup>24</sup> The Mississippian-aged shale is 6,500 to 8,500 feet deep and its thickness ranges from 100 to 600 feet.<sup>25</sup> The depth of the base of treatable drinking water is approximately 1,200 feet. Between the Barnett Shale and the underground drinking water is 5,300 feet of impermeable Marble Falls Limestone formation.<sup>26</sup> Current well spacing is between 60 to 160 acres per well.<sup>27</sup> Its original gas-in-place estimate is 327 tcf, the entire volume of gas contained in the reservoir, regardless of the ability to produce it.<sup>28</sup>

The Marcellus Shale outcrop was first discovered during an 1839 geological survey; however, production was not economically feasible until recently.<sup>29</sup> It covers 95,000 square miles from southern New York through Pennsylvania, western Maryland, eastern Ohio and West Virginia.<sup>30</sup> The Middle Devonian-age shale is 4,000 to 8,500 feet deep and has a thickness range of 50 to 200 feet.<sup>31</sup> The

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<sup>20</sup> *Id.*

<sup>21</sup> *Id.*

<sup>22</sup> *Id.* at 16.

<sup>23</sup> See Aileen Alfonso, *Water Rights in the Marcellus Shale and How They Concern Oil and Gas Companies*, 4 APPALACHIAN NAT. RESOURCES L.J. 1, 3–4 (2010).

<sup>24</sup> MODERN SHALE GAS, *supra* note 10, at 18.

<sup>25</sup> *Id.*

<sup>26</sup> *Id.*

<sup>27</sup> *Id.*

<sup>28</sup> *Id.* at 16–18.

<sup>29</sup> See Alfonso, *supra* note 23, at 3–4.

<sup>30</sup> MODERN SHALE GAS, *supra* note 10, at 21.

<sup>31</sup> *Id.*

depth of the base of treatable drinking water is approximately 850 feet.<sup>32</sup> Between the Marcellus Shale and underground drinking water is 3,150 feet of impermeable Cotton Valley Hamilton Group Shale formation.<sup>33</sup> Current well spacing is between 40 and 160 acres per well and its original gas-in-place estimate is 1,500 tcf.<sup>34</sup>

### C. History of Shale Gas

Natural gas production from shale formations has been continuous since the earliest gas developments. In 1821, the first producing U.S. natural gas well was in the Devonian-aged shale near Fredonia, New York.<sup>35</sup> The well produced a few thousand cubic feet of gas per day for 35 years.<sup>36</sup> Early natural gas was obtained from shallow wells and natural gas seeps and used to illuminate eastern U.S. city streets and households.<sup>37</sup> The first large-scale development was the Ohio Shale in the Big Sandy Field of Kentucky during the 1920s.<sup>38</sup> However, it was not until the 1980s when the technology and cost of producing shale gas became efficient.

The technological advances of horizontal drilling and hydraulic fracturing allowed the Barnett Shale around Fort Worth, Texas, to begin its trek to becoming one of the most active natural gas plays. Although hydraulic fracturing was developed in Texas in the 1950s, it was not until 1986 that it was first used in the Barnett Shale.<sup>39</sup> The first horizontal well in the Barnett Shale was drilled in 1992.<sup>40</sup> These combined technologies increased Texas' natural gas production by 15 percent.<sup>41</sup> Currently, the science of drilling shale gas utilizes horizontal drilling with multi-staged hydraulic fracturing which has led to an additional 9 percent increase of natural gas in the U.S. between 2007 and 2008.<sup>42</sup>

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<sup>32</sup> *Id.* at 17.

<sup>33</sup> *Id.* at 20.

<sup>34</sup> *Id.* at 21.

<sup>35</sup> *Id.* at 13.

<sup>36</sup> *Getting Gas from the Ground . . . and the Sea*, U.S. DEP'T OF ENERGY, [http://fossil.energy.gov/education/energylessons/gas/gas\\_production.html](http://fossil.energy.gov/education/energylessons/gas/gas_production.html) (last updated Mar. 29, 2011).

<sup>37</sup> MODERN SHALE GAS, *supra* note 10, at 13.

<sup>38</sup> *Id.*

<sup>39</sup> *Id.*

<sup>40</sup> *Id.*

<sup>41</sup> *Natural Gas Supply and Demand*, AM. PETROLEUM INST., [http://www.api.org/aboutoilgas/natgas/supply\\_demand.cfm](http://www.api.org/aboutoilgas/natgas/supply_demand.cfm) (last updated July 29, 2011).

<sup>42</sup> *Id.*

#### *D. History of Hydraulic Fracturing*

Although, hydraulic fracturing was first used in 1903, the first commercial stimulation was not performed until 1949.<sup>43</sup> In 1981, George Mitchell of Mitchell Energy began an 18 year-long experiment to extract commercial amounts of natural gas from the Barnett Shale.<sup>44</sup> Mitchell Energy determined that the key to stimulating flow through the impermeable rock was hydraulic fracturing.<sup>45</sup> Initially, Mitchell Energy attempted expensive massive hydraulic fracturing projects that pumped very large volumes of fluids down the wellbore.<sup>46</sup> However, the majority of fractures produced during the process immediately closed once the pressure was removed.

In the mid-1990s, rising natural gas prices led Mr. Mitchell to try the “light sand” or hydraulic fracturing treatments to improve production numbers and cost efficiency of each well.<sup>47</sup> Sand kept the fractures open once the pressure was reduced by keeping the fractures propped open. By the late 1990s, Mitchell Energy perfected this process in vertical wells and the industry became aware of Mr. Mitchell’s hydraulic fracturing success.<sup>48</sup> Since then, the industry has focused on extracting natural gas from unconventional deposits that are in low-permeability formations using Mitchell’s hydraulic fracturing methods.

## II. THE PRODUCTION PROCESS OF SHALE GAS

Natural gas production from shale formations is difficult. Shale layer fractures containing most of the natural gas run roughly vertical. Its low permeability means vertical wells have been unproductive. The industry needed a means for the well to access a greater number of fractures, so it started injecting large volumes of hydraulic fracturing fluids into isolated sections. The pressurized fluids permeate the rock and fracture the shale. Hydraulic fracturing fluid contains sand that lodges into the fractures and remains after the fluids are pumped back out, enabling shale gas to freely flow into the well.

Horizontal drilling significantly multiplies the wells’ pay zone length by aligning the well with the horizontal shale layers. For example, if a rock formation is 100 feet thick, a vertical well would have a pay zone of 100 feet. However, a horizontal well that stayed horizontal for 5,000 feet through the target formation

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<sup>43</sup> *History of Hydraulic Fracturing*, ENERGY IN DEPTH, <http://www.energyindepth.org/in-depth/frac-in-depth/history-of-hf/> (last visited Oct. 6, 2011).

<sup>44</sup> Marc Airhart, *The Father of the Barnett Natural Gas Field: George Mitchell*, GEOLOGY.COM, <http://geology.com/research/barnett-shale-father.shtml> (last visited Oct. 6, 2011).

<sup>45</sup> *Id.*

<sup>46</sup> *Id.*

<sup>47</sup> *Id.*

<sup>48</sup> *Id.*

would have a pay zone that is 50 times longer than the vertical well. Horizontal drilling and hydraulic fracturing techniques make it economically feasible to extract natural gas from unconventional deposits. Operators can produce 10 times the amount of natural gas by drilling 1/10th the number of wells.<sup>49</sup> This section discusses the drilling process for a vertical and horizontal well and the hydraulic fracturing process for a typical well in the Barnett or Marcellus Shale.

#### A. *Drilling a Vertical Well*

Horizontal drilling and hydraulic fracturing stimulation have made shale gas exploration and production successful. First, the vertical portion of the well is drilled.<sup>50</sup> As the drill bit grinds away, drilling mud or air is pumped down the drill pipe and through the bit to remove rock cuttings from the wellbore.<sup>51</sup> State or federal agencies determine the specific depth that the hole must extend below the deepest fresh water zone.<sup>52</sup> Next, the drill pipe and bit are removed, and steel pipe called surface casing is inserted into the drilled hole to isolate the fresh water zones.<sup>53</sup> The casing serves as the base that links the well control and safety devices, which are connected to the well and wellbore.<sup>54</sup>

After the surface casing is in place, cement is pumped down the casing and out through the casing shoe, located at the end of the casing.<sup>55</sup> The cement moves upward between the surface casing and the wellbore to the surface.<sup>56</sup> The cementing process seals the wellbore from the surrounding rock and fresh water zones, preventing contamination of fresh water aquifers.<sup>57</sup>

After the cement hardens, the drill pipe and a smaller bit are lowered back down the hole.<sup>58</sup> The bit drills through the cement at the bottom of the hole and continues to drill the vertical section of the well.<sup>59</sup> As the well is drilled deeper, a mixture of water and additives, called mud, is pumped into the hole to cool the bit and move rock cuttings to the surface.<sup>60</sup>

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<sup>49</sup> RESERVOIR RESEARCH PARTNERS & TUDOR PICKERING HOLT & CO., FRAC ATTACK: RISKS, HYPE, AND FINANCIAL REALITY OF HYDRAULIC FRACTURING IN THE SHALE PLAYS 7 (July 8, 2010) [hereinafter FRAC ATTACK], *available at* <http://westernenergyalliance.org/wp-content/uploads/2010/03/fracattack.pdf>.

<sup>50</sup> Video: Natural Gas Horizontal Shale Drilling, SOUTHWESTERN ENERGY, *available at* <http://www.swn.com/operations/Pages/drillingmethods.aspx> (last visited Oct. 6, 2011).

<sup>51</sup> *Id.*

<sup>52</sup> *Id.*

<sup>53</sup> *Id.*

<sup>54</sup> *Id.*

<sup>55</sup> *Id.*

<sup>56</sup> *Id.*

<sup>57</sup> *Id.*

<sup>58</sup> *Id.*

<sup>59</sup> *Id.*

<sup>60</sup> *Id.*

### B. Drilling a Horizontal Well

At approximately 500 feet above the planned horizontal portion of the well, the drill pipe and bit are pulled out of the well.<sup>61</sup> The angle building process requires a specialized down-hole drill motor with measurement while drilling instrument.<sup>62</sup> The “kickoff point” is where the curve drilling begins to make the transition from a vertical well to a horizontal well.<sup>63</sup> It is about 500 to 600 feet to drill the curve from the kickoff point to where the wellbore becomes horizontal.<sup>64</sup> Once the curve is completed, drilling begins on the horizontal section.<sup>65</sup>

Drill pipe can be 30 feet in length per section and a section can weigh over 495 pounds.<sup>66</sup> It takes over 350 sections of pipe weighing 87 tons to drill a 10,500-foot well.<sup>67</sup> At different stages the pipe is taken out and put back in, called tripping pipe.<sup>68</sup> When the well reaches its targeted distance, the drill pipe and bit are removed from the wellbore.<sup>69</sup> Steel pipe, referred to as production casing, is then inserted into the full length of the wellbore.<sup>70</sup> Cement is pumped into the casing and out through the casing shoe.<sup>71</sup> The cement moves up between the casing and wall of the hole filling the open space known as the annulus.<sup>72</sup> Upon completion of the cementing process, the production casing is pressure tested to ensure its integrity.<sup>73</sup> Casing the well is a very important process, because it permanently secures the wellbore and prevents natural gas and other fluids from seeping out into upper formations as the fluids are brought to the surface.<sup>74</sup>

### C. Hydraulic Fracturing Stimulation

Hydraulic fracturing drastically increases the flow of natural gas from a well by creating a network of interconnected fractures that serve as pore spaces to allow natural gas to escape to the wellbore. The combination of hydraulic fracturing and

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<sup>61</sup> *Id.*

<sup>62</sup> *Id.*

<sup>63</sup> *Id.*

<sup>64</sup> *Id.*

<sup>65</sup> *Id.*

<sup>66</sup> *Id.*

<sup>67</sup> *Id.*

<sup>68</sup> *Id.*

<sup>69</sup> *Id.*

<sup>70</sup> *Id.*

<sup>71</sup> *Id.*

<sup>72</sup> *Id.*

<sup>73</sup> *Id.*

<sup>74</sup> *Id.*; see also Videos: Hydraulic Fracturing, Natural Gas Horizontal Shale Drilling, AM. PETROLEUM INST., available at [http://www.api.org/policy/exploration/hydraulic\\_fracturing/](http://www.api.org/policy/exploration/hydraulic_fracturing/) (last visited Oct. 6, 2011).



horizontal drilling enables previously unproductive shale formations to become some of the largest natural gas fields in the world.

Engineers and geologists spend a significant amount of time designing the fractures. They determine the desired height, length, and orientation of the desired fracture to ensure the fractures stay in the optimal zone and do not exceed the formation.<sup>75</sup> This process must be done correctly, because if the fractures extend beyond the formation, gas has an alternate escape route. This leads to either a significant reduction in productivity from the wellbore or even a “dry hole” where no gas is recovered.<sup>76</sup>

### 1. Hydraulic Fracturing Fluid

To be economically viable, drilling in shale requires hydraulic fracturing because of the low permeability and porosity in shale formations. In hydraulic fracturing, water, sand, and additives are pumped into the wellbore and down the casing under high pressure, up to 10,000 pounds per square inch, into the perforation and into surrounding rock to fracture the shale. Depending on the formation, the process may use two to four million gallons of water, with three million gallons being most common.<sup>77</sup> For example, in a four-stage hydraulic fracturing treatment for a well completed in the Marcellus Shale, the entire operation would require 2.3 million gallons of water and 1.8 million pounds of proppant such as sand.<sup>78</sup> Sand, as a common proppant, remains behind to prop open these small micro-fractures. These micro-fractures create a pathway connecting the reservoir to the well which allows gas to flow into the wellbore.

Hydraulic fracturing fluid is composed of 90 percent water, 9.5 percent sand, and 0.5 percent chemicals.<sup>79</sup> The chemical additives typically contain the following compounds: acids, sodium chloride, polyacrylamide, ethylene glycol, borate salts, sodium/potassium carbonate, glutaraldehyde, guar gum, citric acid, and isopropanol.<sup>80</sup> Glutaraldehyde, commonly used to sterilize medical and dental equipment, is used to eliminate bacteria in the water. Another compound, guar gum, commonly used as a thickener in cosmetics, baked goods, ice cream, tooth paste, sauces, and salad dressing, is used to thicken the water to suspend the sand. Taken together, the chemical additives serve multiple purposes: thickening the

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<sup>75</sup> Wes Deweese, *Fracturing Misconceptions: A History of Effective State Regulation, Groundwater Protection, and the Ill-conceived Frac Act*, 6 OKLA. J.L. & TECH. 49, 8 (2010), available at <http://www.okjolt.org/images/pdf/2010okjoltrev49.pdf>.

<sup>76</sup> *Id.*

<sup>77</sup> MODERN SHALE GAS, *supra* note 10, at 64.

<sup>78</sup> *Id.* at 58–59.

<sup>79</sup> See *Hydraulic Fracturing: Unlocking America's Natural Gas Resources*, AM. PETROLEUM INST., (July 19, 2010) [hereinafter *Unlocking America's Gas*], available at [www.api.org/policy/exploration/hydraulicfracturing/upload/HYDRAULIC\\_FRACTURING\\_PRIMER.pdf](http://www.api.org/policy/exploration/hydraulicfracturing/upload/HYDRAULIC_FRACTURING_PRIMER.pdf).

<sup>80</sup> See *id.*

water into gel to prop the fractures, reducing friction, and preventing equipment corrosion.

## 2. *Hydraulically Fracturing a Well*

Once the horizontal portion of the well is drilled, the drilling rig is no longer needed and a temporary wellhead is installed.<sup>81</sup> The location is then ready for surface crews to prepare the well for production.<sup>82</sup> The first step toward production is to perforate the casing.<sup>83</sup> To do this, workers will lower a perforating gun into the casing to the targeted section of the horizontal leg.<sup>84</sup> Once the perforating gun is in place, workers will send an electrical current down the wire line to the perforating gun.<sup>85</sup> The electric current triggers a charge that shoots small holes through the casing, through the cement, and out a short distance into the shale formation.<sup>86</sup> Workers then remove the perforating gun from the hole.<sup>87</sup>

The horizontal leg is hydraulically fractured and fluid is injected into the rock through the perforations in the well-bore, one section at a time starting at the end farthest from the surface and moving back toward the surface.<sup>88</sup> A temporary plug is placed above each new hydraulically fractured section.<sup>89</sup> Each plug isolates the perforated hydraulically fractured section of the wellbore so the next section of the horizontal leg can be perforated and hydraulically fractured.<sup>90</sup> Each stage of perforation and hydraulic fracturing is approximately 500 to 1,000 feet.<sup>91</sup> This process of perforating and hydraulic fracturing is repeated several times per section to cover the entire horizontal distance of the wellbore.<sup>92</sup> Once hydraulic fracturing is completed, the plugs are drilled out and the natural gas is allowed to flow up the wellbore.<sup>93</sup>

A portion of the hydraulic fracturing fluid used during the operation is usually recovered at this stage and recycled for future use or it is disposed of according to state or federal regulations. Operators may dispose of the fluid by surface discharge under the Clean Water Act or by injection into Class II disposal wells pursuant to the Safe Drinking Water Act. The unrecoverable hydraulic fracturing

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<sup>81</sup> Video: Natural Gas Horizontal Shale Drilling, *supra* note 50.

<sup>82</sup> *Id.*

<sup>83</sup> *Id.*

<sup>84</sup> *Id.*

<sup>85</sup> *Id.*

<sup>86</sup> *Id.*

<sup>87</sup> *Id.*

<sup>88</sup> *Id.*

<sup>89</sup> *Id.*

<sup>90</sup> *Id.*

<sup>91</sup> *Id.*

<sup>92</sup> *Id.*

<sup>93</sup> *Id.*; see also Hydraulic Fracturing, Natural Gas Horizontal Shale Drilling, *supra* note 74.

fluid will remain underground in the horizontal portion of the well confined by thousands of feet of impermeable rock layers.

### III. FEDERAL REGULATION OF NATURAL GAS EXPLORATION AND PRODUCTION

Natural gas exploration and production is regulated under a complex set of federal, state, and local laws. Sustainable development faces obstacles when integrating economic and environmental factors into public policy and the regulatory framework.<sup>94</sup> The overall goal is ecological integrity through a regulatory system that prevents irreversible harm to water, air, and soil resources.<sup>95</sup> This Article will mainly address the Safe Drinking Water Act; however, environmental groups seek federal regulation of the industry under the following: the Clean Water Act, the Clean Air Act, the National Environmental Policy Act, the Resource Conservation and Recovery Act, and the Toxic Control Substance Act.

#### A. *The Safe Drinking Water Act*

The Safe Drinking Water Act (SDWA) protects the nation's drinking water and its sources: rivers, lakes, reservoirs, springs, and ground water wells.<sup>96</sup> The SDWA authorizes the EPA to implement minimum standards for drinking water and requires owner or operator compliance. The 1996 Amendments to the SDWA state that the EPA must consider a detailed risk and cost assessment and best available peer-reviewed science when developing their standards.<sup>97</sup> States are given primacy to create secondary standards, such as ones that are nuisance-related, with the EPA's approval.<sup>98</sup> The EPA also protects underground sources of drinking water by controlling underground injections of fluid waste through the establishment of minimum standards for drinking water quality and by overseeing the states who implement those standards.<sup>99</sup>

The Underground Injection Control (UIC) program regulates the construction, operation, permitting, and closure of wells that inject fluids underground for storage or disposal.<sup>100</sup> If a state is granted primary enforcement responsibility, an operator must petition the state agency for a UIC permit before performing an underground injection that might endanger drinking water sources.<sup>101</sup> The Resource Conservation and Recovery Act (RCRA) also regulates hazardous waste

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<sup>94</sup> Allan Ingelson, *Sustainable Development and the Regulation of the Coal Bed Methane Industry in the United States*, 20 J. NAT. RESOURCES & ENVTL. L. 51 (2006).

<sup>95</sup> *Id.*

<sup>96</sup> 42 U.S.C. § 300f (1974).

<sup>97</sup> Safe Drinking Water Act Amendments of 1996, Pub. L. 104-182 (1996).

<sup>98</sup> 42 U.S.C. §300g-2.

<sup>99</sup> *Id.* § 300h-1.

<sup>100</sup> *Id.* § 300h.

<sup>101</sup> *Id.* § 300h-1.

injection wells.<sup>102</sup> A UIC permit meets the requirements of a RCRA permit.<sup>103</sup> For the past three decades, the EPA has not regulated hydraulic fracturing under the UIC and hydraulic fracturing is now exempt under the SDWA.<sup>104</sup>

Before the Legal Environmental Assistance Foundation (LEAF) litigation began, the EPA had not regulated hydraulic fracturing under the SDWA. In fact, the EPA believed that the SDWA did not intend to regulate hydraulic fracturing.<sup>105</sup> This chapter explains the two key LEAF cases that were argued before the Eleventh Circuit regarding Alabama's UIC program, post-Leaf litigation, and Congress' response by passing the Energy Policy Act of 2005.

### 1. LEAF Part I

On March 4, 1994, LEAF petitioned the EPA to withdraw its approval of Alabama's UIC program, without consideration of legislative intent or environmental impacts.<sup>106</sup> LEAF alleged that Alabama's UIC program was deficient because it did not regulate hydraulic fracturing activities related to coalbed methane gas production as required under the SDWA.<sup>107</sup> Further, it alleged that hydraulic fracturing contaminated a nearby drinking water well of two LEAF members.<sup>108</sup>

On May 5, 1995, the EPA denied the petition to determine that hydraulic fracturing was outside the SDWA's regulatory definition of "underground injection."<sup>109</sup> The EPA excluded methane gas production wells from SDWA regulation, because they found the principal function was the production of coalbed methane gas and not the underground placement of fluids.<sup>110</sup> Additionally, the EPA disputed that hydraulic fracturing affected the drinking water well.<sup>111</sup>

On June 19, 1995, LEAF filed a petition for review of the EPA's order not to withdraw approval of Alabama's UIC program with the Eleventh Circuit, to determine whether the EPA is legally required to regulate hydraulic fracturing under the UIC programs pursuant to the SDWA.<sup>112</sup> The Eleventh Circuit ruled that hydraulic fracturing activities fell within the definition of "underground injection"

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<sup>102</sup> 42 U.S.C. § 6901 (1976).

<sup>103</sup> 40 C.F.R. § 270.60(b)(3) (1987).

<sup>104</sup> 42 U.S.C. § 300h(d)(1)(B)(ii).

<sup>105</sup> See Dennis Lathem, *LEAF v. EPA: A Challenge to Hydraulic Fracturing of Coalbed Methane Wells in Alabama*, COALBED METHANE ASSOCIATION OF ALABAMA (July 9, 2001), available at [http://www.energyindepth.org/PDF/LEAF\\_v\\_EPA.pdf](http://www.energyindepth.org/PDF/LEAF_v_EPA.pdf).

<sup>106</sup> See *Legal Envtl. Assistance Found., Inc. v. U.S. EPA*, 118 F.3d 1467, 1471 (11th Cir. 1997) [hereinafter *LEAF I*].

<sup>107</sup> *Id.*

<sup>108</sup> *Id.*

<sup>109</sup> *Id.*

<sup>110</sup> *Id.*

<sup>111</sup> *Id.*

<sup>112</sup> See *LEAF I*, *supra* note 106, at 1472.

and hydraulic fracturing of coalbed methane gas was under the SDWA's jurisdiction.<sup>113</sup>

The EPA argued before the Eleventh Circuit that it interpreted the UIC regulations to only cover wells whose "principal function" was to inject fluids into the ground.<sup>114</sup> The EPA claimed this was consistent with Congressional intent.<sup>115</sup> The Eleventh Circuit was guided by the *Chevron* framework of analysis for reviewing an agency's interpretation of a statute.<sup>116</sup> The *Chevron* framework required the Eleventh Circuit to determine whether Congress expressed its intent in the plain meaning of the statute as a whole.<sup>117</sup> The Eleventh Circuit found that Congress clearly meant for all underground injections to be regulated under the UIC programs, because the statute states UIC regulations "shall prohibit . . . any underground injection in that State."<sup>118</sup>

The Eleventh Circuit then looked at whether hydraulic fracturing fell within the definition of "underground injection."<sup>119</sup> The statute's definition is "[t]he term 'underground injection' means the subsurface emplacement of fluids by well injection; and excludes the underground injection of natural gas for purposes of storage."<sup>120</sup> The EPA contended that Congress did not define "well injection" so the EPA had the discretion to define it.<sup>121</sup> The Eleventh Circuit disagreed with the EPA's interpretation and held that Congress said what it meant.<sup>122</sup>

The EPA then turned to legislative history as its final defense by seeking to limit the broad scope of the UIC program to the specific underground injection problems that were identified by Congress.<sup>123</sup> The Eleventh Circuit was not persuaded because hydraulic fracturing is not a "drilling technique" and is directly involved with the injection of fluids.<sup>124</sup> Therefore, the Eleventh Circuit granted the petition for review and remanded for further proceedings consistent with hydraulic fracturing being regulated under the SDWA's UIC program.<sup>125</sup>

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<sup>113</sup> *See id.* at 1473–78.

<sup>114</sup> *Id.*

<sup>115</sup> *Id.* at 1473.

<sup>116</sup> *See Chevron, U.S.A., Inc. v. Natural Res. Def. Council*, 467 U.S. 837 (1984).

<sup>117</sup> *See LEAF I*, *supra* note 106, at 1474.

<sup>118</sup> 42 U.S.C. § 300h(b)(1)(A) (emphasis added).

<sup>119</sup> *See id.* at 1474–75.

<sup>120</sup> *Id.* §300h (d)(1).

<sup>121</sup> *See LEAF I*, *supra* note 106, at 1474.

<sup>122</sup> *Id.* at 1474.

<sup>123</sup> *Id.* at 1475.

<sup>124</sup> *See id.* at 1477.

<sup>125</sup> *See LEAF I*, *supra* note 106, at 1478.

## 2. *LEAF Part II*

After *LEAF Part I*, *LEAF* petitioned for a writ of mandamus with the Eleventh Circuit to enforce the *LEAF Part I* ruling.<sup>126</sup> The EPA began proceedings to withdraw its approval of Alabama's Class II UIC program.<sup>127</sup> Before the proceedings were complete, the State Oil and Gas Board of Alabama submitted a revised UIC program to the EPA for approval under the alternative demonstration provision of Section 1425 of the SDWA.<sup>128</sup> The EPA conducted a public hearing and reviewed written comments. On January 19, 2000, the EPA issued its final rule approving Alabama's UIC program under Section 1425.<sup>129</sup> Section 1425 is an alternative method for a state to show that its regulations meet SDWA requirements. A state must show its program meets five requirements.<sup>130</sup>

When *LEAF* filed its second petition for review with the Eleventh Circuit, the State Oil and Gas Board of Alabama intervened in the case.<sup>131</sup> *LEAF*'s first argument was that the underground injection of hydraulic fracturing fluids was not an "underground injection for the secondary or tertiary recovery of . . . natural gas" under Section 1425.<sup>132</sup> Next, *LEAF* claimed the correct classification was Class II wells.<sup>133</sup> Lastly, they claimed that the EPA's approval of the revised UIC program was arbitrary and capricious.<sup>134</sup>

The Eleventh Circuit had to decide whether a state's UIC program for underground injection of hydraulic fracturing fluids for the recovery of methane gas from coalbeds may be approved under the alternative demonstration provision of Section 1425. The Eleventh Circuit ruled that the classification of hydraulic fracturing of coalbed methane gas is not a Class II-like underground injection activity and remanded to the EPA to determine whether Alabama's revised UIC program complied with the Class II well requirements.<sup>135</sup>

Once again, the Eleventh Circuit was required to use the *Chevron* framework as a basis for interpreting provisions of the SDWA Section 1425. First, it determined the meaning of "relates to."<sup>136</sup> The Eleventh Circuit agreed with the EPA's interpretation that Congress meant for this term to pertain to "the

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<sup>126</sup> See *Legal Env'tl. Assistance Found., Inc. v. U.S. EPA*, 276 F.3d 1253, 1256 (11th Cir. 2001) [hereinafter *LEAF II*].

<sup>127</sup> *Id.*

<sup>128</sup> See 42 U.S.C. § 300h-4(a).

<sup>129</sup> See *Underground Injection Control (UIC) Program Revision*, 65 Fed. Reg. 2889 (Jan. 19, 2000) (codified at 40 C.F.R. pt. 147).

<sup>130</sup> See 42 U.S.C. § 300h(b)(1).

<sup>131</sup> See *LEAF II*, *supra* note 126, at 1254.

<sup>132</sup> See *id.* at 1256–61.

<sup>133</sup> See *id.* at 1262–64.

<sup>134</sup> See *id.* at 1264–65.

<sup>135</sup> See *id.* at 1259–65.

<sup>136</sup> See *id.* at 1258–59.

underground injection of brine or other fluids which are brought to the surface in connection with oil or natural gas production” and “any underground injection for the secondary or tertiary recovery of oil or natural gas.”<sup>137</sup> Next, the Eleventh Circuit determined whether hydraulic fracturing is analogous to secondary and tertiary recovery which would be covered by Section 1425. The EPA’s approval of Alabama’s UIC program under Section 1425 was based on a permissible construction of the statute that both procedures enhanced natural gas production through the underground injection of fluids to increase reservoir pressure to force natural gas to a production well.<sup>138</sup> The Eleventh Circuit upheld the EPA’s decision to subject hydraulic fracturing to Section 1425 approval.<sup>139</sup>

The EPA decided to classify the hydraulic fracturing of coalbed methane gas wells as Class II-like underground injection activity.<sup>140</sup> LEAF argued that this classification is erroneous and inconsistent with the statutory language.<sup>141</sup> The Eleventh Circuit agreed and ruled that the EPA’s classification is inconsistent with the plain language of the statute.<sup>142</sup> The classification for Class II wells clearly states “wells which inject fluids . . . for enhanced recovery of oil or natural gas.”<sup>143</sup> Therefore, the EPA’s classification was set aside so that the EPA could determine if Alabama’s UIC regulations met the requirements for Class II wells.<sup>144</sup>

### 3. *Post-LEAF Litigation*

During the LEAF litigation, environmental groups, regulators, and the public became aware that some companies were using diesel fuel as an additive in their hydraulic fracturing fluids. Diesel fuel contains benzene which is a known carcinogen. Following the LEAF litigations and the disclosure of diesel fuel being used in hydraulic fracturing fluids, the industry agreed to give up diesel fuel and understood that the federal government could regulate coalbed methane wells. The December 12, 2003, Memorandum of Agreement (2003 MOA) between the three major service companies and the EPA stated they would not use diesel fuel in hydraulic fracturing injections for coalbed methane gas production.<sup>145</sup> In essence,

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<sup>137</sup> *See id.*

<sup>138</sup> *See id.* at 1262–64.

<sup>139</sup> *See id.* at 1259–65.

<sup>139</sup> *See id.* at 1258–59.

<sup>139</sup> *See id.*

<sup>139</sup> *See id.* at 1262–64.

<sup>139</sup> *See id.* at 1260–61.

<sup>140</sup> *See id.* at 1262–64.

<sup>141</sup> *See id.* at 1264–65.

<sup>142</sup> *See id.* at 1262–64.

<sup>143</sup> *See id.* at 1263 (citing 40 C.F.R. § 144.6 (2011)).

<sup>144</sup> *See id.* at 1265.

<sup>145</sup> Memorandum of Agreement between the EPA and BJ Services Company, Halliburton Energy Services, Inc., and Schlumberger Technology Corporation (Dec. 12,

the 2003 MOA only applied to coalbed methane wells. The EPA never amended the SDWA for it to apply to other rock formations.

In July 2004, the EPA issued its final determination that Alabama complied with Class II well requirements.<sup>146</sup> The ruling was supported by the EPA's June 2004 study which found that injecting hydraulic fracturing fluids into coalbed methane gas wells poses little threat to drinking water.<sup>147</sup> In response to the LEAF litigation regarding Congress' intent in drafting the SDWA, Congress passed the Energy Policy Act of 2005.<sup>148</sup> Environmental groups took this action as another example of a litigation victory being undone by a Congress that favors the industry with little regard to the environmental costs.<sup>149</sup>

#### 4. *The Energy Policy Act of 2005*

The Energy Policy Act of 2005 addresses various forms of energy production. The U.S. Congress inserted a provision addressing the application of SDWA to hydraulic fracturing by amending the SDWA's definition of "underground injection" to exclude "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."<sup>150</sup> This provision exempts hydraulic fracturing from the UIC permit requirements unless the fluid being injected contains diesel fuel.

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2003) [hereinafter 2003 MOA], available at [http://www.halliburton.com/public/about\\_us/pubsdata/hse/pdf/moa\\_dec12\\_Final.pdf](http://www.halliburton.com/public/about_us/pubsdata/hse/pdf/moa_dec12_Final.pdf).

<sup>146</sup> See S. Marvin Rogers, *History of Litigation Concerning Hydraulic Fracturing to Produce Coalbed Methane*, STATE OIL AND GAS BOARD OF ALABAMA (Jan. 2009), available at <http://www.iogcc.state.ok.us/Websites/iogcc/Images/Marvin%20Rogers%20Paper%20of%20History%20of%20LEAF%20Case%20Jan.%202009.pdf> (last updated Feb. 2, 2012).

<sup>147</sup> See *Evaluation of Impacts to Underground Sources of Drinking Water by Hydraulic Fracturing of Coalbed Methane Reservoirs Study (2004)*, EPA [hereinafter *EPA 2004 Study*], available at [http://water.epa.gov/type/groundwater/uic/class2/hydraulicfracturing/wells\\_coalbedmethanestudy.cfm](http://water.epa.gov/type/groundwater/uic/class2/hydraulicfracturing/wells_coalbedmethanestudy.cfm) (last updated Oct. 6, 2011).

<sup>148</sup> Energy Policy Act of 2005, Pub. L. 109-58, § 322, 119 Stat. 594, (amending 42 U.S.C. § 300h(d)).

<sup>149</sup> See James Murphy, *Slowing the Onslaught and Forecasting Hope for Change: Litigation Efforts Concerning the Environmental Impacts of Coalbed Methane Development in the Powder River Basin*, 24 PACE ENVTL. L. REV. 399, 407 (2007).

<sup>150</sup> Pub. L. 109-58, § 322, 119 Stat. at 694.



## 5. Conclusion

In July 2010, the EPA clarified its stance that companies must file for permits as UIC Class II wells before using diesel fuel in hydraulic fracturing fluids.<sup>151</sup> On August 21, 2010, the Independent Petroleum Association of America (IPAA) filed a petition in the U.S. Circuit Court of Appeals for the District of Columbia alleging the EPA did not adhere to the Administrative Procedure Act in creating the new federal regulatory requirements for hydraulic fracturing.<sup>152</sup> The Act requires a notice and comment rulemaking process: submitting a proposal, hearing public comments, and reviewing those comments. The EPA argued that statements on its hydraulic fracturing web page are not a “final agency action” and subject to review, “because it does not impose any obligations upon the Associations’ members” but rather the statements are “only a description of the existing legal obligations under the statute, not the source of new requirements.”<sup>153</sup> On November 10, 2011, the Court removed this matter from the oral argument calendar so the parties could continue settlement discussions.<sup>154</sup> On January 12, 2012, upon consideration of the parties’ status report filed on January 9, 2012, the Court ordered the parties to file motions to govern further proceedings in this case on or before February 23, 2012.<sup>155</sup> It is also possible that the U.S. Congress will pass legislation in response to this debate, which may have the effect of causing pending litigation to become moot.

### B. The Clean Water Act

The Clean Water Act (CWA) regulates the discharge of pollutants into U.S. waters and issues quality standards for surface waters.<sup>156</sup> Acting under the authority of the CWA, the EPA created wastewater standards for industry and set water quality standards for all surface water contaminants. A National Pollutant Discharge Elimination System (NPDES) permit is required to discharge any pollutant from a source into navigable waters. NPDES permits, usually

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<sup>151</sup> *Regulation of Hydraulic Fracturing by the Office of Water*, EPA, [http://water.epa.gov/type/groundwater/uic/class2/hydraulicfracturing/wells\\_hydroreg.cfm#safehyfr](http://water.epa.gov/type/groundwater/uic/class2/hydraulicfracturing/wells_hydroreg.cfm#safehyfr) (last updated Oct. 6, 2011).

<sup>152</sup> *Indep. Petroleum Ass’n of Am. v. U.S. EPA, petition for review filed*, No. 10-1233, (D.C. Cir. Aug. 12, 2010), available at <http://www.frackinginsider.com/IPAA%20Petition.pdf> (last visited Oct. 6, 2011).

<sup>153</sup> *Id.* at motion to dismiss, available at <http://www.frackinginsider.com/IPAA%20MTD.pdf> (last visited Oct. 13, 2011).

<sup>154</sup> *Indep. Petroleum Ass’n of Am. v. U.S. EPA*, per curiam order, No. 10-1233, (D.C. Cir. Nov. 10, 2011).

<sup>155</sup> *Indep. Petroleum Ass’n of Am. v. U.S. EPA*, clerk’s order, No. 10-1233, (D.C. Cir. Jan. 12, 2012).

<sup>156</sup> 33 U.S.C. §1251 (1972).

administered by states, contain industry specific, technology-based, and water quality-based limits and establish pollutant monitoring and reporting requirements.

In 1987, Congress amended the CWA to require the EPA to establish a storm water discharge program, so the EPA began implementing NPDES permits for storm water discharge.<sup>157</sup> However, the CWA states an NPDES permit is not required “for discharges of storm water runoff from . . . gas exploration, production, processing, or treatment operation or transmission facilities.”<sup>158</sup> The Energy Policy Act of 2005 expanded the NPDES permit exemptions for “all field activities or operations associated with exploration, production, processing, or treatment operations, or transmission facilities, including activities necessary to prepare a site for drilling and for the movement and placement of drilling equipment, whether or not such field activities or operations may be considered to be construction activities.”<sup>159</sup>

On June 12, 2006, the EPA published a final rule to address the new meaning added by the Energy Policy Act of 2005. The EPA found that construction activities at natural gas well sites were not required to get an NPDES permit.<sup>160</sup> Following the regulation exemption, the Natural Resources Defense Council (NRDC) petitioned the Ninth Circuit Court of Appeals for direct review of the EPA’s rule. On May 23, 2008, the Ninth Circuit vacated the EPA’s 2006 final rule.<sup>161</sup> The EPA then filed a petition for rehearing that was denied by the Ninth Circuit on November 3, 2008.<sup>162</sup>

The key provisions affected by the Ninth Circuit’s decision are 40 CFR § 122.26(a)(2) and (e)(8), which revert to the prior law stated below. Construction activities at natural gas production sites are required to get a permit for storm water discharge:

The Director may not require a permit for discharges of storm water runoff from mining operations or oil and gas exploration, production, processing or treatment operations or transmission facilities, composed entirely of flows which are from conveyances or systems of conveyances (including but not limited to pipes, conduits, ditches, and channels) used for collecting and conveying precipitation runoff and which are not contaminated by contact with or that has not come into contact with, any

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<sup>157</sup> Water Quality Act of 1987, Pub. L. 100-4 (1987).

<sup>158</sup> *Id.* § 1342(1)(2).

<sup>159</sup> *See id.* § 1362(24).

<sup>160</sup> Amendments to the NPDES Regulations for Stormwater Discharges Associated with Oil and Gas Activities, 40 C.F.R. § 122.26(a)(2)(ii), *available at* [http://www.epa.gov/npdes/regulations/final\\_oil\\_gas\\_rule.pdf](http://www.epa.gov/npdes/regulations/final_oil_gas_rule.pdf) (last visited Oct. 13, 2011).

<sup>161</sup> *Natural Res. Def. Council v. U.S. EPA*, 526 F.3d 591 (9th Cir. 2008).

<sup>162</sup> *Regulation of Oil and Gas Construction Activities*, EPA, <http://cfpub.epa.gov/npdes/stormwater/oilgas.cfm> (last updated Mar. 9, 2012).

overburden, raw material, intermediate products, finished product, byproduct or waste products located on the site of such operations.<sup>163</sup> For any storm water discharge associated with small construction activity identified in paragraph (b)(15)(i) of this section, see § 122.21(c)(1). Discharges from these sources, other than discharges associated with small construction activity at oil and gas exploration, production, processing, and treatment operations or transmission facilities, require permit authorization by March 10, 2003, unless designated for coverage before then. Discharges associated with small construction activity at such oil and gas sites require permit authorization by March 10, 2005.<sup>164</sup>

### C. *The Clean Air Act*

The Clean Air Act (CAA) limits air emissions from equipment used for natural gas operations.<sup>165</sup> The first federal environmental legislation concerning air emissions was the Air Pollution Control Act of 1955 which issued research funds to study air pollution.<sup>166</sup> It was followed by the CAA of 1963, which established a federal program with the U.S. Public Health Services and authorized research into controlling air pollution.<sup>167</sup> In 1967, the Air Quality Act was enacted to permit the federal government to conduct extensive ambient monitoring studies and stationary source inspections.<sup>168</sup> The CAA of 1970 authorized the creation of federal and state regulations to limit emissions from stationary and mobile sources: the National Ambient Air Quality Standards (NAAQS), State Implementations Plans (SIP), New Source Performance Standards, and National Emission Standards for Hazardous Air Pollutants.<sup>169</sup> Additionally, the EPA was created on May 2, 1971 to implement the CAA regulations. In 1977, amendments to the CAA were issued to authorize provisions for the Prevention of Significant Deterioration (PSD) of air quality in areas attaining the NAAQS.<sup>170</sup> A fourth amendment in 1990 required all states to develop operating permit programs for stationary sources.<sup>171</sup> Today, every major industrial source of air pollution must obtain a Title V Operating Permit, which includes air emission control requirements.<sup>172</sup>

Until recently, the executive branch of the federal government was allowed to determine whether GHGs were pollutants and subject to regulation by the EPA.

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<sup>163</sup> 40 C.F.R. § 122.26(a)(2) (2005).

<sup>164</sup> *Id.* § 122.26(e)(8) (2005).

<sup>165</sup> 42 U.S.C. § 7401 (1970).

<sup>166</sup> Air Pollution Control Act, Pub. L. No. 84-159, ch. 360, 69 Stat. 322 (1955).

<sup>167</sup> Clean Air Act, Pub. L. No. 88-206, 77 Stat. 392 (1963).

<sup>168</sup> Air Quality Act, Pub. L. No. 91-604, 81 Stat. 485 (1967).

<sup>169</sup> Clean Air Act, Pub. L. No. 91-604, 84 Stat. 1676 (1970).

<sup>170</sup> Clean Air Act, Pub. L. No. 95-95, 91 Stat. 685 (1977).

<sup>171</sup> Clean Air Act, Pub. L. No. 101-549, 104 Stat. 2399 (1990).

<sup>172</sup> 42 U.S.C. § 7661-7661f (1990).

The Clinton Administration found that GHGs were pollutants subject to regulation; however, the George W. Bush Administration concluded they were not. The judicial branch entered the debate in April 2007, when the U.S. Supreme Court held in *Massachusetts v. EPA* that the CAA authorizes the EPA to regulate GHGs, including carbon dioxide.<sup>173</sup> The Supreme Court ruled the EPA was required to determine if GHG emissions contribute to climate change. On December 18, 2008, the EPA issued a memorandum regarding this issue, which was the EPA's first step in determining if carbon dioxide is a regulated pollutant requiring best available control technology in new PSD permits.<sup>174</sup>

The regulation of GHGs requires natural gas operators to obtain a permit to operate equipment that emits pollutants, such as compressors. State agencies generally adopt SIPs that comply with the NAAQS. The EPA reviews both the states' SIP and NAAQS every five years.

#### *D. The National Environmental Policy Act*

The National Environmental Policy Act (NEPA) requires that an environmental impact statement be performed before conducting natural gas exploration and production on federal land and for all major federal actions.<sup>175</sup> All federal agencies must prepare detailed statements assessing the environmental impact and alternatives to "major federal actions significantly affecting the quality of the human environment."<sup>176</sup> First, a federal agency determines if the undertaking may be categorically excluded from a detailed environmental analysis. Second, a federal agency prepares an environmental assessment to determine if the federal undertaking significantly affects the environment. Finally, if the environmental assessment determines the undertaking is significant, an environmental impact statement (EIS) is performed.

An EIS must provide a fair and full discussion of significant environmental impact that informs both decision makers and the public about reasonable alternatives that would avoid or minimize an adverse impact on the environment. The federal agencies must explore and evaluate all reasonable alternatives, even if they are not within the authority of the lead agency. NEPA authority is solely procedural and it cannot compel implementation of the environmentally preferred alternative.

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<sup>173</sup> See *Massachusetts v. EPA*, 549 U.S. 497 (2007).

<sup>174</sup> Memorandum of Interpretation of Regulations under the PSD Permit Program, U.S. EPA (December 18, 2003), available at [http://www.epa.gov/NSR/documents/psd\\_interpretive\\_memo\\_12.18.08.pdf](http://www.epa.gov/NSR/documents/psd_interpretive_memo_12.18.08.pdf) (last visited Oct. 13, 2011).

<sup>175</sup> 42 U.S.C. §4321 (2006).

<sup>176</sup> *Id.* §4332(2)(C).

*E. The Resource Conservation and Recovery Act*

The Resource Conservation and Recovery Act (RCRA) gives the EPA authority to control hazardous waste from “cradle-to-grave.”<sup>177</sup> In 1978, the EPA proposed hazardous waste management standards that included reduced requirements for numerous types of large volume wastes and for some industries, including oil and gas.<sup>178</sup> Congress exempted these wastes from the hazardous waste regulations under Subtitle C of RCRA pending a study and ruling from the EPA.<sup>179</sup> In 1988, the EPA issued a ruling stating that control of exploration and production waste under the regulation of Subtitle C is not required.<sup>180</sup> However, these wastes are not precluded from control under state regulations, and Subtitle D also provides solid waste regulation.<sup>181</sup>

Exempt wastes covered by the 1978 proposal were “gas and oil drilling muds and oil production brines.”<sup>182</sup> The 1980 amendments expanded this to include “drilling fluids, produced water, and other wastes associated with the exploration, development, or production of crude oil or natural gas . . . .”<sup>183</sup> The EPA published a list of exempt and non-exempt waste generated by exploration and production operations.<sup>184</sup> The distinction of exempt and non-exempt waste has no bearing on whether the material is hazardous, toxic, or harmful to human health and the environment.

On September 8, 2010, the NRDC requested that the EPA regulate certain exploration and production waste.<sup>185</sup> The petition urged the EPA to reconsider its 1988 determination. The NRDC sought to show that: a) current state regulations and enforcement are inadequate, b) natural gas production has dramatically increased, c) regulation under Subtitle C would not harm the industry, and d) the waste is toxic and meets the criteria for regulation.<sup>186</sup> To date, the EPA has not responded to this petition.

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<sup>177</sup> 42 U.S.C. § 6901 (1976).

<sup>178</sup> Exemption of Oil and Gas Exploration and Production Wastes from Federal Hazardous Waste Regulations, EPA (Oct. 2002), *available at* <http://epa.gov/epawaste/nonhaz/industrial/special/oil/oil-gas.pdf> (last visited Feb. 11, 2012).

<sup>179</sup> *Id.*

<sup>180</sup> *Id.*

<sup>181</sup> *Id.*

<sup>182</sup> *Id.*

<sup>183</sup> *Id.*

<sup>184</sup> *Id.*

<sup>185</sup> Letter from NRDC to Lisa Jackson, Administrator, U.S. EPA (regarding Petition for Rulemaking under RCRA Concerning the Regulation of Wastes Associated Energy Activities), *available at* [http://docs.nrdc.org/energy/files/ene\\_10091301a.pdf](http://docs.nrdc.org/energy/files/ene_10091301a.pdf) (last visited Oct. 13, 2011).

<sup>186</sup> *See id.*

### F. Toxic Substances Control Act

The Toxic Substances Control Act (TSCA) grants the EPA authority to create regulations to collect chemical data in order to evaluate, assess, mitigate, and control risks which may be posed by their manufacture, processing, and use.<sup>187</sup> The TSCA provides several control methods to prevent chemicals from posing unreasonable risk. Under Section 5, the EPA has established an inventory of chemical substances.<sup>188</sup> If a chemical is not on the inventory list, then a pre-manufacture notice must be submitted to the EPA prior to manufacture or import.<sup>189</sup> Section 6 permits the EPA to ban manufacture or distribution in commerce, limit usage, require labeling, or place other restrictions on chemicals that pose unreasonable risks.<sup>190</sup> Section 8 allows the EPA to require the producers and importers of chemicals to report information on chemical production, use, exposure, and risks.<sup>191</sup>

## IV. STATE REGULATION OF NATURAL GAS EXPLORATION AND PRODUCTION

Federal agencies are not able to regulate all natural gas activities in the U.S., because most of the laws described above contain provisions that permit states to implement programs with federal approval. A state can adopt its own standards; however, state standards must be at least as protective as the federal standards. Once the respective federal agency approves the standard, the state has primary jurisdiction.

The public is requesting transparent checks and balances between the industry and state regulators due to the increase in natural gas drilling. Currently, natural gas wells cost approximately \$2.5 to \$10 million to drill.<sup>192</sup> In the Marcellus shale formation, new federal and state regulations potentially will increase the cost to complete a hydraulically fractured natural gas well by \$1 million.<sup>193</sup> Additionally, in the Marcellus shale formation, a \$500,000 cost increase per well would reduce the expected rate of return from 36 to 29 percent.<sup>194</sup>

This section discusses regulations from a traditional natural gas state and two states that are not as familiar with natural gas production. State regulations are more effective in addressing regional or local issues because they can tailor

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<sup>187</sup> 15 U.S.C. § 2605 (2008).

<sup>188</sup> *Id.* § 2604.

<sup>189</sup> *Id.* §§ 2604, 2612.

<sup>190</sup> *Id.* § 2605.

<sup>191</sup> *Id.* §§ 2607, 2612.

<sup>192</sup> FRAC ATTACK, *supra* note 49, at 4.

<sup>193</sup> *Id.* at 53.

<sup>194</sup> *Id.* at 54.

regulations for the local environment.<sup>195</sup> Natural gas states have developed a legal infrastructure that ensures environmental protection while facilitating natural gas production.<sup>196</sup> In implementing state regulations, they look at several factors including geology, topography, development history, population density, state laws, and local economies.

Texas has over 100 years of natural gas legal precedent, while New York and Pennsylvania are transforming from natural gas importers to exporters. In Texas, neither the Railroad Commission nor the Legislature has seen it necessary to regulate hydraulic fracturing beyond requiring disclosure of the composition of fracturing fluids. Meanwhile, New York and Pennsylvania already have relatively comprehensive regulations for hydraulic fracturing. Additionally, there are organizations, such as the Interstate Oil and Gas Compact Commission (IOGCC), that strongly influence state compliance assurance.

#### A. Organizations that Impact State Law

The IOGCC coordinates natural gas and environmental issues among natural gas producing states; there are 30 member states and eight associate states.<sup>197</sup> The IOGCC advocates for states' rights to regulate natural gas issues within their own borders. It coordinates regulatory actions among states to protect resources and the environment. The IOGCC acts as a forum to share information and discuss a wide range of issues between the government, industry, and environmental groups. In regards to environmental issues, the IOGCC develops guidelines and reviews state waste management regulatory programs.

#### B. Texas

There is no formal regulation of hydraulic fracturing in Texas.<sup>198</sup> However, Texas does require approval for drilling permit applications and it controls groundwater withdrawals and surface disposal.<sup>199</sup> The Railroad Commission of

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<sup>195</sup> See U.S. DEP'T OF ENERGY, STATE OIL AND NATURAL GAS REGULATIONS DESIGNED TO PROTECT WATER RESOURCES (2009), available at <http://www.gwpc.org/e-library/documents/general/State%20Oil%20and%20Gas%20Regulations%20Designed%20to%20Protect%20Water%20Resources.pdf> (last visited Oct. 14, 2011).

<sup>196</sup> Deweese, *supra* note 75, at 22.

<sup>197</sup> *About the Interstate Oil and Gas Compact Commission*, INTERSTATE OIL & GAS COMPACT COMM'N, <http://www.iogcc.state.ok.us/member-states> (last visited Oct. 17, 2011).

<sup>198</sup> *Coastal Oil & Gas Corp. v. Garza Energy Trust*, 268 S.W.3d 1, 17 (Tex. 2008) (stating hydraulic fracturing has occurred in Texas for over 60 years though neither the Legislature nor the RRC has ever seen fit to regulate it).

<sup>199</sup> See 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, 157 (2009).

Texas (RRC) regulates natural gas exploration and production and has jurisdiction over all natural gas wells. The Texas Commission on Environmental Quality (TCEQ) protects the state's natural resources and strives for clean air, clean water, and the safe management of waste. The RRC and the TCEQ created a memorandum of understanding that details the division in jurisdiction.<sup>200</sup> The memorandum gives the RRC authority to regulate all natural gas activity, including solid waste, water quality, natural gas waste, injection wells, and groundwater. However, the RRC must submit groundwater contamination notices to the TCEQ. The TCEQ provides recommendations concerning groundwater protection such as identifying fresh water zones and drilling protection depths from geological data.

The RRC requires permits for drilling or deepening a natural gas well.<sup>201</sup> In addition to drilling permits, other regulations that affect hydraulic fracturing deal with casing, cementing, and water protection. Casing and cementing regulation is a preventative measure against ground and surface water contamination.<sup>202</sup> The RRC is confident that the casing, cementing, drilling, and completion requirements adequately protect Texas' ground water from hydraulic fracturing fluids.

The RRC also requires permits for the storage, transfer, and disposal of any natural gas waste.<sup>203</sup> Section 3.46 is specifically intended to regulate fluid injection into production reservoirs, which could be interpreted to mean hydraulic fracturing operations. Section 3.46 states that a permit is required for "fluid injection operations in reservoirs productive of oil, gas, or geothermal resources."<sup>204</sup> However, in reality, the RRC does not require a special fluid injection permit for hydraulic fracturing. The RRC may be required to issue these permits in the future if federal regulations are amended to include hydraulic fracturing fluid that does not contain diesel fluid in the Class II underground injection well definition.

On March 11, 2011, the Chairman of the Texas House of Representatives Committee on Energy Resources filed a bill entitled "Disclosure of Composition of Hydraulic Fracturing Fluids."<sup>205</sup> This bill "would require operators to disclose to the Railroad Commission (RRC) the composition of fluids used for fracture stimulation, and it would require the RRC to make the information available to the public on the web, unless the operator claimed and the Commission confirmed the information was a trade secret."<sup>206</sup> On June 17, 2011, the Governor signed the bill,

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<sup>200</sup> 16 TEX. ADMIN. CODE §3.30 (2010) (RRC); 30 TEX. ADMIN. CODE §7.117 (2010) (TCEQ).

<sup>201</sup> 16 TEX. ADMIN. CODE §3.5(c) (2009).

<sup>202</sup> *Id.* §3.13(a)(1).

<sup>203</sup> *Id.* §3.8.

<sup>204</sup> *Id.* §3.46(a).

<sup>205</sup> H.B. 3328, 2011 Leg., 82nd Sess. (Tx. 2011), available at <http://www.capitol.state.tx.us/Search/DocViewer.aspx?K2DocKey=odbc://TLO/TLO.dbo.vwCurrBillDocs/82/R/H/B/03328/1/B@TloCurrBillDocs&QueryText=HB%203328&HighlightType=1> (last visited Oct. 17, 2011).

<sup>206</sup> Fiscal Note, 2011 Leg., 82nd Sess. (Tx. Apr. 5, 2011) (letter from John S. O'Brien, Director, Legislative Budget Board to Jim Keffer, Chair, House Committee on Energy



making Texas the first state to mandate public disclosure of chemicals used in hydraulic fracturing.

The RRC proposed 16 Tex. Admin. Code § 2.29, relating to Hydraulic Fracturing Chemical Disclosure Requirements, on August 22, 2011.<sup>207</sup> The proposal states that natural gas operators are required to submit the following information to the hydraulic fracturing chemical registry website, FracFocus: date of the hydraulic fracturing treatment, location, vertical depth of the natural gas well, total volume of water and base fluid used in the hydraulic fracturing treatment, each additive used, each chemical ingredient used, and all chemical ingredients intentionally added by the operator.<sup>208</sup> However, a supplier, service company, or operator is not required to disclose ingredients that were not intentionally added to the hydraulic fracturing treatment, or identify specific chemical ingredients that are eligible for trade secret.<sup>209</sup> A supplier, service company, or operator has trade secret protection unless the claim has been successfully challenged under Texas Government Code, Chapter 552.<sup>210</sup>

The Ground Water Protection Council (GWPC) and the IOGCC launched FracFocus on April 1, 2011, and the RRC estimates that operators have voluntarily entered data for 50 percent of all natural gas wells on which hydraulic fracturing treatment is performed.<sup>211</sup> On December 13, 2011, the RRC adopted one of the most comprehensive hydraulic fracturing chemical disclosure requirements.<sup>212</sup> The rule requires operators of all wells, to which the RRC has issued an initial drilling permit on or after February 1, 2012, to enter chemical data for the well into the public website FracFocus.<sup>213</sup>

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Resources relating to the disclosure of the composition of hydraulic fracturing fluids used in hydraulic fracturing treatments), *available at* <http://www.legis.state.tx.us/tlodocs/82R/fiscalnotes/html/HB03328I.htm> (last visited Oct. 17, 2011).

<sup>207</sup> Memorandum for New 16 Tex. Admin. Code § 2.29, relating to Hydraulic Fracturing Chemical Disclosure Requirements, from Leslie Savage, Chief Geologist, Oil and Gas Division to Elizabeth Ames Jones, Chairman, Railroad Comm'n of Texas et al., (Aug. 22, 2011), *available at* <http://www.rrc.state.tx.us/rules/prop-new-3-29-frac-disclosure-Aug29.PDF>.

<sup>208</sup> *Id.*

<sup>209</sup> *Id.*

<sup>210</sup> *Id.* at 2.

<sup>211</sup> *Id.*

<sup>212</sup> See News Release, R.R Comm'n of Tex., Railroad Commissioners Adopt One of Nation's Most Comprehensive Hydraulic Fracturing Chemical Disclosure Requirements (Dec. 13, 2011), *available at* <http://www.rrc.state.tx.us/pressreleases/2011/121311.php> (last visited Feb. 13, 2012).

<sup>213</sup> *Id.*

### C. New York

New York has regulated natural gas operations for decades, including regulations that affect hydraulic fracturing. However, the expansion of the Marcellus Shale operations and high-volume hydraulic fracturing is causing New York to review and modify most of its environmental laws. The governor and legislators even passed a moratorium on hydraulic fracturing until more studies are complete on whether hydraulic fracturing may contaminate drinking water.

The New York Environmental Conservation Law declares the regulation of natural gas development, production, and utilization in New York to be done in a manner that is in the public interest of preventing waste.<sup>214</sup> The Department of Environmental Conservation's (NYDEC) Bureau of Oil and Gas Regulation oversees permitting, compliance, and enforcement of natural gas wells in New York. Operators must obtain a permit before beginning "operations to drill, deepen, plug back or convert a well for exploration, production, input, storage or disposal."<sup>215</sup> In order to get the permit, the operator must complete the full State Environmental Quality Review (SEQR) or conform to the requirements established in a generic environmental impact statement.<sup>216</sup>

In 1992, the NYDEC adopted the Generic Environmental Impact Statement on the Oil, Gas and Solution Mining Regulatory Program (GEIS) to create an environmental review and approval of natural gas wells.<sup>217</sup> The GEIS discussed hydraulic fracturing, but did not make any regulatory recommendations. Due to the increase in hydraulic fracturing, in 2008, Governor David A. Paterson directed the NYDEC to prepare a Supplemental Generic Environmental Impact Statement (SGEIS).<sup>218</sup> On September 30, 2009, the draft SGEIS was posted and on December 31, 2009, the public comment period closed.<sup>219</sup> On December 13, 2010, Governor Paterson ordered the NYDEC to conduct a further environmental review and

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<sup>214</sup> See N.Y. ENVTL. CONSERV. LAW § 23-0301 (2010).

<sup>215</sup> N.Y. COMP. CODES R. & REGS. tit. 6, § 552.1(a) (2010).

<sup>216</sup> See *id.* §§ 617.3, 617.10(d) (2010).

<sup>217</sup> See Final Generic Environmental Impact Statement on the Oil, Gas and Solution Mining Regulatory Program, N.Y. STATE DEP'T OF ENVTL. CONSERV. (1992), *available at* [http://www.dec.ny.gov/docs/materials\\_minerals\\_pdf/fgeisexecsum.pdf](http://www.dec.ny.gov/docs/materials_minerals_pdf/fgeisexecsum.pdf) (last visited Oct. 17, 2011).

<sup>218</sup> See Draft SGEIS on the Oil, Gas and Solution Mining Regulatory Program, N.Y. STATE DEP'T OF ENVTL. CONSERV. (2009), *available at* <http://www.dec.ny.gov/energy/58440.html> (last visited Oct. 17, 2011).

<sup>219</sup> See SGEIS on the Oil, Gas and Solution Mining Regulatory Program, Well Permit Issuance for Horizontal Drilling and High-Volume Hydraulic Fracturing to Develop the Marcellus Shale and Other Low-Permeability Gas Reservoirs, N.Y. STATE DEP'T OF ENVTL. CONSERV., *available at* <http://www.dec.ny.gov/energy/47554.html> (last visited Feb. 12, 2011).

present the findings to the public for further review.<sup>220</sup> On July 1, 2011, the NYDEC released its Executive Summary of the Preliminary Revised Draft SGEIS, and on July 8, 2011, the full Preliminary Revised Draft SGEIS was released.<sup>221</sup> On September 8, 2011, the NYDEC released the Revised Draft SGEIS and the public comment period concluded on January 11, 2012.<sup>222</sup> The NYDEC is now evaluating the public comments before releasing the Final SGEIS.<sup>223</sup>

On April 23, 2010, the NYDEC announced that applications to drill in the watersheds that feed the drinking water for New York City and Syracuse will be on a case-by-case environmental review process instead of using the GEIS.<sup>224</sup> In late 2010, the New York legislature passed legislation imposing a moratorium on hydraulic fracturing in both horizontal and vertical wells until May 15, 2011.<sup>225</sup> Governor Paterson vetoed this bill two days before issuing an executive order. On December 13, 2010, Governor Paterson issued Executive Order No. 41 creating a moratorium on hydraulic fracturing in horizontal wells until the final SGEIS is complete.<sup>226</sup> The Executive Order requires the NYDEC to issue a revised draft SGEIS by June 1, 2011 and accept public comments for at least 30 days. On January 1, 2011, Governor Cuomo issued Executive Order No. 2, which continues Executive Order No. 41 that Governor Paterson issued.<sup>227</sup> The NYDEC states that any entity applying for a drilling permit for horizontal drilling in the Marcellus Shale which opts to proceed with its permit application is required to undertake an individual, site-specific environmental review.<sup>228</sup>

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<sup>220</sup> *See id.*

<sup>221</sup> *See id.*

<sup>222</sup> *See id.*

<sup>223</sup> *See id.*

<sup>224</sup> *See* DEC Announces Separate Review for Communities with “Filtration Avoidance Determinations,” N.Y. STATE DEP’T OF ENVTL. CONSERV. (Apr. 3, 2010), *available at* <http://www.dec.ny.gov/press/64699.html>.

<sup>225</sup> *See* Press Release, Assembly Speaker Sheldon Silver, Assembly Passes Moratorium on Hydrofracking (Nov. 30, 2010), *available at* <http://assembly.state.ny.us/Press/20101130/>.

<sup>226</sup> Press Release, Executive Chamber, State of New York, Review, Continuation and Expiration of Prior Executive Orders (Dec. 11, 2010) (stating that Governor Andrew M. Cuomo issued a continuation of Executive Order, No. 41), *available at* <http://gdacc.wordpress.com/2010/12/11/governor-issues-executive-order-on-moratorium/>.

<sup>227</sup> No 2 Review, Continuation and Expiration of Prior Executive Orders, State of New York Executive Chamber (Jan. 1, 2011) (stating that Governor Andrew M. Cuomo issued a continuation of Executive Order, No. 41), *available at* <http://www.governor.ny.gov/executiveorder/2> (last visited Feb. 9, 2012).

<sup>228</sup> *Marcellus Shale*, N.Y. STATE DEP’T OF ENVTL. CONSERV., *available at* <http://www.dec.ny.gov/energy/46288.html#horizontal> (last visited Feb. 12, 2011).

#### *D. Pennsylvania*

Pennsylvania is one of the original natural gas producing states. Most of the pertinent natural gas law is from the initial exploration and production era and Pennsylvania does not have current regulations for hydraulic fracturing.

The Pennsylvania Department of Environmental Protection's (PADEP) Bureau of Oil and Gas Management oversees natural gas permitting and inspection programs, develops statewide regulation and standards, conducts training programs for the industry, and works with the Interstate Oil & Gas Compact Commission and the Technical Advisory Board.<sup>229</sup> The Bureau of Oil and Gas Management was granted its authority under Pennsylvania's Oil and Gas Act.<sup>230</sup> The PADEP requires that an operator obtain a permit to drill or alter a well and register the well.<sup>231</sup>

The PADEP recently amended Pennsylvania's natural gas regulation. On September 17, 2009, the PADEP issued their initial draft of 25 Pa. Code Chapter 78 to the Oil and Gas Technical Advisory Board. There was an Advance Notice of Proposed Rulemaking for public comment session from January 20, 2010 through March 2, 2010. The Notice of Final Rulemaking had its public comment period from July 10, 2010 through August 9, 2010. On February 5, 2011, the Final Regulations were approved on publication in the Pennsylvania Bulletin.<sup>232</sup> The Final Regulation was drafted to "improve drilling, casing, cement, testing, monitoring and plugging requirements for oil and gas wells to minimize gas migration" and protect water supplies.<sup>233</sup>

The significant revisions to the final-form rulemaking include the following: the addition of a provision that requires operators to have a pressure barriers plan to minimize well control events; the addition of a provision that requires operators to keep a list of emergency contact phone numbers at the well site; amended provisions that clarify how and when blow-out prevention equipment is to be installed and operated; the addition of a provision that requires operators to condition the wellbore to ensure an adequate bond between the cement, casing and the formation; the addition of provisions that require the use of centralizers to ensure that casings are properly positioned in the wellbore; the addition of a provision that improves the quality of the cement placed in

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<sup>229</sup> See *Bureau of Oil and Gas Management*, PENNSYLVANIA DEP'T OF ENV'T PROTECTION, <http://www.dep.state.pa.us/dep/deputate/minres/oilgas/oilgas.htm> (last visited Oct. 18, 2011).

<sup>230</sup> Oil and Gas Act, 58 PA. CONS. STATE ANN. §601 (2009).

<sup>231</sup> Environmental Protection Act, 25 PA. CODE § 78.11 (1989).

<sup>232</sup> See 25 PA. CODE Ch. 78 (2011), available at <http://www.pabulletin.com/secure/data/vol41/41-6/239.html> (last visited Oct. 18, 2011).

<sup>233</sup> *Id.* at 1.

the casing that protects fresh groundwater; the addition of provisions that specify the actions an operator shall take in the event of a gas migration incident; and revisions to the reporting requirements for chemicals used to hydraulically fracture a well.<sup>234</sup>

Similar to New York, Pennsylvania issued a moratorium on natural gas development on public lands.<sup>235</sup> On October 26, 2010, Governor Edward G. Rendell signed an executive order banning natural gas drilling operations on state forest lands due to the state Senate's failure to pass House Bill 2235. Once the Final Regulation was effective, Governor Tom Corbett removed the moratorium by stating that the PADEP welcomes public comments on drilling permit applications.<sup>236</sup> Meanwhile, the Pennsylvania legislature proposed compatible bills in the Senate and House to create a three year moratorium on drilling on state forest lands.<sup>237</sup> The bills were referred to the House and Senate's Environmental Resources & Energy Committees in early 2011 and remained in the Committees.<sup>238</sup> Additionally, Pittsburg became the first city in Pennsylvania to pass an ordinance on November 16, 2010, that bans natural gas drilling within city limits.<sup>239</sup> On February 10, 2012, Governor Corbett was presented with House Bill 1950 which amends the oil and gas laws in Title 58 of the Pennsylvania Consolidated Statutes.<sup>240</sup> Governor Corbett applauded the General Assembly for passing the comprehensive Marcellus Shale legislation that he outlined last October following the work of the Marcellus Shale Advisory Commission.<sup>241</sup>

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<sup>234</sup> *Id.* at 1–2.

<sup>235</sup> News Release, Governor Rendell Signs Moratorium Protecting Sensitive State Forest Land from Future Natural Gas Leases, Pennsylvania Office of Governor (Oct. 26, 2010), *available at* [http://www.dcnr.state.pa.us/news/newsreleases/2010/1010-sfdrilling\\_moratorium.htm](http://www.dcnr.state.pa.us/news/newsreleases/2010/1010-sfdrilling_moratorium.htm) (last visited Feb. 11, 2012).

<sup>236</sup> 41 Pa. Bull. 928 (Feb. 19, 2011), *available at* <http://www.pabulletin.com/secure/data/vol41/41-8/284.html> (last visited Oct. 18, 2011).

<sup>237</sup> *See* S.B. 426, Pa. Gen. Assembly, Reg. Sess. (Pa. 2011), *available at* <http://www.legis.state.pa.us/cfdocs/billinfo/billinfo.cfm?year=2011&sind=0&body=S&type=B&bn=0426>; H.B. 150, Pa. Gen. Assembly, Reg. Sess. (Pa. 2011), *available at* <http://www.legis.state.pa.us/cfdocs/billinfo/billinfo.cfm?year=2011&sind=0&body=H&type=B&bn=0150>.

<sup>238</sup> *Id.*

<sup>239</sup> *See* PITTSBURG, PA., CODE § 2010-0909 (2010), *available at* <http://pittsburgh.legistar.com/LegislationDetail.aspx?ID=766814&GUID=3306C0FD-CF64-4F19-9D73-052C69CB9738> (last visited Oct. 18, 2011).

<sup>240</sup> *See* H.B. 1950, Pa. Gen. Assembly, Reg. Sess. (Pa. 2012), *available at* <http://www.legis.state.pa.us/cfdocs/billinfo/billinfo.cfm?year=2011&sind=0&body=H&type=B&BN=1950>.

<sup>241</sup> News Release, Governor Corbett Applauds General Assembly for Passing Marcellus Shale Legislation, Pennsylvania Office of Governor (Feb. 8, 2012), *available at* [http://www.portal.state.pa.us/portal/server.pt/document/1223822/governor\\_corbett\\_applauds\\_general\\_assembly\\_for\\_passing\\_marcellus\\_shale\\_legislation](http://www.portal.state.pa.us/portal/server.pt/document/1223822/governor_corbett_applauds_general_assembly_for_passing_marcellus_shale_legislation) (last visited Feb. 11, 2012).

### *E. River Basin Commissions*

Natural gas operations in New York and Pennsylvania must also consider river basin commissions that cover various regions of the states and establish their own requirements. For example, the Susquehanna River Basin Commission (SRBC) is an interstate watershed agency that manages water resources to prevent flood damage, conservation, and develop surface water supplies on the Susquehanna River Basin in New York, Pennsylvania, and Maryland.<sup>242</sup> The “SRBC regulates all withdrawals of surface water and groundwater and consumptive water uses within the basin for natural gas development in the Marcellus or Utica Shale formations.”<sup>243</sup> Natural gas operators must obtain approval from the SRBC through an application process for water withdrawals and consumptive uses for natural gas operations.<sup>244</sup> Failure to comply with a river basin commission’s regulations can lead to a shutdown of operations. For example, on November 10, 2010, the SRBC ordered a natural gas operator to cease all water related work at the drilling rig site in Cameron County, Pennsylvania.<sup>245</sup>

## V. RANGE RESOURCES AND THE RAILROAD COMMISSION OF TEXAS VERSUS THE EPA

The EPA implements minimum environmental standards under most federal laws. However, the EPA cannot regulate all environmental activities in the U.S. Therefore, federal laws contain provisions that permit states to implement environmental standards with federal approval. States create their own requirements by either adopting federal standards or imposing more stringent requirements. Once the federal agency has approved the state’s standards, the state has primary jurisdiction.

The State of Texas and the EPA continue to disagree on the level of natural gas regulation in Texas. The disagreement began in 2010 when Texas sued the EPA over federal regulation of GHGs under the CAA. The disagreement carried over to 2011, which began with another states’ rights debate on the EPA’s federal

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<sup>242</sup> SUSQUEHANNA RIVER BASIN COMM’N, SUSQUEHANNA RIVER BASIN COMPACT (1972), available at [http://www.srbc.net/about/srbc\\_compact.pdf](http://www.srbc.net/about/srbc_compact.pdf).

<sup>243</sup> *SRBC’s Role in Regulating Natural Gas Well Development in the Marcellus Shale Region*, SUSQUEHANNA RIVER BASIN COMM’N, available at <http://www.clintoncountypa.com/resources/CCNGTF/pdfs/articles/2.10.11%20-%20SRBC%20Series%20for%20Clinton%20Co%20Nat%20Gas%20Task%20Force%20%281st%20article%29.pdf> (last visited Oct. 18, 2011).

<sup>244</sup> Susquehanna River Basin Comm’n, 18 C.F.R. §§ 801.4, 806.4 (2010).

<sup>245</sup> Press Release, Susquehanna River Basin Comm’n, SRBC Orders Natural Gas Driller to Stop all Water-Related Work at Drilling Site in Cameron County, PA (Nov. 10, 2010), available at [http://www.srbc.net/pubinfo/press/docs/Project%20Review%20Natural%20Gas%20JW%20Op%20Cease%20Order%20\\_11\\_10\\_2010\\_.pdf](http://www.srbc.net/pubinfo/press/docs/Project%20Review%20Natural%20Gas%20JW%20Op%20Cease%20Order%20_11_10_2010_.pdf).

regulation of hydraulic fracturing under the SDWA. The EPA is not withdrawing Texas primacy to regulate hydraulic fracturing, but in an unprecedented action is issuing administrative orders to take over the RRC's administrative investigation because the RRC took over three months to investigate the allegation of drinking water contamination.<sup>246</sup>

This section will discuss the Range Resources Corporation and Range Production Company (Range) lawsuit against the EPA's regulation of Texas SDWA regulations due to the alleged contamination of two drinking water wells near Fort Worth, Texas, and the EPA's subsequent lawsuit against Range.

### A. Introduction

Traditionally, federal agencies took a "hands-off" approach to regulating hydraulic fracturing, unless there was clear proof that fluids were contaminating drinking water.<sup>247</sup> However, the EPA now treats allegations as truth and requires the operator to prove its innocence.<sup>248</sup> "It may be true that an environmental regulatory body would be less informed and less familiar with oil and gas procedures and the exact impact of their regulation decisions, but this begs the question—if a regulatory body's goal is environmental protection, should it be more worried about familiarity with industry protocol or with environmental sensitivity?"<sup>249</sup> In the opinion of many observers, the environmental regulatory body is now more worried about social popularity than understanding impermeable geological rock formations, and also ignores facts such as that the Barnett Shale has pre-existing drinking water contamination.<sup>250</sup>

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<sup>246</sup> Emergency Administrative Order, SDWA-06-2011-1208 (EPA, Dec. 7, 2010) [hereinafter *Administrative Order*], available at [http://www.epa.gov/region6/6xa/pdf/range\\_order.pdf](http://www.epa.gov/region6/6xa/pdf/range_order.pdf) (last visited Feb. 8, 2012).

<sup>247</sup> Angela C. Cupas, *The Not-So-Safe Drinking Water Act: Why We Must Regulate Hydraulic Fracturing at the Federal Level*, 33 WM. & MARY ENVTL. L. & POL'Y REV. 605, 607 (2009).

<sup>248</sup> Complaint, Range Prod. Co. v. U.S. EPA, No. 1:11-CV-11, 2011 WL 90134 (W.D. Tex. Jan. 5, 2011) [hereinafter *Range Complaint*]; Complaint, U.S. v. Range Prod. Co., No. 3:11CV00116, 2011 WL 200016 (N.D. Tex. Jan. 18, 2011) [hereinafter *U.S. Complaint*].

<sup>249</sup> Adam J. Bailey, *The Fayetteville Shale Play and the Need to Rethink Environmental Regulation of Oil and Gas Development in Arkansas*, 63 ARK. L. REV. 815, 824–25 (2010).

<sup>250</sup> See News Release, R.R. Comm'n of Tex., Statement from Texas Railroad Commissioner David Porter Regarding Ruling on Range Resources Case (March 22, 2011), available at <http://www.rrc.state.tx.us/pressreleases/2011/032211b.php> (last visited Feb. 13, 2012).

*B. Who Is in Charge of Regulation in Texas*

The EPA accused Range of contaminating two private fresh water wells in southern Parker County, west of Fort Worth, Texas.<sup>251</sup> On August 6, 2010, a landowner filed a complaint with the RRC.<sup>252</sup> Field inspection by RRC noted gas odor. The RRC found two active gas wells within a half mile radius of the water wells, where Range had performed hydraulic fracturing operations in 2009 at a depth of 5,800 feet. Instead of the EPA researching and determining if the water wells' contamination was due to Range's drilling operations, it simply placed the burden of proof on Range to prove whether or not its drilling operations affected the water wells.<sup>253</sup> The water wells' location raises several issues regarding water contamination. First, they are located in the Cretaceous aquifer that is approximately 140 feet from the surface. Immediately below is the Strawn formation that produces natural gas and nitrogen. Surrounding areas have an impermeable seal between the formations that prevents natural gas from migrating into the Cretaceous aquifer. However, these particular areas lack an impermeable seal, so natural gas from the Strawn formation has migrated into the Cretaceous aquifer over geological time.

The second issue relates to previous water well drilling practices in this area of the Cretaceous aquifer. It is well known that a few landowners drilled their water wells too deep, piercing the impermeable seal between the Strawn formation and the Cretaceous aquifer and contaminating their own water wells.<sup>254</sup> Also, shallow natural gas wells that were drilled decades ago, before modern casing and cementing practices were implemented by the industry and the RRC, likely contaminated water wells.<sup>255</sup> The EPA now admits it was aware of some of these factors before issuing its order but did not include those facts in the administrative record because it believes those facts were irrelevant.<sup>256</sup>

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<sup>251</sup> *Administrative Order*, *supra* note 246.

<sup>252</sup> See News Release, R.R. Comm'n of Tex., Railroad Commission's Active, Ongoing Investigation of Parker County Water Well Complaint (Dec. 7, 2010) [hereinafter *Dec. 7th News Release*], available at <http://www.rrc.state.tx.us/pressreleases/2010/120810.php>.

<sup>253</sup> *Administrative Order*, *supra* note 246, at 6 (noting that the EPA does not reference any consultation with Range in the Statement of Facts and only requests information from Range in the Order and General Provision section of the Order.); see also Transcript of EPA Deposition, Range Prod. Co. v. U.S. EPA, No. A-11-CA-011-LY at 258-61 (W.D. Tex. Jan. 25, 2011) [hereinafter *Transcript of EPA Deposition*], available at [http://www.energyindepth.org/wp-content/uploads/2011/02/EPA\\_Blevins\\_Deposition.pdf](http://www.energyindepth.org/wp-content/uploads/2011/02/EPA_Blevins_Deposition.pdf).

<sup>254</sup> Range Prod. Co., R.R. Comm'n of Tex., Oil and Gas Docket No. 7B-0268629, at 9 (2011) [hereinafter *RRC Report*] (examiners' report and proposal for decision), available at <http://www.rrc.state.tx.us/meetings/ogpfd/RangePFD.PDF> (last visited Oct. 18, 2011); see also Transcript of EPA Deposition, *supra* note 253 at 57-63.

<sup>255</sup> See *RRC Report*, *supra* note 254, at 10.

<sup>256</sup> *Transcript of EPA Deposition*, *supra* note 253, at 57-58.



On December 7, 2010, the EPA issued an Emergency Order under Section 1431 of the SDWA.<sup>257</sup> The Emergency Order found Range “caused or contributed to” contamination of the water wells and required Range to conduct a full scale investigation.<sup>258</sup> The EPA required Range to conduct investigations including: immediately providing potable water to residences, sampling soil gas around the residences, sampling all nearby drinking water wells to determine the extent of aquifer contamination, and developing a plan to remediate areas of the aquifer that have been contaminated.<sup>259</sup> The following day, the RRC set a hearing on the Emergency Order for January 10, 2011. Meanwhile, Range provided the landowners with drinkable water, installed methane monitors in their homes, and conducted appropriate tests.<sup>260</sup>

Prior to the EPA’s Emergency Order being issued on December 7, the EPA Region 6 Administrator sent an email to an environmental activist announcing the order minutes before it was issued.<sup>261</sup> The Administrator’s email stated “We’re about to make a lot of news . . . Time to Tivo Channel 8.”<sup>262</sup> The environmental activist replied “Yee haw! Hats off to the new Sheriff and his deputies!”<sup>263</sup> In response to the Emergency Order, RRC Chairman Victor G. Carrillo said

As I repeatedly emphasized to EPA Region 6 Administrator Al Armendariz last Friday, EPA’s actions are premature as the Railroad Commission continues to actively investigate this issue and has not yet determined the cause of the gas. This EPA action is unprecedented in Texas, and commissioners will consider all options as we move forward.<sup>264</sup>

The email chain may provide a glimpse into the tension between federal and state agencies in Texas.

Range provided its results to the EPA; however, the EPA did not reciprocate by sharing its results with Range.<sup>265</sup> On December 17, 2010, Range obtained subpoenas from the RRC for the deposition of EPA employees. The employees did

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<sup>257</sup> *Administrative Order*, *supra* note 246.

<sup>258</sup> *See id.*

<sup>259</sup> *See id.*

<sup>260</sup> *See Range Complaint*, *supra* note 248, at ¶29.

<sup>261</sup> Mike Soraghan, *Natural Gas: Texas EPA Official’s E-mails Show Federal-State Tension over Drilling Sanctions*, E&E PUBLISHING, (Feb. 11, 2011), <http://www.eenews.net/public/Greenwire/2011/02/11/3> (linking the email chain in the article).

<sup>262</sup> *Id.*

<sup>263</sup> *Id.*

<sup>264</sup> *Dec. 7th News Release*, *supra* note 252.

<sup>265</sup> Notice of Removal, Range Prod. Co. v. U.S. EPA, No. 1:11-CV-11, 2011 WL 90134 ¶ 2-3 (W.D. Tex. Jan. 5, 2011).

not appear.<sup>266</sup> On December 28, 2010, Range filed a motion to compel the depositions. On December 30, 2010, the administrative proceeding was moved to the U.S. District Court for the Northern District of Texas.<sup>267</sup> On January 3, 2011, the EPA filed a motion to transfer venue to the Western District of Texas.<sup>268</sup>

Range is unable to defend itself without reviewing evidence the EPA relied upon to issue its December 7 Emergency Order.<sup>269</sup> On January 5, 2011, Range filed a complaint against the EPA in the Western District of Texas seeking judicial review of the EPA's decision to not attend the deposition and to produce substantive documents.<sup>270</sup> In response, the EPA filed a complaint against Range in the Northern District of Texas on January 18, 2011.<sup>271</sup> The EPA's complaint seeks injunctive relief to require Range to comply with the Emergency Order and pay a civil penalty.<sup>272</sup> Even though Range has provided alternative drinking water and installed methane monitors in homes, the EPA claims Range has failed to conduct surveys on private and public water wells, submit plans for field testing, and submit plans to study how methane gas migrated into the aquifer.<sup>273</sup>

### C. RRC's Administrative Hearing

Range presented its evidence to the RRC in an administrative hearing on January 19 and 20, 2011. Even though the EPA claimed that Range is guilty of water contamination, the EPA did not attend the administrative hearings. The federal regulator failed to provide equal access and due process to the public in this administrative hearing.<sup>274</sup> Overall, the EPA has ignored Texas' primacy for regulating hydraulic fracturing in Texas, the public's opportunity for participation in an open administrative hearing, and the alleged violator's right to hear the facts behind each allegation.<sup>275</sup>

At the hearing, Range introduced a photograph of a nearby water well drilled in 2005 that was flaring natural gas and had water flowing without a pump. A geochemical gas fingerprinting expert noted that natural gas found in the water wells contained nitrogen levels comparable to the Strawn formation and twice that

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<sup>266</sup> *See id.*

<sup>267</sup> *See id.*

<sup>268</sup> *Range Complaint, supra* note 248.

<sup>269</sup> *See id.*

<sup>270</sup> *See id.*

<sup>271</sup> *U.S. Complaint, supra* note 248; *see also* News Releases from Region 6, U.S. EPA, U.S. Takes Action to Protect Public Health and Enforce EPA Imminent and Substantial Endangerments Order in Southern Parker County (Jan. 18, 2010), *available at* <http://yosemite.epa.gov/opa/admpress.nsf/e8f4ff7f7970934e8525735900400c2e/6a942b90baed18d58525781c007c48f8!OpenDocument>.

<sup>272</sup> *U.S. Complaint, supra* note 248.

<sup>273</sup> *Id.*; *see also Transcript of EPA Deposition, supra* note 253, at 57–63.

<sup>274</sup> Ingelson, *supra* note 94, at 91.

<sup>275</sup> *See id.*; *RRC Report, supra* note 254.

found in the Barnett Shale.<sup>276</sup> Similarly, the data presented shows natural gas was present in nearby water wells before Range drilled its first well in 2009. A petroleum engineer also testified that pressure tests show the production casing in both wells have mechanical integrity to prevent Barnett Shale gas from migrating behind the pipe.<sup>277</sup> On October 14, 2010, Range performed a pressure test on the production casing and found no leaks.<sup>278</sup> The EPA reviewed this data, but still refused to produce the technical data behind its initial allegations.

On January 25, 2011, Range deposed an EPA official, John Blevins, after the Western District of Texas granted the deposition on January 19, 2011. The statements made during the deposition questioned the EPA's intent in filing its emergency motion. Mr. Blevins said the EPA has the legal authority to ask a company suspected of violating the SDWA to "do the work" proving there is no link between its drilling operation and water well contamination.<sup>279</sup> Even though, the EPA knew at the time that natural gas was in water wells in the immediate area, the EPA admitted that it did not perform a geologic investigation on the Strawn formation near the water wells.<sup>280</sup> Finally, in the deposition, the EPA admitted that Range may not have caused or contributed to the natural gas found in the water wells.<sup>281</sup>

The RRC hearing examiners issued their Proposal for Decision on March 7, 2011, recommending a final order be issued finding that Range has not contributed and is not currently contributing to contamination of any of the water wells.<sup>282</sup> On March 22, 2011, the RRC found that Range's natural gas wells were not contaminating any drinking water wells in Parker County.<sup>283</sup> Additionally, the RRC ruled that Range may continue production from the two natural gas wells:

Evidence presented during the hearing included geochemical gas fingerprinting that demonstrated the gas in the domestic water wells came from the shallower Strawn gas field, which begins about 200 to 400 feet below the surface. The natural gas tested did not match the gas produced by Range from the much deeper Barnett Shale field, which is more than 5,000 feet below the surface in that area. Range also presented information to demonstrate that the two Range gas wells were mechanically sound, without any leaks. Evidence presented at the hearing showed that hydraulic fracturing of gas wells in the area could

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<sup>276</sup> See *RRC Report*, *supra* note 254.

<sup>277</sup> See *id.*

<sup>278</sup> *Dec. 7th News Release*, *supra* note 252.

<sup>279</sup> *Transcript of EPA Deposition*, *supra* note 253, at 269.

<sup>280</sup> *Id.* at 258–61.

<sup>281</sup> See *id.* at 62:6–7.

<sup>282</sup> See *RRC Report*, *supra* note 254.

<sup>283</sup> News Release, R.R. Comm'n of Tex., Statement from Texas Railroad Commissioner David Porter Regarding Ruling on Range Resources Case (Mar. 22, 2011), available at <http://www.rrc.state.tx.us/pressreleases/2011/032211.php>.

not result in communication between the Barnett Shale gas field and shallow aquifers from which water wells in the area produce.<sup>284</sup>

The RRC will continue its ongoing investigation into the source of the natural gas found in the two drinking wells. RRC Commissioner David Porter gave the following statement on the RRC's ruling:

I am pleased with the Railroad Commission's investigation into this matter. We used science, facts and due process in handling this case and found that Range Resources was not responsible for any water contamination in Parker County, contrary to what the EPA said. It is unfortunate that the EPA didn't show up to present their case, but proves the political nature of their stance. I hope this case sets the standard moving forward and that the EPA gets the message that the Railroad Commission of Texas can handle its regulatory jurisdiction and is plenty competent when it comes to protecting our natural resources.<sup>285</sup>

#### *D. Federal Court Cases*

As stated above, the EPA filed a complaint against Range on January 18, 2011, in the Northern District of Texas. Once the RRC found that Range's natural gas wells did not contaminate the water wells, on March 21, 2011, Range filed its Motion to Dismiss and Staying Case under Federal Rule of Civil Procedure 12(b)(1) and 12(b)(6) for lack of subject matter jurisdiction and for failure to state a claim upon which relief may be granted.<sup>286</sup> In May 2011, the EPA filed its response and Range filed its reply. On June 14, 2011, a hearing was held regarding the Motion. On June 20, 2011, the Court denied Range's Motion to Dismiss without prejudice, and stayed the litigation pending the Fifth Circuit's decision in *Range Resources Corp. v. U.S. EPA*, Case No. 11-60040.<sup>287</sup>

After the first significant court ruling on the EPA's test case for using its emergency authority under the SDWA to halt hydraulic fracturing of a natural gas well, the issue will now move to the Fifth Circuit Court of Appeals. On January 20, 2011, Range filed a petition for review asking the Fifth Circuit whether the SDWA's judicial review provisions are unconstitutional and whether the Agency acted arbitrarily and capriciously in issuing Range the broad

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<sup>284</sup> *Id.*

<sup>285</sup> *Id.*

<sup>286</sup> Defendants' Motion to Dismiss for Lack of Subject Matter Jurisdiction or, in the Alternative, for Failure to State a Claim, *U.S. v. Range Prod. Co.*, No. 3:11-CV-00116-F, (N.D. Tex. Mar. 21, 2011).

<sup>287</sup> Order Denying without Prejudice Defendant's Motion to Dismiss and Staying Case, *United States v. Range Prod. Co.*, No. 3:11-cv-116-F, 2011 WL 2469731 (N.D. Tex. June 20, 2011).

emergency order.<sup>288</sup> Oral arguments for this dispute took place on October 3, 2011, and the Fifth Circuit's ruling is pending.

## VI. U.S. CONGRESSIONAL LEGISLATION

The 111th Congress was not successful in passing environmental regulation legislation. The November 2010 elections enabled the Republicans to gain control of the U.S. House of Representatives (House) and close the gap in the U. S. Senate (Senate). The 112th Congress is facing legislation that would limit environmental regulation by the EPA. The 2012 election has 21 Democrats up for reelection in the Senate, 10 of which are from states that do not favor GHG regulation. Political liability will drive future environmental regulatory legislation on Capitol Hill.

### A. *Cap and Trade*

Congress faced regulation of GHGs in proposed cap and trade legislation during the 111th Congress. The issue began gaining traction during the 2008 election cycle and was at its pinnacle prior to the debate over healthcare reform. The House passed the American Clean Energy and Security Act (H.R. 2454) to create jobs, increase energy independence, reduce pollution, and keep energy costs low.<sup>289</sup> Despite the success of the House's version of the European Union's emission trading scheme, cap and trade, the bill languished on the Senate Legislative Calendar for the 111th Congress.<sup>290</sup>

The Clean Energy Jobs and American Power Act of 2009 was passed by the Senate Environment and Public Works Committee in November 2009 and placed on the Senate Legislative Calendar in February 2010.<sup>291</sup> Next, Debbie Stabenow (D-MI) introduced the Clean Energy Partnerships Act of 2009, which was referred to the Committee on Environmental and Public Works in November 2010.<sup>292</sup>

Eventually, a bipartisan effort began in October 2009 when Lindsay Graham (R-SC) and John Kerry (D-MA) announced their effort to pass climate change

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<sup>288</sup> Petition for Review, *Range Resources Corp. v. U.S. EPA*, No. 11-60040, (5th Cir. Jan. 20, 2011).

<sup>289</sup> See Press Release, Pelosi Statement on Comprehensive Clean Energy Legislation (May 13, 2009), available at <http://www.prnewswire.com/news-releases/pelosi-statement-on-comprehensive-clean-energy-legislation-61858007.html>.

<sup>290</sup> American Clean Energy and Security Act, H.R. 2454, 111th Congress (2009), available at <http://thomas.loc.gov/cgi-bin/bdquery/z?d111:h.r.02454>: (last visited Feb. 11, 2012).

<sup>291</sup> Clean Energy Jobs and American Power Act, S. 1733, 111th Congress (2009), available at <http://thomas.loc.gov/cgi-bin/bdquery/z?d111:SN01733:@@@X> (last visited Feb. 11, 2012).

<sup>292</sup> Clean Energy Partnership Act of 2009, S. 2729, 111th Congress (2009), available at <http://thomas.loc.gov/cgi-bin/bdquery/z?d111:s.02729>: (last visited Feb. 11, 2012).

legislation in an opinion piece in *The New York Times*.<sup>293</sup> After Lindsay Graham (R-SC) dropped out in April 2010, John Kerry and Joe Lieberman (I-CT) drafted the American Power Act that was released on May 12, 2010 and revised in July 2010.<sup>294</sup> After Republicans gained control of the House in the November 2010 elections, Ted Poe (R-TX) introduced the Ensuring Affordable Energy Act on December 9, 2010, which would deny fund appropriation to the EPA for cap and trade.<sup>295</sup>

Despite controlling a majority of both the House and the Senate, Democrats could not pass cap and trade legislation. In order to have success in the 112th Congress, the White House and Congress must compromise to ensure GHG regulations pass.

### B. *The EPA's Regulation of GHGs*

Due to the 111th Congress' lack of success, the White House faces bipartisan scrutiny of the EPA's GHG regulations. The EPA's endangerment findings face fierce opposition in the legislative and judicial branches. In January 2010, Lisa Murkowski (R-AK) introduced a resolution to nullify the endangerment finding rule that was defeated in the Senate 47 to 53.<sup>296</sup> In addition, Jay Rockefeller (D-WV) introduced the Stationary Source Regulations Delay Act in March 2010 that would suspend regulations for two years.<sup>297</sup> And, as stated above, the Ensuring Affordable Energy Act would expressly deny the appropriation of funds to the EPA to implement or enforce "any statutory or regulatory requirement pertaining to the emissions of one or more greenhouse gases from stationary sources."<sup>298</sup> On December 28, 2010, Fred Upton (R-MI), chairman of the House Energy and Commerce Committee, stated Congress should overturn the EPA's proposed GHG regulations outright or enter a bipartisan compromise to delay its regulations until the courts rule on the EPA's endangerment findings and proposed rules.<sup>299</sup>

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<sup>293</sup> See John Kerry & Lindsey Graham, *Op-Ed, Yes We Can (Pass Climate Change Legislation)*, N.Y. TIMES, Oct. 10, 2009, [http://www.nytimes.com/2009/10/11/opinion/11kerrygraham.html?\\_r=1](http://www.nytimes.com/2009/10/11/opinion/11kerrygraham.html?_r=1).

<sup>294</sup> See Josh Voorhees & Robin Bravender, *Kerry, Lieberman Push Their Own Utility-Only Climate Bill as Reid's Decision Nears*, N.Y. TIMES, July 14, 2010, <http://www.nytimes.com/cwire/2010/07/14/14climatewire-kerry-lieberman-push-their-own-utility-only-69652.html?adxnnl=1&adxnnlx=1279224042-rEUszfsIUKgzI4Lb0HWXKg>.

<sup>295</sup> See Ensuring Affordable Energy Act, H.R.6511, 111th Cong. (2010).

<sup>296</sup> See S.J.Res. 26, 111th Cong. (2010), <http://thomas.loc.gov/cgi-bin/bdquery/D?d111:38:./temp/~bd4Iri::/home/LegislativeData.php?n=BSS;c=111> (last visited Feb. 11, 2012).

<sup>297</sup> See Stationary Source Regulation Delay Act, S. 3072, 111th Cong. (2010).

<sup>298</sup> Ensuring Affordable Energy Act, H.R.6511.

<sup>299</sup> See Press Release, House Energy & Commerce Comm., Courts Have Yet to Decide if the Agency's Proposed Controls on Carbon Emissions are Even Legal (December

The 112th Congress began with Marsha Blackburn (R-TN) introducing the Free Industry Act on January 5, 2011, which has 125 cosponsors and remains in the Subcommittee on Energy and Power.<sup>300</sup> The bill explicitly amends the CAA to exclude GHG regulations. On March 3, 2011, Fred Upton (R-MI) introduced the Energy Tax Prevention Act of 2011, which currently has 95 cosponsors.<sup>301</sup> The bill seeks to amend the CAA to prohibit the EPA from promulgating any regulation of GHG emissions to address climate change. On March 14, 2011, the Committee on Energy and Commerce passed the bill by a vote of 34 to 19, including three Democrats: John Barrow (D-GA), Jim Matheson (D-UT), and Mike Ross (D-AR).<sup>302</sup> On April 7, 2011, the House passed the bill with a vote of 255 to 172, in which 19 Democrats voted in favor of the law and no Republicans opposed it.<sup>303</sup> On April 8, 2011, the bill was referred to the Senate's Committee on Environment and Public Works.<sup>304</sup>

Meanwhile, on March 3, 2011, James Inhofe (R-OK) introduced the House's version of the Energy Tax Prevention Act of 2011 in the Senate, which has 44 cosponsors.<sup>305</sup> On March 15, 2011, Mitch McConnell (R-KY) introduced an amendment to SBIR/STTR Reauthorization Act of 2011.<sup>306</sup> The amendment incorporates the entire text of the Energy Tax Prevention Act of 2011 that was originally introduced by James Inhofe (R-OK).<sup>307</sup> On March 15, 2011, Mitch McConnell proposed an amendment to Senate Bill 493 that expanded the prohibition of the EPA from any regulation of the emission of GHG to address climate change.<sup>308</sup> On April 6, 2011, the amendment to Senate Bill 493 did not receive 60 votes and the amendment was not agreed to in the Senate.<sup>309</sup> The Democrats' amendment was introduced by Jay Rockefeller's (D-WV), the Stationary Source Regulations Delay Act, which would suspend the EPA's CAA regulations for two years.<sup>310</sup> On April 6, 2011, the amendment was not agreed to in

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28, 2010), <http://energycommerce.house.gov/news/PRArticle.aspx?NewsID=8136> (last visited Sept. 14, 2011).

<sup>300</sup> See Free Industry Act, H.R. 97, 112th Cong. (2011), available at <http://thomas.loc.gov/cgi-bin/bdquery/z?d112:h.r.00097>: (last visited Feb. 11, 2012).

<sup>301</sup> See Energy Tax Prevention Act of 2011, H.R. 910, 112th Cong. (2011), available at <http://thomas.loc.gov/cgi-bin/bdquery/z?d112:h.r.910>: (last visited Feb. 11, 2012).

<sup>302</sup> *Id.*

<sup>303</sup> *Id.*

<sup>304</sup> *Id.*

<sup>305</sup> See Energy Tax Prevention Act of 2011, S. 482, 112th Cong. (2011), available at <http://thomas.loc.gov/cgi-bin/bdquery/z?d112:s.482>: (last visited Feb. 11, 2012).

<sup>306</sup> See SBIR/STTR Reauthorization Act of 2011, S. 493, 112th Cong. (2011), <http://thomas.loc.gov/cgi-bin/bdquery/z?d112:s.493>: (last visited Feb. 11, 2012).

<sup>307</sup> *Id.*

<sup>308</sup> See SA 183, 112th Cong. (2011), available at <http://thomas.loc.gov/cgi-bin/bdquery/z?d112:sp183>: (last visited Feb. 11, 2012).

<sup>309</sup> *Id.*

<sup>310</sup> See SA 215, 112th Cong. (2011), available at <http://thomas.loc.gov/cgi-bin/bdquery/z?d112:sp215>: (last visited Feb. 11, 2012).

the Senate by a vote of 12 to 88.<sup>311</sup> Senate Bill 493 was brought to the Senate floor on May 4, 2011; however, cloture on the bill was not invoked. Even if a bill limiting the EPA's regulation of GHGs passes both the House and the Senate, President Obama will likely veto it.

### *C. The Safe Drinking Water Act*

The 111th Congress failed to pass hydraulic fracturing legislation, although it budgeted for a second EPA study on hydraulic fracturing that may foster federal regulation. On June 9, 2009, Congress introduced the Fracturing Responsibility and Awareness of Chemicals Act.<sup>312</sup> The bill requires the EPA regulation of hydraulic fracturing under the SDWA's UIC program and requires disclosure of hydraulic fracturing fluid chemical constituents. Although the bills never left their committees they inspired funding for a new EPA study on whether hydraulic fracturing affects drinking water. In June 2010, the EPA submitted its proposed study plan for public comment.<sup>313</sup> The EPA expects initial research results by the end of 2012 and a report in 2014.<sup>314</sup>

The issue concerning diesel fuel in hydraulic fracturing fluid began in January 2010 when the Environmental Working Group issued a report (EWG Report) that found state agencies were confused over the diesel exemption.<sup>315</sup> On February 18, 2010, the House Subcommittee on Energy and Environment announced it was sending letters to eight companies regarding the chemicals used in hydraulic fracturing, after two companies admitted using diesel fuel.<sup>316</sup> On August 5, 2010, 25 environmental organizations sent letters to the EPA, House Committee on Energy and Commerce and Subcommittee on Energy and Environment asking them to regulate diesel fuel in hydraulic fracturing.<sup>317</sup> In response, the House

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<sup>311</sup> *Id.*

<sup>312</sup> See Fracturing Responsibility and Awareness of Chemicals Act of 2009, H.R. 2766, 111th Cong. (2009); Fracturing Responsibility and Awareness of Chemicals (FRAC) Act S. 1215, 111th Cong. (2009).

<sup>313</sup> See EPA, HYDRAULIC FRACTURING RESEARCH STUDY (2010) [hereinafter EPA 2010 STUDY], available at <http://www.epa.gov/safewater/uic/pdfs/hfresearchstudyfs.pdf>.

<sup>314</sup> *Id.*

<sup>315</sup> DUSTY HORWITT, ENVTL. WORKING GROUP, DRILLING AROUND THE LAW, available at <http://www.ewg.org/files/EWG-2009drillingaroundthelaw.pdf> (last visited Oct. 24, 2011).

<sup>316</sup> Memorandum: Examining the Potential Impact of Hydraulic Fracturing, *H. Comm. on Energy and Commerce*, 111th Cong. (2010), available at [http://www.bfenvironmental.com/pdfs/hydraulic\\_fracturing\\_memo.pdf](http://www.bfenvironmental.com/pdfs/hydraulic_fracturing_memo.pdf).

<sup>317</sup> See Letter from Wayne Shewmake, President, Arkansas Wildlife Federation et al., to Henry A. Waxman, Chairman, H. Comm. on Energy and Commerce et al., (Feb. 18, 2010), available at <http://ewg.org.s3.amazonaws.com/letters/8-5-10/DieselLetterHouseE&C8.5.2010.pdf>.



included an EPA study on whether hydraulic fracturing contaminates drinking water in its fiscal year 2010 budget report.<sup>318</sup>

The November 2010 elections gave Republicans control of the House. Before closing session, the House Energy and Commerce Committee Democratic congressional investigation issued a letter to the EPA.<sup>319</sup> The Congressmen contended that 12 companies injected 32.3 million gallons of diesel or fluids containing diesel into wells in 19 states from 2005 through 2009 in violation of the SDWA.<sup>320</sup> Under the Energy Policy Act of 2005, companies using diesel fuel must get a permit to be in compliance with the SDWA.<sup>321</sup> The industry does not dispute the EPA's authority to regulate diesel fuel in hydraulic fracturing under the SDWA. However, the industry says there are currently no requirements in the federal regulations that require a company to obtain a federal permit prior to using diesel fuel during a hydraulic fracturing project.<sup>322</sup>

On March 15, 2011, Diana DeGette (D-CO) reintroduced the Fracturing Responsibility and Awareness of Chemicals Act in the House and it remains before the House Committee on Energy and Commerce's Subcommittee on Environment and the Economy.<sup>323</sup> On the same day, Robert Casey (D-PA) reintroduced it in the Senate and on April 12, 2011, hearings were held before the Committee on Environment and Public Works' Subcommittee on Water and Wildlife.<sup>324</sup> On June 2, 2011, Jim Matheson (D-UT) introduced the FUEL Act and it is before four committees, including the House Energy and Commerce's Subcommittee on Energy and Power.<sup>325</sup> Section 112 of the FUEL Act clarifies that the sense of Congress is: 1) the SDWA was not intended to regulate oil and gas well construction and stimulation, 2) states have effectively regulated oil and gas well construction and stimulation, and 3) the industry should voluntarily disclose

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<sup>318</sup> EPA's *Study of Hydraulic Fracturing and its Potential Impact on Drinking Water Resources*, EPA, <http://www.epa.gov/hfstudy/> (last visited Feb. 11, 2012).

<sup>319</sup> See Letter from Henry A. Waxman, Ranking Member, H. Comm. On Energy and Commerce et al to the Honorable Lisa Jackson, Administrator, U.S. EPA (Jan. 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>.

<sup>320</sup> *Id.*

<sup>321</sup> Energy Policy Act of 2005, Pub. L. 109-58, 119 Stat. 694 (Aug. 2005).

<sup>322</sup> Abraham Lustgarten, *Drilling Industry Says Diesel Use Was Legal*, PROPUBLICA (Feb. 2, 2011), available at <http://www.propublica.org/article/drilling-industry-says-diesel-use-was-legal> (last visited Feb. 13, 2012).

<sup>323</sup> Fracturing Responsibility and Awareness of Chemicals Act of 2011, H.R. 1084., 112th Cong. (2011), available at <http://thomas.loc.gov/cgi-bin/bdquery/z?d112:h.r.01084>: (last visited Feb. 11, 2012).

<sup>324</sup> FRAC Act, S. 587, 112th Cong. (2011), available at <http://thomas.loc.gov/cgi-bin/bdquery/z?d112:SN00587:@@@X> (last visited Feb. 11, 2012).

<sup>325</sup> FUEL Act, H.R. 2133, 112th Congress (2011), available at <http://thomas.loc.gov/cgi-bin/bdquery/D?d112:3:/temp/~bdwY2w::/home/LegislativeData.php?n=BSS;c=112> (last visited Feb. 11, 2012).

hydraulic fracturing chemicals used in the stimulation process and make the information available to the public.<sup>326</sup>

## VII. STUDIES ON HYDRAULIC FRACTURING

Environmental groups and industry experts are calling for more peer-reviewed scientific research. For example, The NRDC says, “independent, unbiased scientific inquiry into hydraulic fracturing is critical.”<sup>327</sup> In another example from the industry, Noble Energy says, “[w]e believe that government, environmental groups, and the general public’s opinion of HF has been misrepresented by inadequate studies. These published papers lack some key elements that are integral to include before they can be considered scientific papers.”<sup>328</sup> Out of the numerous studies on hydraulic fracturing, this section will focus on six key studies.

### A. Ground Water Protection Council Survey

On December 15, 1998, the GWPC released a study titled “Survey Results on Inventory and Extent of Hydraulic Fracturing in Coalbed Methane Wells in the Producing States.”<sup>329</sup> The GWPC surveyed the 25 state natural gas regulatory agencies of the major coal producing states that produced coalbed methane gas in 1997.

Its purpose was to determine the number of active coalbed methane wells and to determine if hydraulic fracturing had or would occur. Additionally, the survey sought to identify contamination of drinking water due to hydraulic fracturing. Of the 25 states, 13 reported having coalbed methane wells.<sup>330</sup> Of the reported 10,373 wells in the U.S., 10,260 wells were found in eight states: Oklahoma, Wyoming, Colorado, Utah, New Mexico, Kansas, Virginia, and Alabama.<sup>331</sup> The majority of

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<sup>326</sup> *Id.*

<sup>327</sup> FRAC ATTACK, *supra* note 49, at 28.

<sup>328</sup> Letter from Bob Bernis, V.P. of Envtl. Health & Safety, Noble Energy, to Edward Hanlon, Designated Federal Officer, EPA Science Advisory Board (Mar. 29, 2010), available at [http://yosemite.epa.gov/sab/sabproduct.nsf/4F7BF10C49E55568852576F7006DA70F/\\$File/Pub+Comments+by+B+Bemis+for+Noble+Energy+Inc+3-29-10+for+EE+C+Apr+7-8+2010+Meeting.pdf](http://yosemite.epa.gov/sab/sabproduct.nsf/4F7BF10C49E55568852576F7006DA70F/$File/Pub+Comments+by+B+Bemis+for+Noble+Energy+Inc+3-29-10+for+EE+C+Apr+7-8+2010+Meeting.pdf).

<sup>329</sup> GROUND WATER PROTECTION COUNCIL, SURVEY RESULTS ON INVENTORY AND EXTENT OF HYDRAULIC FRACTURING IN COALBED METHANE WELLS IN THE PRODUCING STATES (1998), available at <http://www.gwpc.org/e-library/documents/general/Survey%20Results%20on%20Inventory%20and%20Extent%20of%20Hydraulic%20Fracturing%20in%20Coalbed%20Methane%20Wells%20in%20the%20Producing%20State.pdf>.

<sup>330</sup> *Id.* at 9.

<sup>331</sup> *Id.*

the wells were already hydraulically fractured.<sup>332</sup> Approximately 1,130 wells were hydraulically fractured in 1997.<sup>333</sup>

Four of the eight major producing states have regulatory or oversight programs for coalbed methane wells. The remaining four states regulate them under their general natural gas rules. Alabama was the only state to report a complaint of drinking water contamination, which was not substantiated after hydrologic and reservoir investigations and tests by several agencies were conducted.<sup>334</sup> The GWPC concluded that no additional federal regulations were necessary to protect drinking water: “[t]here is no evidence to support the claims by some that public health is at risk as a result of the hydraulic fracturing of coalbeds used for the production of methane gas.”<sup>335</sup> It determined that the existing state agencies’ regulation was sufficient to protect drinking water.<sup>336</sup>

The GWPC’s study raised concerns about states’ financial burden of implementing new federal regulations. The federal UIC State Grants budget has remained constant over the last 10 years at \$10.5 million; however, it is spread among all 50 states that regulate the UIC programs.<sup>337</sup> Increasing the states’ regulatory burden would dilute their ability to regulate these programs.

#### *B. Interstate Oil and Gas Compact Commission Survey*

In July 2002, the IOGCC released a survey of the natural gas producing states.<sup>338</sup> The survey’s purpose was to provide an understanding of hydraulic fracturing and its role in the completion of natural gas wells. It found that states have regulated hydraulic fracturing since its inception.<sup>339</sup> Over two-thirds of the responding states claimed a majority of their wells have been hydraulically fractured.<sup>340</sup> All responding states indicated that there is no harm due to hydraulic fracturing.<sup>341</sup> The IOGCC concluded the hydraulic fracturing process was understood and well regulated by natural gas producing states.<sup>342</sup>

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<sup>332</sup> *Id.*

<sup>333</sup> *Id.*

<sup>334</sup> *Id.* at 9–10.

<sup>335</sup> *Id.* at 9–11.

<sup>336</sup> *Id.*

<sup>337</sup> *Id.* at 10.

<sup>338</sup> INTERSTATE OIL AND GAS COMPACT COMM., STATES EXPERIENCE WITH HYDRAULIC FRACTURING: A SURVEY OF THE INTERSTATE OIL AND GAS COMPACT COMMISSION (2002), available at <http://www.energyindepth.org/PDF/IOGCC%20Hydraulic%20Fracturing%20Study%202007-2002.pdf>.

<sup>339</sup> *Id.*

<sup>340</sup> *Id.*

<sup>341</sup> *Id.* at 2.

<sup>342</sup> *Id.* at 1.

*C. The EPA 2004 Survey*

In June 2004, the EPA released its study determining the potential for contamination of underground drinking water due to hydraulic fracturing fluid injections into coalbed methane wells.<sup>343</sup> The EPA “concluded that the injection of hydraulic fracturing fluids into coalbed methane wells poses little or no threat to USDWs and does not justify additional study at this time.”<sup>344</sup> In essence, the EPA did not find “confirmed evidence” that hydraulic fracturing of coalbed methane wells contaminates drinking water.<sup>345</sup>

The EPA study was isolated to hydraulic fracturing operations in coalbed methane gas wells, because the public and Congress saw coalbed methane gas production as the greatest threat to drinking water due to three factors. First, coalbed methane gas is shallower and closer to drinking water than shale gas. Second, the EPA had not heard public concern regarding hydraulic fracturing of shale gas. Third, the Eleventh Circuit LEAF litigation only concerned hydraulic fracturing of coalbed methane gas wells. Therefore, the EPA limited its review to 11 major coal basins throughout the nation in which hydraulic fracturing has been used.<sup>346</sup>

The production of coalbed methane gas began as a safety measure to reduce the explosive hazard of methane gas in underground coalmines. In 1980, Congress enacted a tax credit for coalbed methane gas wells. In 1984, there were a couple wells, but by 1990, there were nearly 8,000 wells.<sup>347</sup> By 2000, there were a total of 13,973 wells in production from 13 states.<sup>348</sup> Coalbed methane gas production from 13 states totaled 1.353 tcf, an increase of 156 percent from 1992.<sup>349</sup>

Coalbed methane gas’ geological location is of significant importance. The target regions may occur within drinking water and injections are made directly into drinking water or the target coalbed may be adjacent, geologically higher or lower, to drinking water. The EPA found that 10 of the 11 basins lie partially within underground sources of drinking water zones.<sup>350</sup>

The EPA study looked at two mechanisms for contamination. First, the “[d]irect injection of fracturing fluids into USDW in which the coal is located, or injection of fracturing fluids into a coal seam that is already in hydraulic communication with a USDW.”<sup>351</sup> The threat of injecting hazardous chemicals into

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<sup>343</sup> *EPA 2004 Study, supra* note 147.

<sup>344</sup> *Id.*

<sup>345</sup> *Id.*

<sup>346</sup> *See id.* The basins include: Powder River, Black Warrior, San Juan, Central Appalachian, Raton Basin, Uinta, Western Interior, Northern Appalachian, Piceance, Pacific Coal, and Sand Wash.

<sup>347</sup> *EPA 2004 Study, supra* note 147, at ES-2.

<sup>348</sup> *See id.*

<sup>349</sup> *Id.*

<sup>350</sup> *Id.*

<sup>351</sup> *Id.*

drinking water is significantly reduced by the removal of large quantities of groundwater, including the hydraulic fracturing fluid, once the hydraulic fracturing operation is performed on a well. The chemical concern was assumed to be moot because of the 2003 MOA which stated that major service companies will not use diesel fuel in hydraulic fracturing injections into drinking water for coalbed methane gas production.<sup>352</sup>

The second mechanism for contamination is “the creation of a hydraulic connection between the coalbed formation and an adjacent USDW.”<sup>353</sup> Unfractured coalbed methane formations have low permeability that protects drinking water from being affected by hydraulic fracturing fluids. Additionally, fluids may also be isolated in the coal seams, strata that contain the coalbed methane gas and dense systems of cleats or naturally occurring fractures.<sup>354</sup> Therefore, the EPA study concluded there is little potential for drinking water contamination due to hydraulic fracturing.<sup>355</sup>

*D. The Natural Resources Defense Council “Drilling Down” Report*

In October 2007, the NRDC issued its report focusing on environmental and human health issues due to the overall natural gas production.<sup>356</sup> The second sentence of the report states “[o]il and gas production is a dirty process; many of the steps involved can be sources of dangerous pollution that can have serious impacts on the region’s air, water, and land—and on people’s health.”<sup>357</sup> Additionally, the report uses “toxic” 85 times to describe natural gas operations. However, the “NRDC has not determined a direct cause and effect relationship between toxic exposure and the health problems of specific individuals.”<sup>358</sup> Its conclusion was based on a mere possibility that hydraulic fracturing is harmful to human health and the environment.

Even though the NRDC found no “direct cause” or chemicals “linked” to health concerns, the report sought three things. First, it wanted public disclosure of the chemicals used that may harm human health, even though the chemical products are confidential and may be legally protected.<sup>359</sup> Second, it wanted to

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<sup>352</sup> See 2003 MOA, *supra* note 145.

<sup>353</sup> *Id.*

<sup>354</sup> *Id.*

<sup>355</sup> *Id.*

<sup>356</sup> AMY MALL ET AL., NATURAL RES. DEF. COUNCIL, DRILLING DOWN: PROTECTING WESTERN COMMUNITIES FROM THE HEALTH AND ENVIRONMENTAL EFFECTS OF OIL AND GAS PRODUCTION (2007), available at <http://www.nrdc.org/land/use/down/down.pdf>.

<sup>357</sup> *Id.* at 4.

<sup>358</sup> *Id.* at 5.

<sup>359</sup> *Id.* at 31–32.

close all legal loopholes for natural gas exemptions under federal laws.<sup>360</sup> Finally, it requested the best available methods to monitor and track human health.<sup>361</sup>

The report suggested modifications to several federal laws that contain natural gas exemptions.<sup>362</sup> Under the CAA, the NRDC requested the aggregation of natural gas emissions under National Emissions Standards for Hazardous Air Pollutants.<sup>363</sup> Natural gas and its equipment should be included on the list of small hazardous air pollutant sources so the EPA may regulate natural gas wells and pits.<sup>364</sup> Hydrogen sulfide should be placed back on the list of hazardous air pollutants, because estimates indicate that 15 to 25 percent of all natural gas wells contain hydrogen sulfide that can be released by well heads, pumps, storage tanks, and flaring.<sup>365</sup>

Under the SDWA, all hydraulic fracturing should be subject to the UIC program.<sup>366</sup> Due to the suspicion that it pollutes drinking water and contains chemicals linked to human health effects, daily fines for the industry need to be increased from \$5,000 to \$10,000 a day, which is equal to other industries.<sup>367</sup> Underground injections must meet the RCRA's definition of hazardous waste under the Class I injection standard.<sup>368</sup>

Under the CWA, the term "navigable" needs to be deleted so that all water is covered to address erosion and discharge of sediments into waters.<sup>369</sup> The industry should be required to get storm water permits for all natural gas activities, which would reduce municipal water treatment costs.<sup>370</sup> The definition of "pollutant" should be expanded to include all materials used in natural gas operations.<sup>371</sup>

The report called for a full investigation of potential health concerns due to all natural gas operations.<sup>372</sup> It noted that operations may release hazardous substances found naturally beneath the earth's surface into the environment, including: benzene, toluene, ethylbenzene, xylene, radioactive materials, hydrogen sulfide, arsenic, and mercury.<sup>373</sup> The report cited an analysis of products used in natural gas operations in four states, which found more than 350 products used and in which more than 90 percent contained chemicals with one or more adverse human health effect.<sup>374</sup> The adverse health effects include "skin, eye, and sensory organ toxicity;

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<sup>360</sup> *Id.*

<sup>361</sup> *Id.*

<sup>362</sup> *Id.*

<sup>363</sup> *Id.* at 8–9.

<sup>364</sup> *Id.* at 10.

<sup>365</sup> *Id.*

<sup>366</sup> *Id.* at 20.

<sup>367</sup> *Id.*

<sup>368</sup> *Id.* at 21.

<sup>369</sup> *Id.* at 20.

<sup>370</sup> *Id.* at 29.

<sup>371</sup> *Id.* at 32.

<sup>372</sup> *Id.* at 22.

<sup>373</sup> *Id.*

<sup>374</sup> *Id.*

respiratory problems; neurotoxicity; and gastrointestinal and liver damage.”<sup>375</sup> In essence, the report requested additional regulations and studies on the effects of hydraulic fracturing.<sup>376</sup>

*E. The Environmental Working Group “Drilling Around the Law” Report*

In the EWG Report, the Environmental Working Group found that natural gas drilling companies were avoiding federal law by injecting toxic “petroleum distillates” into wells which threatened drinking water.<sup>377</sup> The conclusion is based on a six month investigation of chemical disclosure records filed by drilling companies and interviews with five state regulation agencies.<sup>378</sup>

The report found that drilling companies were openly using, in addition to diesel fuel, other “petroleum distillates” that contained the same toxic chemicals: benzene, toluene, ethylbenzene, and xylene.<sup>379</sup> State and federal regulatory agencies were not tracking the fluids used in hydraulic fracturing. Some agencies claimed hydraulic fracturing was exempt under the SDWA, even with diesel fuel. Therefore, the industry could be using diesel fuel in hydraulic fracturing without a permit.

In response, the Environmental Working Group listed five recommendations.<sup>380</sup> First, Congress should require the industry to comply with the SDWA for all hydraulic fracturing fluids.<sup>381</sup> Second, Congress should require public disclosure of chemicals.<sup>382</sup> Third, the U.S. Department of Interior should require such disclosure for wells drilled on federal land.<sup>383</sup> Fourth, Congress should investigate the oversight of hydraulic fracturing by federal and state agencies and instruct them on the law.<sup>384</sup> Finally, the EPA should determine whether the industry is using diesel fuel and enforce permit requirements.<sup>385</sup>

The report recognized hydraulic fracturing is a “bridge fuel” that must be balanced by drinking water protection.<sup>386</sup> For example, contamination of New York City’s watershed would cost New York City \$20 billion to clean.<sup>387</sup> Therefore, regulation agencies must protect drinking water by issuing permits for diesel fuel and “petroleum distillates” used in hydraulic fracturing.

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<sup>375</sup> *Id.* at 6.

<sup>376</sup> *Id.* at 31–33.

<sup>377</sup> HORWITT, *supra* note 315.

<sup>378</sup> *See id.*

<sup>379</sup> *Id.*

<sup>380</sup> *Id.* at 3.

<sup>381</sup> *Id.*

<sup>382</sup> *Id.*

<sup>383</sup> *Id.*

<sup>384</sup> *Id.*

<sup>385</sup> *Id.*

<sup>386</sup> *Id.* at 7–8.

<sup>387</sup> *Id.* at 8.

*F. The EPA 2014 Survey*

The House Appropriations Conference Committee included an EPA study on hydraulic fracturing in its Fiscal Year 2010 budget report.<sup>388</sup> The study seeks to understand any potential impacts of hydraulic fracturing on drinking water and groundwater. The scope of the study includes “the full lifecycle of water in hydraulic fracturing, from water acquisition through the mixing of chemicals and actual fracturing to the post-fracturing stage, including the management of flow back and produced water and its ultimate treatment and/or disposal.”<sup>389</sup>

In June 2010, the EPA submitted its proposed study plan for comment.<sup>390</sup> In September, the EPA issued voluntary information requests to nine hydraulic service companies.<sup>391</sup> In December, they received confirmation from the last company, Halliburton, after serving a subpoena. On February 8, 2011, the EPA issued its draft study plan for review to the agency’s Science Advisory Board which will begin reviewing the draft study plan and will obtain comments from stakeholders and the public in March.<sup>392</sup> They will address the following five fundamental research questions: (i) how might large volume water withdrawals from ground and surface water impact drinking water resources, (ii) what are the possible impacts of accidental releases of hydraulic fracturing fluids on drinking water resources, (iii) what are the possible impacts of the injection and fracturing process on drinking water resources, (iv) what are the possible impacts of accidental releases of flowback and production water on drinking water resources, and (v) what are the possible impacts of inadequate treatment of hydraulic fracturing wastewaters on drinking water resources?<sup>393</sup>

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<sup>388</sup> See EPA, DRAFT PLAN TO STUDY THE POTENTIAL IMPACTS OF HYDRAULIC FRACTURING ON DRINKING WATER RESOURCES (2011) [hereinafter EPA 2011 STUDY], available at [water.epa.gov/type/groundwater/uic/class2/hydraulicfracturing/upload/HFStudyPlanDraft\\_SAB\\_020711-08.pdf](http://water.epa.gov/type/groundwater/uic/class2/hydraulicfracturing/upload/HFStudyPlanDraft_SAB_020711-08.pdf).

<sup>389</sup> *Id.* at vii.

<sup>390</sup> EPA 2010 STUDY, *supra* note 313.

<sup>391</sup> News Release, EPA, EPA Formally Requests Information From Companies About Chemicals Used in Natural Gas Extraction / Information on hydraulic fracturing chemicals is key to agency study of potential impacts on drinking water (Sept. 9, 2010), available at <http://yosemite.epa.gov/opa/admpress.nsf/d0cf6618525a9efb85257359003fb69d/ec57125b66353b7e85257799005c1d64!OpenDocument>.

<sup>392</sup> EPA 2011 STUDY, *supra* note 388.

<sup>393</sup> *Id.* at ix.



Once the Science Advisory Board provides their comments, the EPA will revise the study plan and promptly begin its research. They expect initial research results by the end of 2012 and a full report ready in 2014.

### VIII. ENVIRONMENTAL CONCERNS WITH HYDRAULIC FRACTURING

The social and economic benefits of hydraulic fracturing are offset by its potential burden on the environment. The first environmental issue facing natural gas is whether the coalbed methane regulatory system promotes sustainable development.<sup>394</sup> Sustainable development is the obligation of each generation to ensure the environment is no worse when passed to the next generation.<sup>395</sup>

Sustainable development in the U.S. faces a critical divide between economic and social development. The federal government offers a national perspective on regulation, whereas states consider public policy in local settings that are in close proximity to the regulated community.<sup>396</sup> According to a 2009 Global Insight study, a ban on hydraulic fracturing would reduce U.S. domestic natural gas production by 45 percent within the next five years; this number should be significantly higher due to 2011 natural gas production numbers.<sup>397</sup> This ban would be devastating to state economies. In 2009 alone, the Marcellus Shale natural gas production was estimated to bring Pennsylvania 44,000 new jobs, \$389 million in state and local taxes, over \$1 billion in federal taxes, and \$4 billion in value added to its' economy.<sup>398</sup> Despite the economic benefits, environmental groups continue to attack the industry with allegations of environmental harm.

#### *A. Introduction to Environmental Concerns with Hydraulic Fracturing*

##### *1. Environmental Concerns*

Shale gas caught the public's attention when drilling rigs were no longer silhouetted by a prairie, but instead pierced the urban skyline interlaced with homes, businesses, schools, and churches. For example, the McCoy Elementary School in Aztec, New Mexico has two natural gas wells within 400 feet of its doors and 150 feet from its playground.<sup>399</sup> The Piedra Vista High School in Farmington, New Mexico is roughly 500 feet from a well site.<sup>400</sup> With such proximity to natural gas operations, complaints of smell and operational traffic are no surprise.

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<sup>394</sup> Ingelson, *supra* note 94, at 51.

<sup>395</sup> *Id.*

<sup>396</sup> See John A. Veil, *The Discrete Charm of Cooperative Federalism: Environmental Citizen Suits in the Balance*, 27 VT. L. REV. 81, 97–98 (2002).

<sup>397</sup> See *Unlocking America's Gas*, *supra* note 79.

<sup>398</sup> *See id.*

<sup>399</sup> MALL ET AL., *supra* note 356.

<sup>400</sup> *Id.*

The NRDC looked at the proximity of natural gas wells to residential homes in Garfield County, Colorado and San Juan County, New Mexico. However, the 2007 study does not discuss whether any of the natural gas wells were completed by hydraulic fracturing, but simply identifies active and inactive natural gas and coal bed methane wells. In Garfield County, there are 7,298 wells and 1,179 residential homes, 8.5 percent of the homes are within 500 meters of one well and 276 of those homes are within 500 feet of at least five wells.<sup>401</sup> In San Juan County, New Mexico, there are 18,711 wells and 28,207 residential homes; 20,048 homes are near one well, 14,540 homes are near two wells, and 3,065 homes are near at least five wells.<sup>402</sup> The recent increased number of natural gas wells in populated areas has caused the public to start questioning whether hydraulic fracturing affects human health and the environment.

## 2. *The Industry's Response*

Federal regulators and environmental groups persistently defame hydraulic fracturing as a pollutant that contaminates our nation's drinking water sources. There are a number of criticisms and claims often expressed against the practice of hydraulic fracturing, including: wastes being released into water treatment systems and drinking water supplies; gas seepage into water supplies; air pollution; visual and noise disturbances in neighboring communities; increased traffic and congestion at drill sites; and increased opportunities for industrial accidents.<sup>403</sup>

An unsubstantiated figure quickly spread through environmental groups that more than 1,000 drinking water contamination cases had been documented by state and local governments.<sup>404</sup> However, representatives from the EPA and U.S. Geological Survey testified before the Senate Committee on Environment and Public Works' hearing on "Federal Drinking Water Programs" that they were unaware of a single example of drinking water contamination from hydraulic fracturing.<sup>405</sup> In reality, in 2007, the industry spent \$14 billion on environmental preservation and \$11.9 billion "to implement new technologies, create cleaner fuels, and fund ongoing environmental initiatives."<sup>406</sup> In addition to making the

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<sup>401</sup> *Id.* at 2.

<sup>402</sup> *Id.*

<sup>403</sup> See generally Ian Urbina, *Regulation Lax as Gas Wells' Tainted Water Hits Rivers*, N.Y. TIMES (Feb. 26, 2011), <http://www.nytimes.com/2011/02/27/us/27gas.html> (describing some of the concerns typically raised in opposition to hydraulic fracturing).

<sup>404</sup> See Matthew J. Armstrong & Jason B. Hutt, *Congress May Address Hydraulic Fracturing this Year: Boom in Shale Drilling for Natural Gas Brings to the Forefront Debate over Environmental Risks*, 32 NAT'L L.J. 22 (2010).

<sup>405</sup> See *Obama Administration: No Documented Cases of Hydraulic Fracturing Contamination*, MEDIA NEWSWIRE (Dec. 9, 2009), [http://media-newswire.com/release\\_1107527.html](http://media-newswire.com/release_1107527.html).

<sup>406</sup> *Investing in Our Environment*, ENERGY IN DEPTH, <http://www.energyindepth.org/in-depth/environment-in-depth/sound-stewardship/> (last visited Oct. 27, 2011).

public aware of its environmental efforts, the industry needs to draw the public's attention to the fact that it has hydraulically fractured more than 1 million natural gas wells over the last 60 years without ever directly contaminating a drinking water source.<sup>407</sup> EISs have been done on both coalbed methane and shale gas wells. There is a 1,700 page EIS for Wyoming and Montana regarding coalbed methane gas wells in which the EPA provided feedback on "environmental issues to be covered and the mitigation measures required to minimize environmental impacts on hydrological resources, soil resources, vegetation resources, livestock, aquatic resources, wildlife resources, and ecological integrity from CBM development."<sup>408</sup> In the 1,700 page report, not one piece of evidence showed that hydraulic fracturing contaminates drinking water or destroys the environment. Additionally, the EPA's main recommendation in the report was to create a slower approach to producing coalbed methane gas; however, the Bureau of Land Management (BLM) and state agencies chose not to implement its recommendation.

### *B. Groundwater and Underground Water Contamination*

Water contamination near natural gas wells is potentially due to one of three possibilities. First, hydraulic fracturing could produce fractures that extend directly into the shallow rock formations that contain drinking water supplies. Second, the well's casing might fail and permit fluids to escape into underground drinking water supplies. Third, accidentally spilled fluids at the surface used for hydraulic fracturing might contaminate surface water or seep into groundwater.

#### *1. Migration through Natural Fractures*

##### *(i) Environmental Concerns*

Operators use two practices that could potentially allow chemicals to migrate over a mile through impermeable rock formations and into drinking water. The first practice is allowing a percentage of fluids to remain underground in the shale formations upon completion of the hydraulic fracturing process. The fluid's rate of recovery may be only 70 to 80 percent, depending on several factors.<sup>409</sup> Environmental groups fear that unrecovered chemicals will migrate into drinking water sources. Unfortunately, to date, there is very little research on the impact that remaining hydraulic fracturing fluids have on the environment. The majority of the research that currently exists focuses only on coalbed methane formations, because of its close proximity to drinking water.<sup>410</sup>

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<sup>407</sup> See Lee, *supra* note 1.

<sup>408</sup> Ingelson, *supra* note 94, at 84.

<sup>409</sup> See Murphy, *supra* note 149, at 407.

<sup>410</sup> Bailey, *supra* note 249, at 824–25; Cupas, *supra* note 247, at 606.

The second practice potentially leading to the migration of chemicals underground occurs when operators re-inject disposal wells with hydraulic fracturing wastewater containing chemicals. The injection wells are both on and off-site underground cavities where operators inject wastewater, drilling mud, or salt water that contains heavy metals.<sup>411</sup> Underground saltwater injection wells pose a contamination risk due to seepage, so saltwater injection wells are heavily regulated by state and federal agencies. In Texas, steel casing and cement must be used in all zones above the disposal zone to prevent drinking water contamination.<sup>412</sup> In 2008, there were 96,684 injection wells on the books in Texas.<sup>413</sup> However, only 50,650 of these wells were properly permitted.<sup>414</sup>

(ii) *The Industry's Response*

In addition to creating environmentally friendly technology, the industry needs to educate the public about the geology of shale gas formation. In the Barnett Shale, the depth to the base of treatable water is roughly 1,200 feet; meanwhile, the shale formation is usually 6,500 to 8,500 feet deep.<sup>415</sup> The force of gravity and over a mile of impermeable rock separating the target shale formation from the shallow ground water zone prevents migration of hydraulic fracturing fluids.<sup>416</sup> These intervening layers of rock often contain multiple layers of shale or siltstone that act as natural barriers to the vertical migration of fluids.

There is limited risk from hydraulic fracturing injections because the majority of fluids are withdrawn from the well after injection is complete and handled pursuant to state and federal waste management regulations. What little hydraulic fracturing fluid is left behind is isolated deep underground separated from drinking water supplies by impermeable rock and steel casing and cement.

Operators use design target analysis of hydraulic fracturing treatments through microseismic fracture mapping and tilt measurements.<sup>417</sup> This technology allows engineers to define the success and orientation of the fractures created and enables them to manage the reservoir through strategic placement of additional wells. These techniques ensure that the fractures do not extend beyond the target formation and into adjacent rock formations.

When operators re-inject disposal wells with hydraulic fracturing wastewater containing chemicals it is done deep below the surface to protect the shallow drinking water wells. For example, in the Barnett Shale, injection wells reach the

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<sup>411</sup> Bailey, *supra* note 249, at 826.

<sup>412</sup> R. Marcus Cady, II, *Drilling into the Issue: A Critical Analysis of Urban Drilling's Legal, Environmental, and Regulatory Implications*, 16 TEX. WESLEYAN L. REV. 127, 143 (2009).

<sup>413</sup> *Id.* at 142.

<sup>414</sup> *See id.* at 141.

<sup>415</sup> MODERN SHALE GAS, *supra* note 10, at 17.

<sup>416</sup> Deweese, *supra* note 75, at 16.

<sup>417</sup> MODERN SHALE GAS, *supra* note 10, at 57.

Ellenburger formation 1.5 miles below the surface which is even deeper than the Barnett Shale itself.<sup>418</sup> The extremely porous rock of the Ellenburger formation already contains saltwater and easily absorbs the wastewater preventing it from migrating above.

## 2. Casing or Cement Issues

### (i) Environmental Concerns

Industry standards and regulations for proper casing and cementing have been implemented to act against natural gas contamination. On November 4, 2009, the PADEP released its Consent Order and Agreement which found that nine Cabot Oil and Gas Corporation (Cabot) wells in Susquehanna County, Pennsylvania, were in violation of proper casing regulations.<sup>419</sup> Two of Cabot's wells had excessive pressure and six wells had insufficient or improper casing cement that allowed natural gas to vent. Investigators found that the faulty well casings allowed natural gas to migrate to drinking water. Cabot was required to submit well casing and cementing plans to the PADEP for approval before resuming natural gas operations.

Once the PADEP ruled against Cabot, the Susquehanna County drinking water dilemma led to litigation in late 2009 and further fines. Nineteen families sued Cabot for drinking water contamination.<sup>420</sup> In April 2010, Cabot was required to plug and abandon three wells that were believed to have contaminated the drinking water. The PADEP originally said Cabot must pay \$11.8 million for a new public water line.<sup>421</sup> However, on December 15, 2010, Cabot came to an agreement with the PADEP to pay the residents \$4.1 million.<sup>422</sup> Cabot also agreed to pay Pennsylvania \$500,000 to offset the investigation expenses.<sup>423</sup> The agreement allowed Cabot to continue hydraulic fracturing operations in Susquehanna County.

The Deepwater Horizon well in the Gulf of Mexico brought public attention to the importance of a blowout preventer. At the surface, the casing is attached to a

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<sup>418</sup> CHESAPEAKE ENERGY, THE FACTS AND PROCESS OF SALTWATER DISPOSAL IN THE BARNETT SHALE (2008) [hereinafter SALTWATER DISPOSAL FACTS], *available at* [http://www.askchesapeake.com/Barnett-Shale/Multimedia/Brochures/SWD\\_Final\\_12-15-08%20spread.pdf](http://www.askchesapeake.com/Barnett-Shale/Multimedia/Brochures/SWD_Final_12-15-08%20spread.pdf).

<sup>419</sup> See Consent Order and Agreement for Cabot Oil and Gas Corp., Pa. Dep't of Env'tl. Protection (Nov. 4, 2009), *available at* [http://s3.amazonaws.com/propublica/assets/natural\\_gas/final\\_cabot\\_co-a.pdf](http://s3.amazonaws.com/propublica/assets/natural_gas/final_cabot_co-a.pdf).

<sup>420</sup> Jon Hurdle, *UPDATE 1-Cabot to Pay \$4.1 Mln in Penn. Gas Contamination*, REUTERS (Dec. 15, 2010), <http://www.reuters.com/article/2010/12/16/cabot-idUSN1518374720101216>.

<sup>421</sup> *Id.*

<sup>422</sup> *Id.*

<sup>423</sup> *Id.*

well head that has a blowout preventer attached. Blowout preventers are large valves that immediately close if overpressure from an underground formation causes fluids to enter the wellbore. However, blowout preventers can fail which may cause personal injury or environmental contamination. On June 3, 2010, an EOG Resources well suffered a blowout in Clearfield County, Pennsylvania, that spewed natural gas and wastewater for 16 hours.<sup>424</sup> An independent investigation found that the blowout, which happened while post-hydraulic fracturing well cleanout activities were being performed, was the result of untrained personnel and the improper use of well control procedures.<sup>425</sup> The PADEP fined both EOG Resources and C.C. Forbes, LLC more than \$400,000 and suspended all natural gas operations in Pennsylvania for 40 days.<sup>426</sup>

(ii) *The Industry's Response*

The industry places multiple strings of steel casing and cement in the wellbore to protect surface groundwater. State agencies set regulatory controls for exploration and production, i.e., casing and cementing. For instance, Texas regulations require the operator to set and cement the surface casing deeper than 200 feet below the specified depth to protect all usable-quality water strata.<sup>427</sup> Additionally, the American Petroleum Institute creates industry standards for cementing and casing that the industry follows.<sup>428</sup>

Natural gas operators use industry standards that include safety precautions that are designed to protect the environment. For example, Chesapeake uses seven layers of protection in its well design for deep shale developments.<sup>429</sup> First, conductor casing is set and cemented into place with impermeable cement.<sup>430</sup> Second, surface casing is run inside the cemented conductor casing below the deepest aquifer.<sup>431</sup> Third, surface casing is cemented back to the surface.<sup>432</sup> Fourth,

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<sup>424</sup> *Pa. Blowout Report Cites Mistakes*, TIMES LEADER (July 13, 2010), [http://www.timesleader.com/news/Pa\\_blowout\\_report\\_cites\\_mistakes\\_07-14-2010.html](http://www.timesleader.com/news/Pa_blowout_report_cites_mistakes_07-14-2010.html).

<sup>425</sup> Press Release, Pa. Dep't of Env'tl. Protection, Independent Report Faults Clearfield County Gas Well Operators for June 3 Blowout DEP Outlined Proper Procedures for all Marcellus Drilling Firms (July 13, 2010), *available at* <http://www.portal.state.pa.us/portal/server.pt/community/newsroom/14287?id=12818&typeid=1>.

<sup>426</sup> *Id.*

<sup>427</sup> 16 TEX. ADMIN. CODE §3.13(b)(2)(A)(i) (2010) (RRC).

<sup>428</sup> AM. PETROLEUM INST., HYDRAULIC FRACTURING OPERATIONS-WELL CONSTRUCTION AND INTEGRITY GUIDELINES (2009), *available at* [http://www.api.org/~media/Files/Policy/Exploration/API\\_HF1.ashx](http://www.api.org/~media/Files/Policy/Exploration/API_HF1.ashx).

<sup>429</sup> CHESAPEAKE ENERGY, ENVIRONMENTAL CHALLENGES: THE FACTS ABOUT WATER (2010) [hereinafter WATER FACTS REPORT], *available at* [http://csis.org/files/attachments/100309\\_PHagemeier\\_ChESApeake.pdf](http://csis.org/files/attachments/100309_PHagemeier_ChESApeake.pdf) (last viewed Sept. 14, 2011).

<sup>430</sup> *Id.* at 13.

<sup>431</sup> *Id.*

<sup>432</sup> *Id.*

production casing is run inside the cemented surface casing to the deep shale formation.<sup>433</sup> Fifth, production casing is sealed with a combination of bentonite clay and additives and cemented back to the surface in three stages.<sup>434</sup> Sixth, steel production tubing is run inside the cemented production casing.<sup>435</sup> Finally, internal plastic coating is run inside the steel production tubing to prevent corrosion.<sup>436</sup>

These layers of protection are designed to prevent natural gas or chemicals from escaping around the drill pipe and contaminating drinking water by preventing natural gas or chemicals from traveling outside the casing from the mile deep shale formations to surface drinking water. If chemicals and natural gas were allowed to escape, it would potentially not only contaminate drinking water, but would also cost the operator lost revenue from natural gas production and lost time and money in order to stop the natural gas from escaping from the reservoir.

### 3. *Surface Spills*

#### (i) *Environmental Concerns*

Hydraulic fracturing fluids are handled above ground before and after injection. Because this creates contamination risks from spills, run-off, or seepage from reserve and storage tanks, the chemicals must be handled properly to prevent an environmental threat. For example, chlorine is an important water purifier, but if handled improperly it can create a disaster.<sup>437</sup>

The PADEP gave Cabot 10 days to explain its cleanup strategy for two chemical spills in Dimock, Pennsylvania on September 16, 2009, that were due to a pipe connection failure.<sup>438</sup> The first spill was between 1,000 and 2,000 gallons of a lubricant used in hydraulic fracturing; the second spill was approximately 5,900 gallons of the same material.<sup>439</sup> On September 22, 2009, a third spill of 420 gallons occurred when a hose ruptured.<sup>440</sup> The chemicals spilled into a nearby stream killing fish, but there is no evidence of drinking water contamination from these

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<sup>433</sup> *Id.*

<sup>434</sup> *Id.*

<sup>435</sup> *Id.*

<sup>436</sup> *Id.*; see also RANGE RES., HYDRAULIC FRACTURING: MARCELLUS SHALE (2010) [hereinafter HYDRAULIC FRACTURING REPORT], available at <http://www.rangeresources.com/rangeresources/files/6f/6ff33c64-5acf-4270-95c7-9e991b963771.pdf>.

<sup>437</sup> Deweese, *supra* note 75, at 8.

<sup>438</sup> See John Hurdle, *Penn. Charges Cabot with Natgas Chemical Spills*, REUTERS (Sept. 22, 2009), available at <http://www.reuters.com/article/2009/09/22/energy-pennsylvania-idUSN2236809420090922>.

<sup>439</sup> See *id.*

<sup>440</sup> See *id.*

spills.<sup>441</sup> The PADEP fined Cabot \$56,650 and ordered all hydraulic fracturing operations to cease; the ban was lifted on October 16, 2009.<sup>442</sup>

In addition to spills, chemicals may potentially seep out of durable pit liners and contaminate ground water. If this happens and depending on what chemicals are being stored in the pit, it may effectively render the soil unsuitable for vegetative growth by creating a barren wasteland. Operators are currently permitted to store wastewater in lined pits at the well site while waiting on disposal trucks. The pits also collect storm water and overflow. Municipalities, including Fort Worth, have recently enacted ordinances that require closed-loop drilling systems to eliminate the need for pits.<sup>443</sup>

(ii) *The Industry's Response*

The industry continues to research and implement environmentally friendly hydraulic fracturing fluids. For example, Range uses a defoamer to flush the wellbore and break down soaps.<sup>444</sup> The defoamer strengthens the cementing process by removing the soaps and eliminating annular spaces between the casings that may impact cementing.<sup>445</sup> The industry seeks to replace harmful chemicals “with biodegradable or organic substances, such as ground fruit seeds and nutshells.”<sup>446</sup>

Surface spill contamination technology has also drastically improved. The industry uses mats that contain potential spills. For example, Chesapeake requires all chemical trailers, containers, and raw chemical transfer equipment to be placed in lined secondary containment sites that are constructed to contain fluids.<sup>447</sup> Additionally, there are several absorbent materials onsite to soak up a spill. To further ensure environmental safety, the industry should require a storm water pollution prevention plan. This could be accomplished by “installing vegetative ground cover, berms, temporary fabric barriers known as silt fences, or turnouts (ditches extended into a vegetated area to disperse and filter storm water runoff).”<sup>448</sup> These containment measures will help prevent contamination from runoff and seeping due to surface spills.

Operators have also begun drilling with compressed air instead of fluids.<sup>449</sup> This practice saves the operators money by reducing their mud costs and

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<sup>441</sup> *See id.*

<sup>442</sup> *See DEP Fines Cabot Oil and Gas Corp. \$56,650 for Susquehanna County Spills*, PENNSYLVANIA DEP'T OF ENV'T PROTECTION, available at [http://www.portal.state.pa.us/portal/server.pt/community/search\\_articles/14292](http://www.portal.state.pa.us/portal/server.pt/community/search_articles/14292) (last visited Feb. 10, 2012).

<sup>443</sup> *See Cady*, *supra* note 412, at 141.

<sup>444</sup> *See HYDRAULIC FRACTURING REPORT*, *supra* note 436.

<sup>445</sup> *Id.*

<sup>446</sup> *Cupas*, *supra* note 247, at 630.

<sup>447</sup> *WATER FACTS REPORT*, *supra* note 429.

<sup>448</sup> *MALL ET AL.*, *supra* note 356.

<sup>449</sup> *MODERN SHALE GAS*, *supra* note 10.



shortening drilling times. The air functions like drilling mud to cool the bit and remove cuttings. However, current technology limits its use to only low pressure formations such as the Marcellus formation.

### *C. Hydraulic Fracturing Wastewater Disposal*

#### *1. Environmental Concern*

Hydraulic fracturing wastewater is usually trucked to sewage treatment plants for treatment or disposed of on the surface into rivers and streams. Wastewater may contain high levels of radioactivity that naturally exists in the rock formations. Federal and state regulators only began testing for radioactivity at most sewage treatment plants within the last five years. In Pennsylvania, most drinking water intake plants downstream from sewage treatment plants have not tested for radioactivity since before 2006.<sup>450</sup> Because there is no comprehensive federal standard to determine a safe level of radioactivity in drilling wastewater, drilling wastewater is unrealistically compared to federal drinking water standards. The radioactivity in drilling wastewater can be hundreds or even thousands of times the maximum allowance for drinking water.<sup>451</sup>

Most treatment facilities are unable to remove enough radioactive material to meet the federal drinking water standards before releasing the wastewater into rivers.<sup>452</sup> For example, in Pennsylvania, radioactive wastewater was discharged into the Mongahela River, which provides drinking water to more than 800,000 people, including Pittsburgh.<sup>453</sup> Radioactive wastewater was also discharged into the Susquehanna River which feeds into Chesapeake Bay and provides drinking water to more than six million people, including Harrisburg and Baltimore.<sup>454</sup>

Wastewater is also disposed of on the surface at the well site without testing for radioactivity. In the Powder River Basin in Wyoming and Montana, 99.9 percent of the water is discharged on the surface, estimated to be 60 million gallons each day.<sup>455</sup> The disposal of water into washes, gullies, and rills can potentially change the flow of streams and rivers.<sup>456</sup> This can alter ecological structure, damage vegetation, increase sediments downstream, and cause erosion.<sup>457</sup> Wastewater that has high salinity can be harmful to croplands. Federal and state regulators should prevent the industry from disposing of wastewater that contains harmful chemicals and radioactive materials directly on the surface.

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<sup>450</sup> Urbina, *supra* note 403.

<sup>451</sup> *Id.*

<sup>452</sup> *Id.*

<sup>453</sup> *Id.*

<sup>454</sup> *Id.*

<sup>455</sup> *See* Murphy, *supra* note 149, at 407.

<sup>456</sup> *Id.*

<sup>457</sup> *Id.* at 408.

## 2. *The Industry's Response*

Hydraulic fracturing wastewater is either disposed of at wastewater treatment plants, underground storage wells, or runoff into nearby streams or rivers. The industry must become involved in self-regulating the sewage treatment facilities that dispose of hydraulic fracturing wastewater. Treatment plants operate under the premise that most toxic materials will settle during the treatment process into a sludge that can be taken to landfills and the remaining toxic materials will be diluted when sent to rivers. In Pennsylvania, the EPA found that sewage treatment plants were discharging radium-laced drilling wastewater into the Ohio River in attempts to unsuccessfully dilute radium to allowable levels.<sup>458</sup> Even though the act was done by a non-industry company, the industry took the blame for polluting the environment.<sup>459</sup>

Most state agencies claim their regulations are sufficient to prevent the disposal of toxic materials. However, isolated events occur that do not reflect state practices at sewage treatment facilities. For example, 12 sewage treatment plants in three states discharged partially treated drilling waste into rivers, lakes, and streams.<sup>460</sup> Pennsylvania currently only requires its drinking water intake facilities to be tested once every six to nine years.<sup>461</sup> Agencies need to strictly and frequently inspect the treatment facilities to ensure toxic material is properly removed. Additionally, state agencies should assist the industry in creating better technology to remove harmful chemicals.

The industry needs more treatment plants that are equipped to remove potential toxic substances from hydraulic fracturing wastewater. Drilling companies continue to recycle more wastewater; however, recycling is not yet utilized on a large enough scale to reduce the strain on local resources and reduce production costs.<sup>462</sup> The long term goal should be to create onsite treatment facilities that will immediately treat the fluid once it exits the wellbore. Also, the industry needs to find ways to limit the amount of water used in hydraulic fracturing operations in order to lessen the workload for treating wastewater.

Reverse osmosis is a promising water clarification process that needs more research and development. It uses semi-permeable membrane filters that vary in pore size to limit bigger particles from passing through the filter when pressurized water is forced through the filters.<sup>463</sup> The membrane allows pure water to flow

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<sup>458</sup> *Documents: Natural Gas's Toxic Waste*, N.Y. TIMES, Feb. 26, 2011, <http://www.nytimes.com/interactive/2011/02/27/us/natural-gas-documents-1.html#document/p533/a9948>.

<sup>459</sup> *See id.*

<sup>460</sup> Urbina, *supra* note 403.

<sup>461</sup> *Id.*

<sup>462</sup> Bailey, *supra* note 249, at 828.

<sup>463</sup> *Reverse Osmosis*, ENVIRONMENTALLY FRIENDLY EXPLORATION & PROD., <http://www.efdsystems.org/Technologies/ProducedWater/ReverseOsmosis/tabid/1785/Default.aspx> (last visited Nov. 7, 2011).

through, while blocking contaminants, such as salt, lead, manganese, iron, and calcium.<sup>464</sup> However, reverse osmosis is unable to filter municipal water because it contains volatile organic compounds (VOC) and contaminants, such as chlorine.<sup>465</sup> Currently wastewater that is treated by reverse osmosis and is still too contaminated will need a permit for disposal in an injection well.<sup>466</sup>

Underground disposal wells are mostly natural gas wells that were found not to contain natural gas upon completing drilling, called dry wells. In Texas, wastewater disposal is usually conducted by injecting water into deep dry wells that serve as natural depositories. Texas has natural saltwater depositories with limestone caps over a mile below drinking water which makes underground disposal a viable option.<sup>467</sup> However, in Pennsylvania, the underlying geological formations make underground disposal much more difficult.<sup>468</sup> The best option for Pennsylvania would be to treat the wastewater at in-state facilities.<sup>469</sup>

In addition to treatment and disposal options, the industry needs to continue exploring the environmentally friendly option of recycling wastewater, such as a closed-loop drilling fluid system. The RRC has approved several companies' application for recycling projects in the Barnett Shale. Fountain Quail Water Management's recycling process reuses 80 percent of the returned hydraulic fracturing fluids that are processed through its mobile recycling unit.<sup>470</sup> "As of October 2010, Fountain Quail has processed over 12.7 million barrels of returned fracture fluid to recover over 9.9 million barrels of reusable distilled water."<sup>471</sup>

Since 2005, Devon has been recycling wastewater at an increase of 40 percent of traditional disposal methods.<sup>472</sup> The recycling process requires four steps.<sup>473</sup> First, a flocculant is added to the wastewater to make the fine particles congeal and settle at the bottom for easier separation.<sup>474</sup> Second, the suspended solids are removed and disposed of in a landfill.<sup>475</sup> Third, a boiling, vaporization, and

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<sup>464</sup> *Id.*

<sup>465</sup> *Id.*

<sup>466</sup> *Id.*

<sup>467</sup> Laura C. Reeder, *Creating a Legal Framework for Regulation of Natural Gas Extraction from the Marcellus Shale Formation*, 34 WM. & MARY ENVTL. L. & POL'Y REV. 999, 1000 (2010).

<sup>468</sup> *Id.* at 1001.

<sup>469</sup> *Id.* at 1012.

<sup>470</sup> *See Water Use in the Barnett Shale*, R.R. COMM'N OF TEXAS, (last modified Jan. 24, 2011), available at [http://www.rrc.state.tx.us/barnettshale/wateruse\\_barnettshale.php](http://www.rrc.state.tx.us/barnettshale/wateruse_barnettshale.php) (last visited Sept. 14, 2011).

<sup>471</sup> *Id.*

<sup>472</sup> *Water Recycling in North Texas: 400 Million Gallons and Counting*, DEVON ENERGY CORP., <http://www.devonenergy.com/CorpResp/initiatives/Pages/Initiatives-Water-Recycling.aspx> (last visited Nov. 7, 2011).

<sup>473</sup> *Id.*

<sup>474</sup> *Id.*

<sup>475</sup> *Id.*

distillation process separates the salt.<sup>476</sup> Finally, the distilled water is returned to use in future hydraulic fracturing operations. Devon has recycled 600 million gallons of water through late-2010, enough water to hydraulically fracture 125 wells.<sup>477</sup>

Land farming is another successful disposal option that uses bioremediation or biological agents to remove contaminants. The U.S. Geological Survey has found certain microorganisms, naturally present in the soil, that actively consume and change toxic compounds from natural gas into harmless carbon dioxide.<sup>478</sup> Researchers are stimulating microorganisms through nutrient addition to increase the rate of biodegradation which would potentially limit contamination.<sup>479</sup>

Chesapeake has begun studying evaporating a portion of the wastewater as another potential method for wastewater disposal. Chesapeake uses Intevras' EVRAS system that filtrates water and uses heat generated by the natural gas compressors to evaporate a portion of the wastewater.<sup>480</sup> Estimates indicate that 1,200 barrels of fresh water can be evaporated out of 3,000 barrels of concentrated saltwater.<sup>481</sup> Evaporation reduces the total amount of wastewater that would then need to be injected into disposal wells.

#### *D. Human and Animal Health*

##### *1. Environmental Concern*

Environmental groups are requesting more research to determine the impact of hydraulic fracturing on human health. They claim the 2004 EPA study was botched.<sup>482</sup> Weston Wilson, an ex-EPA environmental engineer, blew the whistle on the study by claiming it was "scientifically unsound . . . [and] that the study's findings were premature. . . ."<sup>483</sup>

In Texas, a hospital system in six counties with active natural gas drilling stated it found a 25 percent asthma rate increase for young children in 2010.<sup>484</sup> A study of a New Mexico community on a former oil field with several active wells nearby showed a higher prevalence of rheumatic diseases, lupus, neurological systems, respiratory systems, and cardiovascular problems compared to like

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<sup>476</sup> *Id.*

<sup>477</sup> *Id.*

<sup>478</sup> *Bioremediation: Nature's Way to a Cleaner Environment*, U.S. GEOLOGICAL SURVEY, <http://water.usgs.gov/wid/html/bioremed.html> (last modified Apr. 1, 1997).

<sup>479</sup> *Id.*

<sup>480</sup> SALTWATER DISPOSAL FACTS, *supra* note 418.

<sup>481</sup> *Id.*

<sup>482</sup> Cupas, *supra* note 247, at 607.

<sup>483</sup> *Id.* at 624.

<sup>484</sup> *See Urbina, supra* note 403.

communities without similar exposure.<sup>485</sup> To date, there are numerous health complaints, but no direct way to link them to hydraulic fracturing.

In addition to potentially harming human health, discharge of wastewater into streams or rivers can severely alter wildlife habitat, rivers, soils, and aquifers. Wastewater may change riparian vegetation which affects roosting spots, shade, and woody debris that are relied upon by trout, eagles, herons, and other species.<sup>486</sup> In the BLM's first environmental assessment of the Powder River Basin, the BLM found that coalbed methane development "may result in trends toward federal listing under the Endangered Species Act for 16 species, including the white-tailed prairie dog, the burrowing owl, and the Brewer's sparrow."<sup>487</sup> Environmental groups now want to require the industry to conduct an environmental impact statement on fish, wildlife, and plant inventories before drilling in a new region.

In 2009 in Caddo Parish, Louisiana, 17 cattle were found dead near a Chesapeake drill site.<sup>488</sup> Schlumberger was the onsite service company.<sup>489</sup> Louisiana regulators found that hydraulic fracturing fluid leaked from a well pad and ran into the adjacent pasture where the cattle consumed the fluid.<sup>490</sup> Although Chesapeake and Schlumberger denied that the material discharge from the well site killed the cattle, the Louisiana Department of Environmental Quality entered a settlement agreement with the companies where both companies paid \$22,000.<sup>491</sup>

## 2. *The Industry's Response*

The industry has responded to environmental concerns by drilling several wells at a single location in order to reduce its environmental footprint. Horizontal drilling has allowed Devon to drill up to 11 wells on one pad in the Barnett Shale.<sup>492</sup> Carrizo Oil & Gas has drilled 22 wells from one drill pad that captures natural gas from 1,100 acres beneath the University of Texas at Arlington campus.<sup>493</sup> This practice of drilling multiple wells at a single location minimizes surface disturbances and truck traffic. Additionally, it reduces the number of

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<sup>485</sup> *Id.*

<sup>486</sup> See Murphy, *supra* note 149, at 407.

<sup>487</sup> *Id.* at 410.

<sup>488</sup> FRAC ATTACK, *supra* note 49, at 25.

<sup>489</sup> *Id.*

<sup>490</sup> *Id.*

<sup>491</sup> *Companies Fined \$22,000 each in Cattle Deaths*, WBRZ.COM (Mar. 26, 2010, 8:34 AM), <http://www.wbrz.com/news/companies-fined-22000-each-in-cattle-deaths/>.

<sup>492</sup> *Multi-well Pads Becoming the Norm*, DEVON ENERGY CORP., <http://www.devonenergy.com/CorpResp/initiatives/Pages/Multi-wellPads.aspx> (last visited Nov. 7, 2011).

<sup>493</sup> See Jack Z. Smith, *UT-Arlington Pad Site Exemplifies New Drilling Trend*, FORT WORTH STAR-TELEGRAM, Oct. 1, 2010, at C1; see also *Directional and Horizontal Drilling in Oil and Gas Wells: Methods used to increase production and hit targets that cannot be reached with a vertical well*, GEOLOGY.COM, <http://geology.com/articles/horizontal-drilling/> (last visited Nov. 7, 2011).

storage tanks and other equipment needed by consolidating operations between the numerous wells on one pad. These actions lessen natural gas production's impact on human health because they reduce the number of compressors needed which in turn reduces the amount of GHGs emitted into the air.

The industry recognized that several animal species require particular protection. One example is the sage grouse which is a bird found throughout the western U.S., though their population numbers are dwindling.<sup>494</sup> Sage grouse fear manmade structures, so state and federal regulations generally require a two mile buffer from their known breeding grounds.<sup>495</sup> Along with federal and state agencies, the industry conducts surveys counting the sage grouse at their breeding grounds in order to ensure their breeding grounds are properly identified and that natural gas production is not interfering with their annual breeding rituals.<sup>496</sup>

The survival of sage grouse is also at grave risk because of the development of wind energy on their breeding grounds. Approximately "440,000 birds are killed by wind turbines each year, according to the United States Fish and Wildlife Service, although that number is expected to exceed one million by 2030 as the number of wind farms grows to meet increased demand."<sup>497</sup> The sage grouse dilemma requires environmental groups to choose between promoting renewable wind energy and preserving wildlife in their habitats. In the meantime, the industry is working toward preserving and restoring sage grouse's habitat, the sagebrush. The industry and environmental groups must work together to ensure that sage grouse are not placed on the endangered species list or, even worse, become extinct.

### *E. Air Quality and Pollution*

#### *1. Environmental Concern*

Natural gas operations contribute to air pollution by emitting carbon dioxide and other pollutants into the air. First, gas powered compressors at each well emit carbon dioxide and other air pollutants including formaldehyde.<sup>498</sup> Additionally, motor vehicles used in hydraulic fracturing operations also emit carbon dioxide into the air.

Second, air pollutants are emitted from venting storage tanks and during the production process itself.<sup>499</sup> Methane is a clean burning fuel; however, venting

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<sup>494</sup> *Helping Preserve the Sage Grouse*, DEVON ENERGY CORP., <http://www.dvn.com/CorpResp/initiatives/Pages/Sage%20Grouse.aspx#terms?disclaimer=yes> (last visited Nov. 7, 2011).

<sup>495</sup> *Id.*

<sup>496</sup> *Id.*

<sup>497</sup> Elisabeth Rosenthal, *Tweety Was Right: Cats Are a Bird's No. 1 Enemy*, N.Y. TIMES, Mar. 21, 2011, at A15.

<sup>498</sup> See Murphy, *supra* note 149, at 412.

<sup>499</sup> *Id.*

done during the production process releases large amounts of GHG into the air which counters the positive effects of methane.<sup>500</sup> In 2009, rural parts of Wyoming failed to meet federal standards for air quality for the first time in its history, because of fumes containing benzene and toluene that were allegedly emitted from roughly 27,000 wells in Wyoming.<sup>501</sup> Sublette County in Wyoming experienced higher levels of ozone than Houston and Los Angeles due to vapors reacting in sunlight.<sup>502</sup> And, in Garfield County, Colorado, a study found that more than 30 tons of benzene were released from 460 wells into the air, nearly 20 times more benzene than released by giant industrial oil refineries in Denver.<sup>503</sup>

Natural gas operations may also emit VOC chemicals into the air.<sup>504</sup> VOC reacts with sunlight and creates smog that is hazardous to human health and causes chest pain, coughing, throat irritation, bronchitis, emphysema, and asthma.<sup>505</sup> A report projects that natural gas operations in Colorado, New Mexico, Utah, Wyoming, and Montana will double the VOC emissions to 965,000 tons a year by 2018.<sup>506</sup> This would equal the average VOC emitted from 50,000 gas stations a year or 25 million passenger cars each driven 12,500 miles.<sup>507</sup> In Garfield County, Colorado, natural gas operations release more VOC than cars, trucks, and all other sources, equating to 77 percent of all human-caused emissions and 95 percent of all stationary VOC emissions county wide.<sup>508</sup>

It is estimated that 15 to 25 percent of natural gas wells contain hydrogen sulfide, which is associated with eye, nose, and throat irritation, nausea, vomiting, and headaches.<sup>509</sup> A famous example of the potential health effects from wells involved Mayor Calvin Tillman of Dish, Texas, who left his government position due to his children's health issues, which were potentially linked to air emissions.<sup>510</sup> Mayor Tillman's sons have been waking up during the night with severe nosebleeds.<sup>511</sup> Residents of Dish have been complaining of health issues since the first compressor station was built there in 2005.<sup>512</sup>

The TCEQ Mobile Monitoring Team began conducting ambient air monitoring survey projects in the Fort Worth, Texas, area from April 19 through

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<sup>500</sup> *Id.*

<sup>501</sup> Urbina, *supra* note 403.

<sup>502</sup> *Id.*

<sup>503</sup> MALL ET AL., *supra* note 356.

<sup>504</sup> *Id.* at 8.

<sup>505</sup> *Id.*

<sup>506</sup> *Id.*

<sup>507</sup> *Id.*

<sup>508</sup> *Id.* at 9.

<sup>509</sup> *Id.* at 9, 11.

<sup>510</sup> Joanna Zelman, *Mayor Calvin Tillman Leaves Dish, Texas Fearing 'Fracking' Effects on Family's Health*, THE HUFFINGTON POST (Feb. 24, 2011, 11:55 AM), [http://www.huffingtonpost.com/2011/02/24/mayor-calvin-tillman-leav\\_n\\_827478.html](http://www.huffingtonpost.com/2011/02/24/mayor-calvin-tillman-leav_n_827478.html).

<sup>511</sup> *Id.*

<sup>512</sup> *Id.*

23, 2010.<sup>513</sup> The Team surveyed 97 locations for samples to analyze for 84 target VOC's.<sup>514</sup> The results from the samples did not show any short-term health or welfare concerns.<sup>515</sup> However, the benzene concentrations were considered elevated above typical background concentrations.<sup>516</sup> The TCEQ will continue surveillance and characterization of the emissions to help determine if these concentrations are representative of typical ambient conditions.<sup>517</sup>

In 2002, the NRDC testified before the Senate on behalf of families in Alabama that developed cancers from “unknown” sources.<sup>518</sup> The testimony was prior to the industry discontinuing the use of diesel fuel in the hydraulic fracturing fluids. Diesel fuel contains toxins, including benzene, toluene, ethylbenzene, and xylenes.<sup>519</sup> Benzene is a known human carcinogen.<sup>520</sup> Excessive exposure to the toxins listed above has been shown to cause damage to the central nervous system, liver, and kidneys.<sup>521</sup> Although, hydraulic fracturing is used in roughly 90 percent of all natural gas wells, all hydraulic fracturing operations are prohibited from using diesel fuel.<sup>522</sup> The industry needs to take the opportunity to hedge the dangers of hydraulic fracturing fluids by disclosing all chemicals currently used in hydraulic fracturing fluids and their potential health risks to the public.

## 2. *The Industry's Response*

The main issue of air pollution is carbon dioxide from compressors and methane emissions from natural gas operations. The EPA states that natural gas-fired power plants produce half the carbon dioxide, less than a third of the nitrogen

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<sup>513</sup> Interoffice Memorandum from the Texas Comm'n on Env'tl. Quality on the Health Effects Evaluation of City of Fort Worth Follow-Up Survey Project, Fort Worth, Texas Area April 19–23, 2010 (July 7, 2010), available at [http://www.tceq.state.tx.us/assets/public/implementation/barnett\\_shale/samplingFtWorth/2010.07.07-HealthEffectsFollow-upApril%202010.pdf](http://www.tceq.state.tx.us/assets/public/implementation/barnett_shale/samplingFtWorth/2010.07.07-HealthEffectsFollow-upApril%202010.pdf).

<sup>514</sup> *Id.*

<sup>515</sup> *Id.*

<sup>516</sup> *Id.*

<sup>517</sup> *Id.*

<sup>518</sup> Bailey, *supra* note 249, at 824–26.

<sup>519</sup> David O. Williams, *House Probe: Fracking Companies Injected 32 Million Gallons of Diesel Fuel Into Ground*, REAL ASPEN (Feb. 3, 2011), <http://www.realaspen.com/article/449/House-probe-Fracking-companies-injected-32-million-gallons-of-diesel-fuel-into-ground>.

<sup>520</sup> Bailey, *supra* note 249, at 828.

<sup>521</sup> Williams, *supra* note 519.

<sup>522</sup> *Free Pass for Oil and Gas: Env'tl. Protections Rolled Back as Western Drilling Surges: Oil and Gas Industry Exemptions*, ENVTL. WORKING GRP., <http://www.ewg.org/reports/Free-Pass-for-Oil-and-Gas/Oil-and-Gas-Industry-Exemptions> (last visited Nov. 7, 2011); Allison Sherry, *Democrats Raise Red Flag on Drilling, Water-Safety Act*, DENVER POST, February 1, 2011, available at [http://www.denverpost.com/news/ci\\_17255410](http://www.denverpost.com/news/ci_17255410).



oxides, and one percent of the sulfur oxides that coal-fired power plants emit.<sup>523</sup> Additionally, in comparison to gasoline or diesel-fueled vehicles, natural gas vehicles produce 80 percent less ozone precursors and 95 percent fewer particulates.<sup>524</sup> To further reduce air pollution, the industry has begun implementing several environmentally friendly measures that have also proven to be economical.

Chesapeake began using polyethylene pipe to transport water instead of vehicles that emit carbon dioxide into the air. At the Dallas-Fort Worth International Airport, Chesapeake constructed nearly 21 miles of corrosion resistant polyethylene pipe to transport wastewater directly from the wells to two saltwater injection wells.<sup>525</sup> This act significantly reduced emissions and eliminated road wear.<sup>526</sup>

Failure to implement the emission reducing activities as standard practice costs operators time and money. In May 2007, Kerr-McGee agreed to spend \$18 million in pollution controls as part of its settlement under the CAA across Utah and Colorado.<sup>527</sup> Its control measures and operational improvements are expected to reduce the annual air pollutant emission by more than 5,500 tons per year.<sup>528</sup> However, Kerr-McGee could have mitigated its costs by preemptively implementing these measures.

The industry has systems in place to reduce methane that escapes during the clean-up stage after hydraulically fracturing a well. During flow back of hydraulic fracturing fluid, natural gas is produced along with water from the wellbore.<sup>529</sup> Green completion systems use portable equipment to separate the natural gas from the water.<sup>530</sup> This recovers at least half of the total natural gas produced.<sup>531</sup> The recovered natural gas is then directed to a pipeline and sold.<sup>532</sup>

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<sup>523</sup> See Cady, *supra* note 412, at 130.

<sup>524</sup> See *id.*

<sup>525</sup> SALTWATER DISPOSAL FACTS, *supra* note 418.

<sup>526</sup> See *id.*

<sup>527</sup> See News Release, Office of Enforcement and Compliance Assurance, EPA, Kerr-McGee Reaches Major Settlement on Natural Gas Production in Colorado and Utah (May 17, 2007), available at <http://yosemite.epa.gov/opa/admpress.nsf/2467feca60368729852573590040443d/0ff61e4e98efe594852572de0069cfcc!OpenDocument> (last visited Sept. 14, 2011).

<sup>528</sup> EPA, A LEGACY OF PROGRESS: ENVTL. RESULTS IN THE ROCKY MOUNTAINS AND PLAINS REGION 2001–2008 11 (2008), available at <http://www.epa.gov/region8/about/EPARegion8ProgressAndPriorities.pdf> (last visited Nov. 9, 2011).

<sup>529</sup> *Green Completions Now the Standard in Barnett Shale*, DEVON ENERGY Corp., <http://www.devonenergy.com/CORPRESP/INITIATIVES/Pages/GreenCompletions.aspx#terms?disclaimer=yes> (last visited Nov. 9, 2011) [hereinafter *Devon's Green Completions*].

<sup>530</sup> *Id.*

<sup>531</sup> *Id.*

<sup>532</sup> *Id.*

Devon has been using the green completion system in the Barnett Shale since 2004 and has reduced its methane emissions by more than 15 bcf.<sup>533</sup> The system works by using a sand separator to filter out sand into a disposal tank.<sup>534</sup> Then, the remaining water and natural gas is separated into a second piece of equipment.<sup>535</sup> The natural gas is eventually diverted and sent by pipeline to a processing plant.<sup>536</sup> The total cost to rent the system is roughly \$1,000 a day and can save an average of 11,900 mcf of natural gas per well.<sup>537</sup> According to Devon, the conservative net value of the natural gas saved was \$50,000 per well.<sup>538</sup>

In addition to using the green system, Devon is also installing a new pneumatic controller pilot valve on its older wells to more efficiently remove water during production.<sup>539</sup> Natural gas needs to be free of water before being piped to a processing plant.<sup>540</sup> The process begins with a separator that removes the liquid near the wellhead and a controller that regulates the fluid level in the separator.<sup>541</sup> Once the fluid reaches a certain level, the controller directs natural gas to a diaphragm valve that opens and dumps the liquid into a storage tank.<sup>542</sup> The older natural gas well sites vented natural gas continuously.<sup>543</sup> However, the newer controllers only vent when actively controlling fluid levels and only emit small amounts of gas needed to open the diaphragm.<sup>544</sup> The device has reduced methane emissions by 90 percent at a cost of only \$300 a valve, recoverable within three months.<sup>545</sup>

#### *F. Disclosure of Chemicals in Hydraulic Fracturing Fluids*

##### *1. Environmental Concern*

Investors and federal and state legislatures have begun to request the disclosure of the chemicals used in hydraulic fracturing fluids. Historically, natural

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<sup>533</sup> *Id.*

<sup>534</sup> *Id.*

<sup>535</sup> *Id.*

<sup>536</sup> *Id.*

<sup>537</sup> *Id.*; see also *Green Completions*, ENVIRONMENTALLY FRIENDLY EXPLORATION & PROD., <http://www.efdsystems.org/Technologies/AirQuality/EmissionsControl/GreenCompletion/tabid/1859/Default.aspx> (last visited Nov. 9, 2011).

<sup>538</sup> *Devon's Green Completions*, *supra* note 529.

<sup>539</sup> *Tiny valve offers huge environmental impact*, DEVON ENERGY CORP., <http://www.devonenergy.com/CorpResp/initiatives/Pages/Valve%20Reductions.aspx> (last visited Nov. 9, 2011).

<sup>540</sup> *Id.*

<sup>541</sup> *Id.*

<sup>542</sup> *Id.*

<sup>543</sup> *Id.*

<sup>544</sup> *Id.*

<sup>545</sup> *Id.*

gas operators were protected from disclosure of chemicals used in hydraulic fracturing because of trade secret concerns.<sup>546</sup> To date, there has been no ruling on whether the chemical formula for hydraulic fracturing fluids is a trade secret.<sup>547</sup> However, in most states, trade secrets consist of information, “including a formula”—that has “independent economic value” due to the information’s private nature—and “is subject of efforts that are reasonable under the circumstances to maintain its secrecy.”<sup>548</sup> Hydraulic fracturing fluids meet this definition.<sup>549</sup> Additionally, the industry may use nearly identical formulas because trade secrets, unlike patents, need not be novel.<sup>550</sup>

Currently, financial investors in major natural gas companies are filing resolutions seeking the disclosure of fluids used for hydraulic fracturing and company plans for managing water pollution, litigation, and regulatory risks.<sup>551</sup> Because environmental groups are concerned that chemicals used in hydraulic fracturing fluids are linked to human health issues, they have organized shareholder groups that filed resolutions for disclosure of the chemicals last year with 12 companies.<sup>552</sup> Although none of the resolutions passed, several got over 30 percent of the vote; e.g., Cabot 36 percent, EOG Resources 31 percent, and Williams Companies 42 percent.<sup>553</sup> Environmental groups will continue to file resolutions until transparency is achieved.

The shareholder resolutions also ask companies to disclose their policies and strategies for reducing environmental and financial risks from chemical use.<sup>554</sup> The resolutions focus on recycling and reusing waste waters, reducing the volumes and toxicity of chemicals, disclosing chemicals used in hydraulic fracturing, and assuring the integrity of well cementing through pressure testing and other methods.<sup>555</sup> Further, numerous conservation organizations have requested that the

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<sup>546</sup> Deweese, *supra* note 75.

<sup>547</sup> See Hannah Wiseman, *Trade Secrets, Disclosure, and Dissent in a Fracturing Energy Revolution*, 111 COLUM. L. REV. SIDEBAR 1, 6–7 (2011) [hereinafter Wiseman, *Trade Secrets*].

<sup>548</sup> *Id.* at 7.

<sup>549</sup> *Id.*

<sup>550</sup> *Id.*

<sup>551</sup> See *Shareholder Resolutions*, INVESTOR ENVTL. HEALTH NETWORK, <http://www.iehn.org/resolutions.shareholder.php> (last visited Nov. 9, 2011) [hereinafter *Shareholder Resolutions*]. The companies include: Anadarko Petroleum Corp., Cabot Oil & Gas Corp., Carrizo Oil & Gas, Chevron, El Paso Corp., Energen Corp., ExxonMobil, Southwestern Energy, and Ultra Petroleum.

<sup>552</sup> See Lee, *supra* note 1.

<sup>553</sup> See *Shareholder Resolutions*, *supra* note 551.

<sup>554</sup> See *Report on Hydraulic Fracturing Risks*, INVESTOR ENVTL. HEALTH NETWORK (2011), [http://www.iehn.org/resolutions.shareholder.detail.php?pageid=104&fsubject=Hydraulic %20Fracturing](http://www.iehn.org/resolutions.shareholder.detail.php?pageid=104&fsubject=Hydraulic%20Fracturing).

<sup>555</sup> *Id.*

EPA probe into the use of diesel fuel in hydraulic fracturing operations and its effect on drinking water quality.

## 2. *The Industry's Response*

The industry can foster transparency by disclosing the chemicals used in hydraulic fracturing fluids without having to disclose the actual formulas. Doing so will improve public participation in hydraulic fracturing policy and ensure adequate regulation. Operators would be able to adequately dispel allegations of contamination, and it would assist medical professionals in locating the causes of symptoms of workers and citizens that come in contact with chemicals.<sup>556</sup> If the industry fails to disclose the chemicals, policymakers could remove trade secret protections and require the industry to patent their formulas for protection of economic value.<sup>557</sup> A patent is costly and time consuming, but it allows the public access to the formulas.

Natural gas operators are now requesting disclosure of chemicals used in the hydraulic fracturing fluids from the service companies that supply the fluids.<sup>558</sup> Additionally, on September 9, 2010, the EPA sent a voluntary information request to nine hydraulic fracturing providers for chemical data to assist with the current hydraulic fracturing study.<sup>559</sup> The industry has begun to disclose the chemicals. For example, Halliburton now lists the chemicals used in its Pennsylvania WaterFrac Formulation on its website.<sup>560</sup> FracFocus, the national hydraulic fracturing chemical registry, references that there were over 7,000 records in the system and 80 participating companies, as of November 10, 2011.<sup>561</sup>

### *G. Opportunities for Reform and Improvement*

The industry needs to take an active role in preventing environmental harm. While environmental groups continue to seek comprehensive environmental studies on drinking water and soil quality, in addition to environmental impact statements on wildlife and plant sources before natural gas exploration and production is started, natural gas operators should conduct water and soil tests

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<sup>556</sup> See Wiseman, *Trade Secrets*, *supra* note 547, at 10.

<sup>557</sup> See *id.* at 6–7.

<sup>558</sup> Deweese, *supra* note 75, at 11–12.

<sup>559</sup> News Release, EPA, EPA Formally Requests Information From Companies About Chemicals Used in Natural Gas Extraction / Information on Hydraulic Fracturing Chemicals is Key to Agency Study of Potential Impacts on Drinking Water (Sept. 9, 2010), available at <http://yosemite.epa.gov/opa/admpress.nsf/d0cf6618525a9efb85257359003fb69d/ec57125b66353b7e85257799005c1d64!OpenDocument>.

<sup>560</sup> See *Pennsylvania WaterFrac Formulation*, HALLIBURTON, [http://www.halliburton.com/public/projects/pubdata/Hydraulic\\_Fracturing/fluids\\_disclosure.html](http://www.halliburton.com/public/projects/pubdata/Hydraulic_Fracturing/fluids_disclosure.html) (last updated Sept. 9, 2011).

<sup>561</sup> *About Us*, FRACFOCUS, <http://fracfocus.org/welcome> (last visited Feb. 13, 2012).

before each well is drilled.<sup>562</sup> Currently, landowners have the legal right to refuse water and soil samples on their property. However, because landowners could eventually file suit against the operator, state regulatory agencies should allow the industry to perform these tests, even if drinking water wells are on private land. Otherwise, a private land owner could refuse water and soil samples on their property and eventually file a lawsuit against the operator. The industry, state regulators, and environmental groups must work together to create an environmental regulatory plan that balances both economic and environmental factors.<sup>563</sup>

Despite environmental concerns, natural gas is a clean burning fuel source that has several distinct environmental advantages over other fuel sources. The industry must continue reducing its environmental footprint by minimizing waste, using nontoxic alternatives, recycling and reusing chemicals where possible, and treating wastewater to remove its toxicity in order to ensure viability and future production. These environmentally friendly practices will potentially alleviate a stringent regulatory framework and will ensure that sustainable development of energy needs for future generations are met.

#### IX. CONCLUSION

The goal for hydraulic fracturing regulation should be to promote sustainable development by focusing on the following five principles: 1) respect for ecological integrity, 2) preservation of options for future generations, 3) equity, 4) citizen participation, and 5) stewardship.<sup>564</sup> The administrative, judicial, and legislative branches cannot meet these principals alone. The industry, environmental groups, and regulators need to work together to ensure polluter accountability, facilitate public input in environmental impact assessments, and allow citizen lawsuits.

The natural gas industry needs to inform the public of the environmentally friendly technology that it uses in natural gas production. Press releases should not feed negative stereotypes by focusing only on natural gas company earnings. Rather, they should emphasize environmental successes such as reductions in GHG footprints, increased efficiencies in recycling wastewater, and reducing water consumption. The industry must inform the public of its continuing efforts to disclose chemicals used during hydraulic fracturing on FracFocus.org and on company websites.

Environmental groups, regulators, and the media need to recognize the environmental benefits of using natural gas as a clean burning fuel source. In addition, they should also recognize the economic impact that natural gas is having as a “bridge fuel” to a cleaner energy future. They should not treat an isolated surface spill as the whole industry contaminating the U.S. underground drinking

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<sup>562</sup> Ingelson, *supra* note 94, at 95.

<sup>563</sup> Reeder, *supra* note 467, at 1002.

<sup>564</sup> Ingelson, *supra* note 94, at 54–56.

water source. Instead, they should focus on the facts of the particular environmental concern and the actions of the alleged violator. The industry needs to recognize the “polluter will pay” principal and should therefore settle legitimate disputes in a timely manner. Likewise, environmental groups and federal regulators must also recognize that the public will eventually pay the cost for cleaning up contaminations and cost for prohibiting natural gas production in the U.S. If the operator pays for cleaning up a spill, then the cost is passed to the consumer in natural gas price increases. If the operator fails to clean up the contamination, then tax-paying citizens will have to pay for the cleanup. One reasonable recommendation for alleviating the need for the public to pay for remediation is for the industry to create a fund that would help with plugging and abandoning natural gas wells that unethical operators have abandoned. Therefore, the industry should continue enforcement on itself, including requiring preventive measures and assisting with regulating environmentally unsafe operators.