What's the Big Fracking Deal?

Vanessa Klass
I. Introduction

At a time when the country has struggled to grow economically, energy production in the United States has been one of the most promising success stories. A large part of the success behind this remarkable oil and gas production is due to an energy-extraction process known as Hydraulic Fracturing (also known as “fracking”). Fracking has transformed America’s energy potential by allowing increased production of oil and natural gas from formerly inaccessible shale formations. As a
result, the United States has surpassed Russia as the world’s top natural gas producer, and by 2020, the U.S. will overtake Saudi Arabia as the world’s largest oil producer. A decade ago, this type of surge in oil and gas production was an unlikely feat but the advent of fracking has made it possible.

Despite such positive developments, much attention in the fracking debate has focused on the potential negative impacts of fracking. “Fracking has been around for decades, and there’s a tremendous amount of misinformation out there about it, a lot of fear that I think is unfounded.” As such, little debate has focused on the protections that are already in place, and what is currently being done to prevent any negative consequences.

Our country’s legal system was founded on the notion that a party is presumed innocent until proven guilty. When a claim is made against a party, we seek the truth of the allegations by producing evidence that either proves or fails to prove their guilt. However, this is not always the case in the arena of public opinion. There, perception trumps reality, and the concept of fracking is no different. Too often with fracking, the media – specifically its headlines – provide the main source of information people receive shaping their perception. These negative misconceptions in the news cause people to opine that the oil industry is guilty of all the allegations made against them, whether these are true or false. Such negative allegations create fear among those uninformed of fracking’s impacts.

---


5. See Sally Jewell, U.S Secretary of Interior (Nov. 8, 2013); accord Gina McCarthy, Current U.S. EPA Administrator (Nov. 4, 2013) (“There’s nothing inherently dangerous in fracking that sound engineering practices can’t accomplish.”); accord, Ken Salazar, Former U.S. Interior Secretary, Former Colorado Senator (Feb. 15, 2012) (“There’s a lot of hysteria that takes place now with respect to hydraulic fracking, and you see that happening in many of the states . . . . My point of view, based on my own study of hydraulic fracking, is that it can be done safely and has been done safely hundreds of thousands of times.”).

Because studies estimate that up to eighty percent of natural gas wells drilled in the next decade will require hydraulic fracturing technology, an informed dialogue of the truth regarding fracking is imperative. If fracking is inherently dangerous, we need to know. If potentially negative consequences can be minimized, regulated, and possibly eliminated, we need to know that too.

Biased coverage of fracking fails to serve the public interest. A rational assessment of proper policy requires an inspection of both costs and benefits. Therefore, the focus of this article will be on the benefits side of the equation, which can hopefully be used to better weigh costs when they are debated now and in the future.

II. HYDRAULIC FRACTURING

Although fracking has been around since the 1940s, understanding among the community remains unclear. This needs to change if America wants to continue to be a leader in energy production and maintain the level of jobs and infrastructure. For many Americans, “fracking connotes something dangerous, unhealthy – even, as in a recent Hollywood production, potentially nefarious.” For others, fracking is the key to our future and should be regulated as the best hope for a struggling economy.

As such, there are two schools of thought: (1) those who want an outright ban on fracking based on fear of the unknown, or (2) those who support fracking because it is a proven method of oil and gas extraction. This article, examines the pros and cons of fracking, ultimately concluding that it can and should be done safely, in a controlled, regulated environment.

A. Origin of Oil and Gas

Understanding where oil and gas come from will help the reader understand the techniques required to extract oil and gas from reservoirs where it is trapped. Oil and natural gas are liquid and gaseous forms of petroleum formed from the remains of prehistoric plants and animals – hence the name: fossil fuels. Petroleum deposits, trapped with sand and silt, are found buried in sedimentary rock. Similar to how a sponge holds water, petroleum is held inside the rock formation. Being buried in

9. Id.
10. See generally David K. String, Note, A Fracking Good Solution to the Hydraulic Fracturing Regulation Conundrum, 48 VAL. U. L. REV. 417, 419 (2013) (indicating that a Quinnipiac University poll found that 66% of Republicans support fracking, 68% of Democrats oppose fracking, and 55% of those unaffiliated with a party believe fracking will harm the environment).
sediments with no air, the organic layers could not rot away and, over time, increasing pressure and temperature changed the mud, sand, and silt into source rock and slowly “cooked” the organic matter into petroleum.\(^1\)

Over millions of years, due to weight and pressure from overlying deposits,\(^2\) the oil and gas formed deep within the Earth in the source rock, then migrated from its source rock into more porous\(^3\) and permeable\(^4\) reservoir rock, transforming the organic material into crude oil and natural gas.\(^5\) The oil and gas further migrated until confined in a “trap,”\(^6\) where it remains until disturbed.\(^7\) The more permeability, the better the oil and gas will flow out of the rock.

These underground traps of oil and gas are called reservoirs. Reservoirs are not underground “lakes” of oil; rather they are made up of porous and permeable rocks that can hold significant amounts of oil and gas within their pore spaces. The more porosity a rock has, the better the oil can be stored. Some reservoirs are hundreds of feet below the surface while others are thousands of feet underground.\(^8\)

B. **Why is this important?**

The above is important to understand in order to have a working knowledge of why fracking is such an amazing technological invention. The reservoirs that are hundreds of feet below the surface are easily reachable using conventional drilling techniques that everyone is accustomed to. However, because the oil and gas is easily reached, we have essentially tapped all of our resources available using conventional drilling.\(^9\)

Luckily, “[g]eologists have known about vast reservoirs of natural gas and oil trapped in shale formations across the United States for decades, but extraction techniques were not available and the resources remained untapped.”\(^10\) Thus, it was

\(^1\) Id.
\(^2\) Id. (explaining that one must have sufficient “natural reservoir energy” (pressure) to force the oil or gas into the wellbore).
\(^3\) Id. (stating that all sedimentary rocks contain pore spaces between the sediment particles. To be a good source for petroleum, sedimentary rocks must be porous. High porosity means the amount of pore space is relatively large and that the rock contains a large area within which oil and gas might accumulate).
\(^4\) Id. (indicating the rock must have sufficient “permeability.” Geologists describe rocks in which the pore spaces are well interconnected as highly permeable. This connecting pore spaces permits petroleum, which is lighter than water, to float upwards through the original seawater contained in the pores of permeable rocks to collect and to flow towards a borehole).
\(^5\) Id.
\(^6\) Id.
\(^7\) ANDERSON ET AL., supra note II (explaining that layers of permeable rocks are often bounded by layers of impermeable rocks. When the rock layers form a dome-like shape, petroleum “traps” are formed).
\(^8\) Id.
\(^9\) Id.
not until the combination of two old technologies was perfected—horizontal drilling and hydraulic fracturing, known colloquially as fracking—that shale factored into most serious analysis of U.S. energy prospects.\footnote{22}

Historically, wells that were selected for fracturing were primarily “vertical,” and extended down into the earth directly below the well site.\footnote{23} By the 1970s, oil production had begun to decline, as oil companies had already extracted the oil reserves they could, using traditional methods.\footnote{24} But, because in the last decade the oil industry has utilized fracking in combination with horizontal drilling, oil and natural gas production has increased and oil and natural gas can now be produced in an economical way.\footnote{25} Moreover, the fracking of one well will produce natural gas for 20 to 50 years, or longer.\footnote{26}

Therefore, the technique of fracking has revolutionized the energy industry by allowing drillers to reach previously inaccessible oil and gas deposits that are trapped in tight sand and shale formations thousands of feet underground.\footnote{27}

C. The Fracking Deal

In the simplest terms, hydraulic fracturing refers to the fracturing or breaking of a rock due to forces caused by a pressurized liquid. Unlike conventional drilling and production techniques that allow us to extract oil and gas from permeable or semi-permeable rock formations\footnote{28} where natural gas is found under pressure and easily flows to the surface,\footnote{29} shale oil and shale gas are trapped in non-permeable rock found at great depths (usually 4,000 – 10,000 feet) below Earth’s surface.\footnote{30}

The drilling process used in fracking is the same as conventional drilling and consists of multiple stages. In the early 1980s advances in the ability to control the trajectory of a wellbore made horizontal drilling practical and the techniques for isolation of surface waters are the same for horizontal wells as for vertical wells, which have been used since the early 1900s.\footnote{31}
The combinations of multi-stage fracturing and horizontal drilling have created the huge increases in oil and gas production in the U.S.\textsuperscript{32} Thus, because techniques that have produced unprecedented production gains have been in use for many years with little or no deleterious effects, anti-fracking groups should be at ease.\textsuperscript{33}

Further, petroleum is the most consumed type of energy in the United States.\textsuperscript{34} Thus, because of its value, and it being a finite resource, all levels of government heavily regulate the drilling process.\textsuperscript{35}

### III. The Initial Drilling Process

The oil industry requires certain protocols and procedures to be followed before, during, and after a well is drilled. These drilling processes are perfected continuously. Initially, the drill moves through the top layers of soil and rock, through the saturated aquifer layer,\textsuperscript{36} and down through numerous layers of rock until the target formation is reached. To accomplish the drilling, conductor casing is first used to protect the well from caving in and reduces the risk of contamination of aquifers from the surface.\textsuperscript{37} Inside the conductor casing is the surface casing, which must extend below the water table and is intended to protect the aquifer from any oil, gas, or other fluid contamination that might migrate along the annulus of the well.\textsuperscript{38}

Inside the surface casing is either production casing or intermediate casing.\textsuperscript{39} In Pennsylvania, where the current standard is to have four layers of casing in a well, intermediate casing is installed outside the production casing.\textsuperscript{40} The production casing is the steel pipe through which the oil or gas is removed from the formation and can

\textsuperscript{32} And\textit{er}son \textit{E}t \textit{Al}., \textit{sup}ra note 11.

\textsuperscript{33} \textit{Id}.


\textsuperscript{35} String, \textit{supra} note 10.

\textsuperscript{36} \textit{For Groundwater Use Facts}, Dep't of Nat'l Res., State of La., http://dnr.louisiana.gov/index.cfm?md=pagebuilder &tmp=home&pid=459 (last visited Apr. 12, 2015) ("An aquifer is a geologic formation that can store and transmit water to wells, springs and some streams. An aquifer is more like a sponge than an underground river: geologic materials have connected pores that allow water to move from one space to another.").

\textsuperscript{37} See Harvey Consulting, LLC, New York State Casing Regulation Recommendations Report to: Natural Resources Defense Council (NRDC) (Sept. 16, 2009), available at \url{http://docs.nrdc.org/energy/files/enc_10092901e.pdf} (explaining that regulations of conductor casing vary considerably by state, but the conductor casing is generally between 16 to 20 inches in diameter and extends from the surface of the ground to between 30 and 75 feet below the surface).

\textsuperscript{38} State Oil and Natural Gas Regulations Designed to Protect Water Resources, Office of Fossil Energy Nat'l Energy Tech. Lab., U.S. Dep't of Energy (May 2009), available at \url{http://energy.wilkes.edu/PDFFiles/Library/State%20Oil%20and%20Gas%20Regulations%20Designed%20to%20Protect%20Water%20Resources.pdf}. The annulus is "the space around a pipe in a well bore, the outer wall of which may be the wall of either the bore hole or the casing; sometimes termed the annular space." See \textit{Annulus}, OSHA, \url{https://www.osha.gov/SLTC/etools/oilandgas/illustrated_glossary/annulus.html} (last visited May 13, 2015).


\textsuperscript{40} See 25 PA. Code § 78.83 (2011).
run to a depth of up to 10,000 feet before turning horizontally at the “kickoff” point, running up to a mile or more through the target formation. This reachability makes unconventional oil and gas development so attractive. Further, casing and its different layers, is so important because casing prevents any leakage that might occur unintentionally.\(^4\)

Cement is used to affix each string of casing to the surrounding rock and soil so that it is stable and will not shift. Improper cementing – using too little cement, or using an inappropriate mix so that curing time is not optimal – can result in the formation of channels within the cement or along the casing through which fluids or gases from the surrounding rock can migrate up the casing to the surface or to aquifers.\(^5\)

For this reason, most states require cementing of the entire length of the surface casing and also require the surface casing to run below the deepest groundwater aquifer.\(^6\) Moreover, many states require drillers to conduct tests to ensure proper bonding of the cement and to keep a cement bond log.\(^7\) Also, when cement is not affixed properly or the casing fails to do its job due to negligence, regulatory procedures are already in place to remedy the situation.\(^8\)

### IV. The Fracking Process

After the production casing is installed, horizontal sections of the casing are perforated in preparation for hydraulic fracturing of the target rock formation. Perforation is achieved by sending small charges into the wellbore using perforating guns creating holes in the casing and formation.\(^9\) These holes are typically just less than one-half inch in diameter and extend through the casing and approximately three feet into the rock. Fractures are initiated through these perforations. The typical width of a fracture at the wellbore can be one-quarter inch or wider and can extend vertically from tens of feet to perhaps a hundred feet.\(^10\) These fractures create paths that increase the rate at which fluids can be produced from the reservoir formations and allow larger volumes of oil or gas to be recovered.

---

\(^{41}\) **State Oil and Natural Gas Regulations Designed to Protect Water Resources**, *supra* note 38.

\(^{42}\) *Id.*

\(^{43}\) *Id.*


\(^{47}\) *Id.*
While the well is being fractured, pressures in the wellbore and annulus are continually monitored from a control van. This is to prevent leakage or other problems by ensuring the correct pressure is being used and the correct target formation is being reached.

As seen above, the oil industry has set regulations and procedures required before drilling and fracking can begin. Also, before drilling can occur, a permit is required. All oil and gas producing states have permitting requirements governing the location, drilling, completion and operation of wells. Notably, the only cases and evidence discussing harmful oil spills leading to contamination are due to negligence on the part of the operator, not due to the process itself. In fact, most leaks occurred before regulations in the 1980s. Nonetheless, there is casual misinformation in the news that poses a great threat to energy production in America.

V. DEMYSTIFYING THE MYTHS

Fracking is a safe, proven drilling technique. However, the only statements and voices being broadcast in the media are anti-fracking activists who make claims that are unsupported by facts. To make matters worse, articles and comments about any oil issue often tend to be negative, betraying a mind-set trapped by Murphy’s Law – if something may go wrong, surely it will go wrong. “This mind-set exaggerates and thus misrepresents reality.” We must stop letting emotions and fear rule our decisions. We must start basing energy policy in reality for if we act on every fear that concerns the public, what will we have left?

Regrettably, because fracking is relatively unknown to most, development of the laws and policies governing fracking is still in its infancy. For this reason, we cannot be 100 percent certain of its long-term effects, which causes justifiable fear among the public. However, accuracy is most often pushed away for simplicity. The best possible way to deal with such uncertainty is to solve problems in advance by enacting regulations and safeguards that prevent the potential dangers from happening.

49. *State Oil and Natural Gas Regulations Designed to Protect Water Resources*, supra note 38, at 18.
51. MacRae, supra note 27.
For instance, getting into a car each day puts a person’s life at risk. Yet, we are not going to ban cars because of potential accidents. In the alternative, to prevent future accidents, we learn what may cause harm, if any is to be caused, and how to prevent that harm by creating regulatory standards requiring cars to have certain safety measures to prevent serious injury upon collision. This is precisely what past and current federal and state regulations have done with fracking.54

A fundamental fact to bear in mind as the regulatory process moves forward, is that: “In California, hydraulic fracturing has been used as a production stimulation method for more than 30 years with no reported damage to the environment.”55 Nonetheless, the anti-fracking groups do not seem to notice or care about the lack of evidence in their arguments.

Fear, not scientific evidence, is the driving factor behind the anti-fracking movement’s goal to ban fracking. But fear should not be a platform for policies and laws. We must dig for the facts and ensure that conclusions are not based on public opinion.

Therefore, following are the most prevalent myths leading the anti-fracking movement, followed by the actual scientific truth. These include water contamination, chemicals used in fracking fluid, air pollution, and earthquakes. Getting to the truth of the matter rather than lashing out in fear is a much more efficient alternative for all.

A. Water Contamination

1. Underground Water Sources

The most prevalent myth in the fracking debate is that hydraulic fracturing threatens underground water sources and has led to the contamination of drinking water. This assertion is false. Subject to both federal and state regulations, there have been no instances of fracking causing contamination of drinking water.56

In fact, fracking has been safely used more than one million times since the 1940s and the technology is continually improving.57 Fear arises because people do not understand that the relationship and distance between the sources of drinking water and the sources of fracking are far apart. Importantly, there is often more than a mile of impermeable rock between the fractures created and drinking water aquifers just below the surface. Thus, as Mark Zoback, Stanford University geophysics professor, and energy adviser to the U.S. Department of Energy, stated:

There have been fears that hydraulic fracturing fluid injected at depth could reach up into drinking water aquifers. But, the injection is

54. MacRae, supra note 27.
55. Hydraulic Fracturing in California, supra note 45.
56. Loris, supra note 1.
typically done at depths of around 6,000 to 7,000 feet and drinking water is usually pumped from shallow aquifers, no more than one or two hundred feet below the surface. Fracturing fluids have not contaminated any water supply and with that much distance to an aquifer, it is very unlikely they could.  

Equally, basic geology has a great deal to do with it. Hydrocarbons have been trapped miles underground for millions of years, and the same geologic structures that have kept oil and gas trapped at depth also keep hydraulically fractured zones isolated from what’s above – including groundwater. Recent studies show that if water is contaminated, it is due to faulty drilling and well completion techniques, not fracturing. As Lisa Jackson, former Environmental Protection Agency (“EPA”) Administrator stated: “In no case have we made a definitive determination that fracking has caused chemicals to enter groundwater . . . I am not aware of any proven case where hydraulic fracturing itself has affected water.”

There are a variety of reasons why the hydraulic fracturing process does not connect with groundwater, chief among them being the industry’s commitment to safe operations and a dynamic process of improving operations. The drilling process techniques, discussed above, show how the oil industry constantly works to prevent any leakage into groundwater. Significantly, based on over sixty years of practical application and a lack of evidence to the contrary, there is nothing to indicate that

58. Mark Zoback, Stanford University geophysics professor, and energy adviser to the U.S. Department of Energy, (2011); see also CARDNO ENTRIX, INGLEWOOD OILFIELD STUDY (Oct. 10, 2012), available at http://yosemite.epa.gov/sab/SABPRODUCT.nsf/7CB327356AEBOA43685257C240068582A/$File/4+++Cardno+Entrix+PXP+Inglewood+2012.pdf (“Micro seismic monitoring showed all fractures were separated from the designated base of fresh water by 7,700 feet (1.5 miles) or more . . . Before-and-after monitoring of groundwater quality in monitor wells did not show impacts from high-volume hydraulic fracturing . . .”).

59. Thomas Howard, Executive Director, State Water Resources Control Board (Feb. 8, 2013) (“The Water Boards generally consider hydraulic fracturing a low threat to groundwater because oil production/hydraulic fracturing predominantly occurs at thousands of feet below the base of fresh groundwater. It is separated by thousands of feet of solid rock. It is very unlikely that fluids emplaced by hydraulic fracturing will migrate upwards through solid cap rock and other low-permeability zones to reach drinking water groundwater aquifers.”).


when coupled with appropriate well construction, the practice of hydraulic fracturing in deep formations endangers ground water.\textsuperscript{63}

\textit{a. Fracking Fluids do not Migrate into Groundwater}

In spite of this, news stories about the process of fracking consequently led the public to think otherwise. Negative reports further tarnish an already defensive oil and gas industry. One such story portrayed an incredibly deceptive and misleading informational graphic showing hydraulic fracturing fluids migrating from depth to contaminate groundwater.\textsuperscript{64} The assertion suggests that fracturing fluids always migrate and flow into groundwater, thus contaminating the water. This assertion is false: the suggested fluid migration has never happened.\textsuperscript{65}

Furthermore, articles that depict fracking fluids and chemicals leaking into groundwater reinforce beliefs regarding the infamous videos of families lighting their faucet water on fire due to methane in the pipes. However, the methane leakage is not caused by fracking. The fact is tap water could be lit on fire long before fracking came about due to naturally occurring methane pockets in the ground.\textsuperscript{66} However, as Winston Churchill famously said “a lie gets halfway around the world before the truth has a chance to get its pants on”\textsuperscript{67} and the flaming faucet is proof.

Homes with methane coming out of water pipes were prevalent before fracking. In fact, evidence shows that most homes with “flaming faucets” were built atop methane deposits in areas with no active natural gas exploration or

\textsuperscript{63} See generally John Hanger, Former Secretary, Pa. Dep’t. of Envtl. Prot. (2012) (“We’ve never had one case of fracking fluid going down the gas well and coming back up and contaminating someone’s water well”); see also U.S. Dept. of Energy and Ground Water Prot. Council (May 2009) (“There is also a lack of demonstrated evidence that hydraulic fracturing conducted in many shallower formations presents a substantial risk of endangerment to ground water.”); see also U.S. EPA (2004) (“EPA did not find confirmed evidence that drinking water wells have been contaminated by hydraulic fracturing fluid injection . . . .”); see also Carol Browner, former EPA Adm’r (May 1995) (“There is no evidence that the hydraulic fracturing at issue has resulted in any contamination or endangerment of underground sources of drinking water.”).

\textsuperscript{64} What Goes in and Out of Hydraulic Fracturing, DANGERSOFFRACKING.COM, http://dangersoffracking.com (last visited Apr. 12, 2015) (showing you can see the green, vapor-like plume emanating from the fractures in the shale formation. As the graphic’s author helpfully, yet wrongfully, explains: “During this process, methane gas and toxic chemicals leach out from the system and contaminate nearby groundwater.”).

\textsuperscript{65} See Everley, supra note 6; see also Dr. Stephen Holditch, Dep’t of Petroleum Eng’g, Tex. A&M Univ., (Oct. 2011) (“I have been working in hydraulic fracturing for 40 plus years and there is absolutely no evidence hydraulic fractures can grow from miles below the surface to the fresh water aquifers.”).


development.\textsuperscript{68} Actually, there is evidence of such claims that contradict the anti-fracking arguments dating back to 1951.\textsuperscript{69}

In 1951, an Oregon newspaper wrote an article about a man who dug up his water well. Thereafter, natural gas rose from the 400-foot well creating flames when lighting a match close to the spout of his water faucet.\textsuperscript{70} It was concluded that methane gas can occur naturally in water wells and when it does, it can create unique problems such as flammable and explosive hazards.\textsuperscript{71} Thus, natural forces created the methane build up, not fracking.

Furthermore, there is evidence that most Pennsylvania water wells contain gas. Thus, when people do not vent their water wells, methane will build up and cause an explosion.\textsuperscript{72} Likewise, tap water in homes has contained methane, creating fires, due to underground coal layers covering much of the area.\textsuperscript{73} These past stories regarding “firewater” show that faucets have long contained methane in places where no natural gas development had been found.

Unfortunately, movies such as \textit{Promised Land}, incorrectly depict the relationship between chemicals and fluids used in fracking with the environmental effects. In a room full of students, the teacher mixes chemicals together – meant to replicate those used in fracking – and poured the mixtures over a toy barn that catches fire.\textsuperscript{74} The reason for doing this was to explain that the oil industry does this to the water the students, cows, puppies, and kittens drink.\textsuperscript{75}

However, this was an erroneous comparison. Several layers of casing and cement control and prevent any fracking fluid from leaking into groundwater aquifers.\textsuperscript{76} When movies portray the oil industry in a negative light, society forms incorrect opinions based on the misconceptions portrayed in the films. This detracts from the beneficial necessity that oil production contributes to the essentials of our economy.


\textsuperscript{70} Id.

\textsuperscript{71} Id.


\textsuperscript{74} \textit{Promised Land} (Participant Media 2012).

\textsuperscript{75} Id.

\textsuperscript{76} Everley, \textit{supra} note 6.
Nonetheless, these types of stories appeal to the emotions of people because – albeit wrong, they give an answer to environmental concerns. When studies are conducted backwards – starting with a conclusion and seeking fracking as the answer, fracking will always be the answer and the root cause of environmental problems. This tactic stems from fear of the unfamiliar, in hopes of finding unanswered questions.

Comparatively, parties in Pavillion, Wyoming, and the EPA found that fracking “likely” polluted ground water. There, residents near a drilling site suspected water contamination where the company fracked close to a shallow water source. EPA’s draft report includes this carefully worded connection: “When considered together with other lines of evidence, the data indicates likely impact to ground water that can be explained by hydraulic fracturing.” Because we know fracking has never contaminated drinking water, the report comforted the complainants by following the ignorance mentioned above – reaching an answer after starting with the conclusion.

In light of the EPA’s conclusion, some states still fear fracking. For example, New York’s Governor Andrew Cuomo recently banned fracking in the state of New York: “We cannot afford to make a mistake; the potential risks are too great. In fact, they are not even fully known.” This highlights the fact that the EPA’s message is not being received. This is unfortunate, as even the Governor stated the “potential risks are not even fully known,” indicating there is no definitive evidence linking fracking to any harmful environmental effects.

Fortunately, there is some hope that science is winning. Federal and state regulators, scientists and responsible environmentalists, and even Democratic and Republican officials have confirmed the lack of contamination. In Colorado, Democratic Governor John Hickenlooper called negative reports concerning dangers associated with hydraulic fracturing “hyperbole,” arguing there is no scientific fact to indicate that the oil and natural gas extraction process contaminates groundwater in Colorado.

Being a Democrat, Governor Hickenlooper’s party opposes fracking. Thus, this is big news that Hickenlooper is working with science and not fear – unlike

78. Id.
80. Id.
Governor Cuomo from New York. Also, because Governor Hickenlooper was a geologist before becoming Governor, he has proficient knowledge regarding technologies effect on the environment.

Further, Governor Hickenlooper is in the beer brewery business. Thus, safe and clean water is very important to him to ensure proper production of beer. Plus, since we now know hydraulic fracturing does not connect to groundwater, it is unthinkable to believe a state or industry would contaminate groundwater through a fracturing process.

Luckily, Colorado is not the only state to follow science. In the recent midterm elections, fracking was a hot button issue. In California, cities such as Santa Barbara, where oil drilling has been performed for several decades without any environmental problems, voted against banning fracking by reasoning with science. Further, Santa Barbara has always been known for off shore drilling rigs seen along the 101 Freeway, making them landmarks in the beautiful city. The platforms produce the oil that make it possible to fuel our cars and trains to visit Santa Barbara.

b. Uneducated Accusations

Nonetheless, “[a] recent report from the University of Missouri and U.S. Geological Survey researchers suggested that fracking might be responsible for elevated levels of hormone-disrupting chemicals found in some water.” “Because appeals to morality and ethics are known to mobilize public attention to important and hot debated issues,” opponents of fracking often frame their objections in normative ethical terms. The focus being on potential harm that shale oil and shale gas production may cause, the oil industry’s alleged indifference to that harm, and on the locals’ right to be free from that harm.

This is exactly what those against fracking did following the release of the report. A rush of fear-mongering headlines like “Sex-Change Chemicals Linked to Fracking” and “Fracking Chemicals Could Cause Infertility, Cancer and Birth

87. Spence, supra note 25, at 146.
88. Id.
Defects" arose. In other words, the follow up articles were driven by fear, not scientific facts yet again. In fact, there is no evidence that exposure to fracking chemicals will change a person’s sex or disrupt their sexual function or cause infertility, cancer, or birth defects. “Whether people should be worried requires a more nuanced understanding of both EDCs and fracking,” which the report did not contain.

2. Flowback Water (Wastewater)

This leads to another fear relative to water contamination. There is a myth that wastewater from hydraulic fracturing is dangerous and unregulated. This is false. With fracking, good regulations are needed and welcomed by the oil industry to control flowback water so we don’t have releases. Thus, companies dispose of, and recycle wastewater using many different methods, all of which are compliant with existing federal and state laws.

Companies typically use around four million gallons of water – what a golf course uses in one week – to fracture a well by using water from lakes, rivers, or municipal supplies. Much of that water remains in the ground; about fifteen percent to twenty percent of the water returns to the surface by flowing back through the well. The flowback water contains the chemicals used in the fracking process and can also collect other naturally harmful substances in the ground. Importantly, because this water is never used for drinking and the disposal is subject to federal and state regulations, there is nothing to fear. Each state has different regulations for disposal, and companies employ a variety of methods including temporary storage of wastewater in steel tanks or contained pits. More companies are recycling or reusing the flowback water because it makes both economic and environmental sense.


92. Friedman, supra note 86.

93. Loris, supra note 1.


95. Loris, supra note 1.

96. Hydraulic Fracturing in California, supra note 45.

97. Loris, supra note 1.

98. Laton, supra note 84.

99. Id.
increased demand for wastewater treatment has driven the process to be cleaner and cheaper.\textsuperscript{100}

Notably, potential wastewater contamination has been linked to several everyday activities such as gas stations and dry cleaners.\textsuperscript{101} Because both operating systems are located almost directly underneath the surface, leakage can occur at the same level and location as groundwater.\textsuperscript{102} Also, landfills and fertilization from people’s yards can contaminate drinking water because unlike oil rigs where there are several layers of protection, the waste and fertilization can seep into areas where groundwater is found.\textsuperscript{103}

Other disposal methods include storing wastewater underground in injection wells that states regulate individually, and the EPA regulates under the Safe Water Drinking Act.\textsuperscript{104} Because of the continuing advancement of disposal methods, a demand for wastewater disposal and recycling has resulted in opportunities for new companies with emerging technologies to treat wastewater.\textsuperscript{105} Thus, work is constantly available to those in different job sectors.

There have been concerns, in Pennsylvania for instance, that treating wastewater at sewage treatment plants that discharge into rivers supplying drinking water would contaminate drinking water with radioactive material.\textsuperscript{106} But Pennsylvania’s Department of Environmental Protection (“PDEP”) found levels of radioactivity well within federal and state standards.\textsuperscript{107} Further, PDEP found the same amount of radioactivity could be found on a bunch of bananas in the store or on granite countertops.\textsuperscript{108} Thus, fracking was not the cause of the radioactivity. Similar to the Missouri Study,\textsuperscript{109} where there is zero evidence that fracking causes birth defects and sex changes, here, fracking does not cause harmful radioactivity either.
3. California’s Drought

It is no secret that California is experiencing the worst drought in its history. Thus, because fracking requires water—an invaluable resource—this is another disruptive element between the pro-fracking movement and anti-fracking movement. In Central California, a small town called Bakersfield, located in the San Joaquin Valley in Kern County, is home to two of the most prominent industries in the world—the oil industry, and agriculture. Specifically, Bakersfield contains the fourth-largest oil field in the nation, and is also the richest food-producing region in the world. Much of the nation’s fresh fruits, nuts and vegetables are grown on the region’s seven million acres of irrigated farmland. Also, because of California’s continuing drought, water has become more valuable to many locals.

Thus, since farmland requires water and because farmers and oil producers have coexisted peacefully for decades in Kern County, a continuing working relationship between the two communities is vital. There is one crucial factor that is yielded from fracking in California that media outlets have failed to broadcast: WATER. In Bakersfield, their 115-year old Kern River oil field, which was a contributor to the state’s original oil boom, is still going strong yielding 70,000 barrels a day. Although this is a great achievement, only one-tenth of the production is oil, as water produces 10 times more than oil. Thus, the oil industry is not taking water away from farmers. In fact, the oil industry is the reason farms are experiencing continuous growth.

About 760,000 barrels of water a day are produced at the Kern River oil field—compared with 70,000 barrels of oil. Therefore, with the current drought, growers had to replace their normal water supply with groundwater that came from the Kern oil fields. It is one of the more unusual sources of water, one whose importance has increased in a year when the drought has forced farmers to fallow fields and bulldoze almond orchards. Also, the water is pumped out of the same underground rock that contains oil.

By farmers utilizing this water produced from oilrigs, it shows that if agriculture farmers trust the water for their livelihood in producing their yearly supply of vegetables and other crops, the water is not harmful. Farmers would not risk using

114. Id.
115. Id.
contaminated groundwater that could ruin their harvest season and harm those who purchase from them.

Further, Jay Lund, director of the Center for Watershed Sciences stated that, “without access to groundwater, this year’s drought would be truly devastating to farms and cities throughout California.”116 Oil is just as important as water for agriculture. Similar to how farmers need water to harvest crops; farmers need oil and gas to fuel vehicles that water the crops. “You can’t plow a field without diesel. You can’t bring product to market without a truck.”117

B. Chemicals

Another myth that causes fear among the community is that the chemicals used in the fracking process are foreign chemicals that the industry hides from the public. However, as with all myths, that is simply not true. Fracking fluid is ninety-eight to ninety-nine percent sand and water and uses a small percentage of chemicals – 0.5 percent – that have common household applications and are regulated by the state.118 In fact, all chemicals used in the fracking process have common applications from swimming-pool cleaners, laundry detergents, cosmetics, and even ice cream.119

Furthermore, the 0.5 percent of additives (typically between three and twelve different chemicals) depends on the composition of the shale formation that varies by region and by well. Thus, it is not possible to have a standard baseline chemical list.120 This does not mean though that the additives used in fracking fluids are harmful to the environment. Conversely, the additives function as gelling agents to create thickness going down the well to dissolve minerals, prevent bacteria growth and pipe corrosion, minimize friction, and keep the fractures open or propped up.121

Previously mentioned,122 most chemicals used can be found in common household cleaners such as acid we put in our swimming pools for chlorine balance, and biocides used in water fountains to prevent algae from growing.123 Most notably, hydrochloric acid124 makes up thirty percent of the chemical additives.125 This should

119. Id.
121. ANDERSON ET AL., supra note 11.
122. Chemical Use in Hydraulic Fracturing, supra note 118.
shed positive light on anti-fracking groups because hydrochloric acid is found naturally in gastric acid and has many industrial uses. In sum, the same chemicals used to clean kitchen counters, and produce gelatin, as well as other food additives, are used to clean the pipe that oil and gas run through and make the extraction process run smoothly.

1. Disclosure Requirements

It makes sense to be concerned with chemicals used in fracking fluids near water sources if the chemical ingredients are unknown and withheld. But, the chemicals are not completely unknown. Federal law stipulates that a company must provide detailed chemical information sheets to emergency personnel in case of an accident. Also, in pursuit of pleasing Americans who want chemical information disclosed, a website – FracFocus.org – was created by the U.S. Department of Energy, in collaboration with the Groundwater Protection Council and the industry. Companies voluntarily disclose the chemical makeup for specific wells across the country allowing users to search wells by operator, state, and county.

In all, the site provides a full list of chemicals used in the fracking process. If people are concerned about whether their water is contaminated, they have the ability to look up chemicals used and the closest source of water in their neighborhood located near the fracking site. However, based on the constant protests allegedly linking fracking fluids and chemicals with contamination, the resources are not being utilized.

2. Who has the power to regulate?

Despite Congress’s power to regulate hydraulic fracturing activities under the Commerce Clause of the U.S. Constitution, regulation of the technology and of the oil and gas industry in general, is largely left to the states. Each state has different terrain and something unique to offer making each well a little different such that procedures and regulations may differ among the states.

125. Chemical Use in Hydraulic Fracturing, supra note 118.
126. Hydrochloric acid, supra note 124.
128. Loris, supra note 1.
130. Id.
131. Chemical Use in Hydraulic Fracturing, supra note 118.
132. U.S. CONST. art. 1, § 8, cl. 3.
Indeed, the composition of shale formations varies by region and by well, making it impossible to have a policy that governs each state in the same way. Thus, the regulation of oil and gas activities is managed best at the state level where regional and local conditions are understood and where regulations can be tailored to fit the needs of the local environment.

For instance, California sits atop the Monterey Shale Formation. However, because California has several fault lines and is currently in a drought, development of the Monterey Shale will differ from development of other areas not dealing with a drought. For example, because California is predicted to have one year of water left, regulations regarding amount of water allowed to be used will differ from areas such as the Bakken Shale formation in North Dakota or the Marcellus Shale formation in Pennsylvania who are not currently suffering from a drought.

Unfortunately, this is a major problem as most critics insist the oil industry follow all federal laws currently enacted relating to water, air, and disclosure requirements. However, the oil and gas industry is currently exempt from some federal environmental statutes. Though, this does not mean the industry is free to do as they please. For example, the oil and natural gas production industry mandates that every oil producer follow best practices to minimize the environmental and societal impacts associated with development.

Although best management practices hold oil companies to strict standards, many believe best management practices are not enough. Thus, as seen in almost every state, much of the public’s concern with fracking is because of unanswered questions and concerns from the oil industry. For this reason, each state should do


136. The oil and gas industry is exempted from several major federal environmental statutes, including: the Safe Drinking Water Act; the Resource Conservation and Recovery Act; the Emergency Planning and Community Right-To-Know Act; the Clean Water Act; the Clean Air Act; the Comprehensive Environmental Response, Compensation, and Liability Act; and the National Environmental Policy Act; see RENEE L. KOSNIK, EARTHWORKS, THE OIL AND GAS INDUSTRY’S EXCLUSION AND EXEMPTIONS TO MAJOR ENVIRONMENTAL STATUTES (2007), available at http://www.shalegas.energy.gov/resources/060211_earthworks_petroleumexemptions.pdf (discussing oil and gas industry exemptions from major environmental statutes).


139. See generally Steve Horn, NY Assembly Passes Two-year Fracking Moratorium, Senate Expected to Follow, HUFFINGTON POST (Mar. 7, 2013), http://www.huffingtonpost.com/steve-horn/ny-assembly-fracking-moratorium_b_2831272.html (“New York has had a moratorium on the books since 2008.”); see also Patrick McGreevy, Proposal for fracking moratorium advances in state Senate,
what they can to place their citizens at ease by working together with those concerned to come to a compromise about disclosure requirements.

In fact, the first state to disclose chemicals used in fracking fluid was Texas. Governor Rick Perry signed a bill requiring drillers to publicly disclose the chemicals used when extracting oil and gas. In spite of this, a controversial exemption is prevalent in every oil and gas state for trade secrets. Many anti-fracking groups claim that because the oil industry is allowed such an exemption, it means the industry knows the chemicals are dangerous; otherwise there would be no reason to keep them secret. Likewise, anti-fracking groups argue they cannot test chemicals in water because they do not know what chemicals to look for.

But, states are not hesitant to disclose chemicals to the public because they are toxic and dangerous. Rather, some companies have resisted disclosing exact recipes of fracking fluids for competitive reasons. Moreover, Americans do not know the recipe for a Twinkie - a snack that should raise concern as it can last in plastic wrap for weeks before going bad. But it appears no one cares.

In addition to Texas requiring chemical disclosures, Colorado goes further and requires the disclosure of chemicals as well as concentrates. Colorado enacted a voluntary groundwater-sampling program where participants will voluntarily collect groundwater samples before and after drilling. In fact, the industry itself encouraged the voluntary program to ease concerns associated with drilling and fracking.

This is important because opponents cannot argue they are left in the dark by not knowing what chemicals to look for. If every state participated in such a program,
anti-fracking groups could not argue that fracking fluids are disrupting their livelihood and contaminating water. Sampling water before and after fracking will result in an accurate outcome.\textsuperscript{149}

Likewise, the California Legislature recently passed Senate Bill 4\textsuperscript{150} ("SB 4") as an alternative to a moratorium on fracking and drilling exploration. SB 4 requires California to study the environmental and health impacts of hydraulic fracturing.\textsuperscript{151} Specifically, SB 4 contains extensive notification and disclosure requirements for fracking jobs such that oil companies will not be allowed to frack or acidize in California unless they test the groundwater, notify neighbors, and list each and every chemical on the Internet.\textsuperscript{152}

In addition, the Bill requires oil and gas well operators to obtain and comply with permits for these applications.\textsuperscript{153} Moreover, SB 4’s disclosure requirements, compared to those of Colorado and Texas, make California the strictest state to perform oil exploration and fracking.\textsuperscript{154} "In fact, we have the most intelligent regulation on the drilling of oil in the country."\textsuperscript{155} "This is a first step toward greater transparency, accountability and protection of the public and the environment."\textsuperscript{156}

SB 4’s goal was to reach a compromise between environmentalists and the oil industry. Unfortunately, both the oil industry and environmentalists opposed the measure.\textsuperscript{157} The oil industry feared “the new law could make it difficult for California to reap the benefits offered by development of the Monterey Shale, including thousands of new jobs, increased tax revenue, and higher incomes for residents.”\textsuperscript{158} Also, the oil industry stated the law “could create conditions that will make it difficult to continue to provide a reliable supply of domestic petroleum energy for California.”\textsuperscript{159} Specifically, subjecting well development to environmental review under the California Environmental Quality Act will be unduly burdensome, costly and time-consuming.\textsuperscript{160}

\textsuperscript{149} Id.
\textsuperscript{151} Id.
\textsuperscript{152} Id.
\textsuperscript{155} Chris Reed, In His Own Words: Gov. Brown on Fracking, CAL WATCHDOG (May 19, 2013), http://calwatchdog.com/2013/05/19/in-his-own-words-gov-brown-on-fracking/#sthash.ATx2SGbl.dpuf.
\textsuperscript{156} Sharon Bernstein, California Law to Regulate Fracking Signed by Governor, REUTERS (Sept. 20, 2013, 8:42 PM), http://www.reuters.com/article/2013/09/21/us-usa-california-fracking-idUSBRE98K00C20130921 (quoting Senator Fran Pavely).
\textsuperscript{157} Id.
\textsuperscript{158} Id.
\textsuperscript{159} Bernstein, supra note 156 (quoting Catherine Reheis-Boyd).
Since the environmentalists sought a full out moratorium, they feared the new regulations would essentially allow for the unfettered use of fracking techniques in oil and gas development.\textsuperscript{161} However, SB 4 should be viewed as a safe, middle-ground between no new legislation, which the oil industry supported, and an outright moratorium on all well stimulation techniques, which environmental groups had advocated.\textsuperscript{162} The oil industry should not have unfettered discretion, and a moratorium should not be allowed unless based off of realistic concerns.\textsuperscript{163}

In order to give a fair assessment to those critical of the oil industry and diminish false reports, chemical disclosures should be required in every state. As Governor Hickenlooper declared:

\begin{quote}
The best way to fight back on that kind of misinformation is to be transparent. To really step out and say this isn’t something that happens, and we’re so confident that this is not going to happen that we’re going to measure before drilling and then after drilling, and we’ll monitor and just clearly demonstrate beyond any possible doubt that this doesn’t happen.\textsuperscript{164}
\end{quote}

Regardless of the information at hand, people will argue that a conspiracy exists. However, it would be foolish to prevent fracking based solely on the potential fear that fluids have harmful side effects, just as it would be foolish to not drive cars or fly in airplanes or travel by trains because of the potential of an accident occurring.

\section*{C. Air Quality}

Climate change is a well-known, hot button issue. There are many theories pointing to the causes of climate change. Fracking is one such theory. Fracking operations do utilize large amounts of horsepower, normally provided almost exclusively by diesel engines. However, fracking is not the cause of bad air quality or air pollution.

In fact, “we are about halfway” to the President’s goal to cut greenhouse gas emissions and “about half of that is because of the substitution of natural gas for coal in the power sector.”\textsuperscript{165} Moreover, Colorado, a state at the forefront of regulating air emissions from oil and gas operations for many years, has a comprehensive regulatory framework that has seen decreases in gas emissions.\textsuperscript{166} Notably, in his 2014 State of

\begin{thebibliography}{9}
\bibitem{161} Bernstein, supra note 156.
\bibitem{162} Id.
\bibitem{163} BLACK’S LAW DICTIONARY 1101 (9th ed. 2009) (in general, a moratorium is a legally authorized period for the delay or abeyance of some activity).
\bibitem{164} Marcus, supra note 82.
\bibitem{166} See generally William C. Allison, Director, Air Pollution Control Div., Colo. Dep’t of Public Health and the Env’t, Testimony before the U.S. S, ENV’T AND PUBLIC WORKS COMMITTEE, CLEAN AIR AND NUCLEAR SAFETY SUBCOMMITTEE (June 19, 2012), available at http://www.epw.senate.gov/
the Union Address, President Obama declared that “[t]aken together, our energy policy is creating jobs and leading to a cleaner, safer planet. Over the past eight years the United States has reduced our total carbon pollution more than any other nation on Earth.”\textsuperscript{167}

This is imperative to point out because it refutes challenges that fracking has caused our carbon footprint to increase. Moreover, the sources of potential air emissions associated with hydraulic fracturing are temporary in nature. Although there have been well-documented air quality impacts in areas with active natural gas development,\textsuperscript{168} with proper safeguards in place, fracking operations pose no threat to local air quality.\textsuperscript{169} Thus, the myth that fracking causes seizures, headaches, asthma, and other health related problems cannot be true.

In fact, a Fort Worth Natural Gas Air Quality Study found that “there are no immediate health concerns from air quality in the [Dallas-Fort Worth] area, and when they are properly managed and maintained, oil and gas operations do not cause harmful excess air emissions.”\textsuperscript{170} Maintaining air quality is not something that just happens, engines must be tuned up and seals must be checked.

But, there are federal,\textsuperscript{171} state, local and tribal requirements\textsuperscript{172} regarding air emissions that apply to oil and gas operations. For instance, the EPA, the Department of the Interior, other federal agencies and states are aware of potential negative impacts, and are working to better characterize and reduce air emissions and their associated impacts.\textsuperscript{173}

\begin{footnotes}
\item[168] \textit{Natural Gas Extraction - Hydraulic Fracturing}, U.S. ENVTL. PROT. AGENCY, available at http://www2.epa.gov/hydraulicfracturing (“[T]here have been . . . increases in emissions of methane, volatile organic compounds (VOCs) and hazardous air pollutants (HAPs).”).
\item[170] \textit{EASTERN RESEARCH GROUP, CITY OF FORT WORTH NATURAL GAS AIR QUALITY STUDY} (July 13, 2011), available at http://fortworthtexas.gov/uploadedFiles/Gas_Wells/AirQualityStudy_final.pdf (“The measured and estimated air pollution levels did not reach levels that have been observed to cause adverse health effects.”).
\item[171] \textit{AM. PETROLEUM INST., supra} note 169 (“Federal regulations that have a direct impact on controlling emissions from fracturing operations include the Standards of Performance for Stationary Compression Ignition and Spark Ignition Internal Combustion Engines (“NSPS”) and Reciprocating Internal Combustion Engine (“RICE”) NESHAP rules, which regulate new, reconstructed and existing stationary engines. In general, these rules apply to most internal combustion engines regardless of horsepower rating, location or fuel.”).
\item[172] \textit{Id.} (“The EPA typically delegates implementation of air regulations to state and tribal agencies. This delegation of authority can include rule implementation, permitting, reporting and compliance. Any state with delegation of authority can pass more restrictive rules, but they are prohibited from passing a rule that is less stringent than the federal rule.”).
\item[173] \textit{Natural Gas Extraction, supra} note 168.
\end{footnotes}
In spite of this, there have been lawsuits centered on causes of seizures, headaches, and migraines rumored to be caused by air pollutants given off by fracking.\textsuperscript{174} One lawsuit filed in Kern County by Tom Franz, the President of the Association of Irritated Residents, who lives near fracking sites, claimed Kern County is already highly polluted, and with more fracking, drilling and processing of crude oil, toxic chemicals will be released into the air, and water will become contaminated.\textsuperscript{175} This is entirely untrue because with the enactment of SB 4, Californians are provided with the strongest regulatory protection in the country—there has not been a single confirmed case of fracking causing health problems.\textsuperscript{176}

Nonetheless, unsubstantiated claims continue to occur from those who fall sick, but do not know why. Unfortunately, doctors and the Internet can influence people’s opinions when they hear or read that illness \textit{may} be caused by fracking. However, the key word is \textit{may}.\textsuperscript{177} There is nothing worse than having a loved one fall sick from causes that are unknown. Placing blame on anything can make loved ones feel comfort because people want an answer for their problems.

This was seen with Rosario Garcia\textsuperscript{178} who suffers from Valley Fever—a disease causing high fevers and difficulty breathing.\textsuperscript{179} Garcia is a resident of Shafter, a town right outside Bakersfield, in Kern County, and works as a farmer near almond orchards.\textsuperscript{180} Garcia, sadly, had two of his best friends pass away from the disease and fears that because his son, who was recently diagnosed with asthma, will catch Valley Fever since their home is located near fracking sites.\textsuperscript{181}

However, growing up in Kern County, it is known that Valley Fever is caused from dust in the air that comes from soil—specifically the vast amounts of almond orchards where Garcia works. Also, Bakersfield is located in the central valley where Valley Fever is prominent and dust gets trapped from the surrounding cities due to its central location. Hence the name ‘Valley’ Fever in the San Joaquin ‘Valley.’\textsuperscript{182}

\textsuperscript{174} Zeko, \textit{supra} note 123.
\textsuperscript{175} Mimi Elkalla, \textit{Lawsuit Takes Aim at Kern County Oil Drilling Permits}, \textit{Bakersfield Now} (Nov. 12, 2014), http://www.bakersfieldnow.com/news/business/Lawsuit-takes-aim-at-Kern-County-oil-pumping-permits-282506381.html?tab=video&c=y (“I think there is significant pollution there that isn’t being accounted for, and I think if there’s mitigation that will take place that will improve our health,” said Tom Frantz, the president of the Association of Irritated Residents, “that will help to clean up our air.” This quote shows how fears are based on thoughts, not truth. There is nothing in this statement that can back up what the opposition is fighting for).
\textsuperscript{177} Hannah Guzik, \textit{Fracking the Poor}, \textit{In These Times} (Nov. 19, 2014), http://inthesetimes.com/article/17355/fracking_the_poor.
\textsuperscript{180} Hertsgaard, \textit{supra} note 178.
\textsuperscript{181} Id.
\textsuperscript{182} \textit{What is Valley Fever}, \textit{supra} note 179.
Moreover, broadcasters frame issues around lower economic communities in hopes of making people believe the industry is testing the side effects of fracking on poor people. The location of fracking sites has nothing to do with the economic standings of the area. Fracking occurs wherever the government issues the oil industry a permit when oil is found. In Bakersfield, California especially, fracking occurs where oil is found and oil has always been a part of the Bakersfield community. In fact, Bakersfield’s oldest high school – Bakersfield High School – has a driller as their mascot, which has been around for over 100 years.

In addition, because fracking is most commonly performed using existing oilrigs, the oil industry is not singling out poor communities. Rather, they are going back to where they drilled for oil decades ago with the ability to reach deeper areas due to the new technological advancement.

D. Earthquakes

The process of hydraulic fracturing a well as presently implemented for shale oil and shale gas recovery does not pose a high risk for inducing felt seismic events. Yet another prevalent myth, especially in California where there are many fault lines, is that fracking causes earthquakes. The reality is quite different; the fracturing process itself does not cause earthquakes.

Additionally, induced seismicity does not occur only from oil and gas extraction. In rare instances earthquakes are caused by the use of underground injection wells whereby wastewater is injected back into the ground. But, induced seismic activity from many underground energy activities is not a new phenomenon and has been closely monitored by the Department of Energy. Also, a recent National Research Council study highlights the fact that geothermal activities (capturing and using heat stored in the earth’s core) have caused relatively small earthquakes (some felt, some not) at more frequent rates from far fewer projects. The study also warns that continuously injecting carbon dioxide at high pressures...
(carbon capture and sequestration from coal plants) could induce earthquakes of higher magnitudes.\textsuperscript{191}

In Northern Orange County California, despite reports and scares that attempted to link fracking with seismic activity, earthquakes are not caused from nearby fracturing activity.\textsuperscript{192} Actually, at this point in time, there is no direct or strong evidence to link the most recent earthquake in La Habra, California to fracturing activity.\textsuperscript{193} In fact, fracking very rarely causes earthquakes of magnitude three or larger, because it is typically performed at somewhat shallow depths, is a quick activity, is low rate in terms of materials and chemicals injected, and much of the material is taken out.\textsuperscript{194}

As a refresher, fracking is designed to put in a relatively small amount of fluid under very high pressure designed to crack the rock.

These are mostly hairline cracks, a myriad of those, the largest of which is maybe a pencil-width diameter. And we have a lot of information about the seismicity that is caused by fracking. . . . The magnitudes of these are all less than magnitude 1, in fact many of the magnitudes take very sensitive seismometers in order to pick these up; magnitude minus 0.4 to minus 0.1.\textsuperscript{195}

Moreover, the Inglewood Oilfield study\textsuperscript{196} found that before-during-and-after measurements of vibration and seismicity, including analysis of data from the permanently installed California Institute of Technology accelerometer at the Baldwin Hills, “indicates that the high-volume hydraulic fracturing and high-rate gravel packs had no detectable effects on vibration, and did not induce seismicity (earthquakes).”\textsuperscript{197}

Though extremely small micro seismic events do occur during hydraulic fracturing operations, these micro seismic events affect a very small volume of rock and release, on average, about the same amount of energy as a gallon of milk falling off a kitchen counter.\textsuperscript{198}

\textsuperscript{191} Id.


\textsuperscript{194} Graves, supra note 192.

\textsuperscript{195} CALIFORNIANS FOR ENERGY INDEPENDENCE (Feb. 12, 2013), http://www.energyindependenceca.com/quotes/ (quoting John Parrish, California State Geologist).


Furthermore, the U.S. Department of Energy has been observing and monitoring induced seismic activity from energy-related activities since the 1930s.\textsuperscript{199} Instances of seismic activity are rare; out of 30,000 injection wells, there have only been eight events of induced seismicity — none of which caused significant property damage or injury.\textsuperscript{200}

While companies that induce seismic activity should be liable for any damage they cause, calls for bans of hydraulic fracturing or the use of underground injection wells are unfounded. Things are not perfect, but it is not out of lack of effort or failure to engineer things properly. It is a matter of keeping perspective with what is going on and how it is carried out.

VI. LET’S FRACKING WORK TOGETHER

The truths behind the myths of fracking relative to the environment have been revealed above as exaggerated and unsubstantiated. But, because anti-fracking groups seek to ban fracking all together and solely rely on renewable energy technology, we must be flexible in working with anti-fracking groups. As Americans, we always look ahead and prepare for the future. This makes America the most progressive nation in the world. However, an energy ban would prevent that progress.

Nevertheless, Exxon and ExxonMobil — the world’s largest publicly traded international oil and gas company — expects wind, solar and other non-hydro electric energy to grow much faster than any other energy technology.\textsuperscript{201} However, those renewables\textsuperscript{202} will provide just four percent of the world’s energy by 2040, up from one percent in 2010. Not surprising, fossil fuels will still dominate: “Oil will account for 32 percent of world energy, natural gas for 26 percent, and coal for 19 percent. Nuclear and biomass will account for 8 percent each, and hydroelectric power will account for 3 percent.”\textsuperscript{203}

Moreover, as technology stands today, the renewables cited by governments are too expensive to come to fruition, as the technologies have not advanced far enough to make them cheap or effective enough for broad adoption globally.\textsuperscript{204} Thus, green energy will be in our future, but as California Governor Jerry Brown stated:

I stand on intelligent analysis of the issues. The reason why I have some sympathy for oil drilling in California is because 98 percent of

\textsuperscript{199} Graves, \textit{supra} note 192. (indicating cataloging of earthquakes has only been performed since 1932. As such, we have lack of pre-extraction production of background levels of seismicity).

\textsuperscript{200} Loris, \textit{supra} note 1.


\textsuperscript{202} For purposes of this article, renewable energy is energy that comes from natural resources such as sunlight, wind, rain, tides, waves and geothermal heat.

\textsuperscript{203} Fahey, \textit{supra} note 20.

\textsuperscript{204} \textit{Wind and Solar Energy are 'Not Ready for Primetime,' Says Exxon Analyst, supra} note 198.
the people are using oil that is imported. And until we get them in electric cars or walking or riding on bikes, we need oil...205

Thus, hydraulic fracturing and horizontal drilling should be celebrated as important technological progress that has opened new opportunities for the safe development of affordable, reliable energy. Moreover, because California is "[m]ostly cut off from the rest of the country’s oil production, California relies on countries such as Iraq and Saudi Arabia to meet more than half of its crude oil needs."206

In fact, "[w]e do import two-thirds of our oil, and our cars drive 332.2 billion miles a year. I haven't heard anyone call for a moratorium on that... You cannot get to 333 billion miles without a lot of oil. What doesn’t come from here will come from a boat or a train. It is coming."207

Challenges in California oil production do not arise from the ability to find oil; rather the challenge is overregulation by the government. An entry on House Majority Leader Kevin McCarthy’s (R-CA) website stated:

The American energy revolution has been one of the lone bright spots in an otherwise beleaguered economy. But despite this abundance, the Obama administration is relentless in their pursuit to crowd out low-cost energy options by mandating regulations that favor expensive and unreliable energy sources, says.208

Moreover, oil and gas are an important source of domestic energy for our states and our nation. An energy boom was created and state regulators have been ensuring that energy production occurs in an environmentally sensible way.209 Additionally, unconventional oil and gas activity provides good-paying jobs and needed tax revenues.

For example, in 2012, the average U.S. household income increased by $1,200, in the form of lower energy costs and a related decrease in prices of other goods and services.210 Likewise, the shale boom is predicted to create as many as 250,000 jobs by 2020, up from 150,000 in 2010. More than 190,000 jobs supporting the shale gas industry were added by 2010, from steel makers to chemical producers,
and the number is expected to rise to 370,000 by 2020 when shale gas is projected to contribute $150 billion to the U.S. economy.\textsuperscript{211}

Furthermore, unconventional drilling in North Dakota’s Bakken formation has allowed North Dakota to become the second-largest U.S. oil producer in recent years, behind Texas.\textsuperscript{212} According to the U.S. Energy Information Administration, “[w]ith more than an estimated 15 billion barrels of oil . . . California’s Monterey shale formation is twice as large as North Dakota’s Bakken formation.”\textsuperscript{213} Thus, similar to the Gold Rush that swept over California in the late 1800s, making California one of the most profitable and enriched states in the nation, California has the opportunity to relive those glory days.

A recent study conducted by the University of Southern California discovered that “the prudent development of the Monterey Shale could add hundreds of thousands of new jobs to California over the next decade while stimulating economic growth and generating significant new state and local tax revenues.”\textsuperscript{214} Further, “California had the third-largest U.S. oil output in 2013, narrowly ahead of Alaska, but could produce far more if the state aggressively moved to develop its energy resources . . . .”\textsuperscript{215}

Even better, the American economy will benefit in a myriad of ways from its change in energy supply. Hundreds of thousands of jobs are already being created, some in remote, previously stagnating regions. This additional economic activity will boost overall growth in the United States’ gross domestic product, yielding significant new fiscal revenues.\textsuperscript{216} Also, some U.S. industries, such as chemicals and plastics, will gain a significant comparative advantage in production costs.

In spite of these estimates, many stand very critical. The anti-fracking groups argue the estimates regarding accessible oil and gas in shale formations are overestimated.\textsuperscript{217} For instance, regarding the Monterey Shale formation, the U.S. Energy Information Association (“EIA”) originally estimated there could be between 13.7 and 15.4 billion barrels of oil.\textsuperscript{218} Though, in 2014, the EIA drastically reduced their estimates to 0.6 billion barrels of recoverable oil, marking a 95.6% reduction.\textsuperscript{219}

However, similar to the stock market, estimates change due to market price and availability of completion equipment in the region. Likewise, it can be argued the boom and bust cycle of oil and gas production can hinder energy growth and lead to

\textsuperscript{211} Id.
\textsuperscript{213} Rascoe, supra note 205 (quoting the U.S. Energy Information Administration).
\textsuperscript{215} Rascoe, supra note 206 (quoting lawmakers at a House Natural Resources committee hearing).
\textsuperscript{218} Where is Fracking Occurring?, supra note 133.
\textsuperscript{219} Id.
swings in employment between oil-producing and nonproducing states as commodity prices fluctuate. But the boom and bust cycle is nothing new. In sum, because it may be more profitable to buy oil from other countries, estimates may shift for money purposes. The next estimate may be higher.

Actually, the recent sharp decline in oil prices does not have much effect on the long-term vision of oil and gas production. The United States is estimated to have enough gas to sustain its current rate of production for more than a century, and prices are expected to rise and fall, sometimes dramatically throughout the period. In fact, even if available in the United States through unconventional drilling, if it is not profitable to extract oil or natural gas from the United States, we will choose to buy from Saudi Arabia or other exporting nations where it is cheaper.

In the past, the United States did not always have the luxury of choosing the most profitable option. “In September 2008, the United States thought it would soon need to secure new foreign supplies of natural gas.” Thankfully, the United States has turned the corner. America is now producing more and importing less natural gas than before, making it clear the United States will become an exporter — a dynamic that is calculated to improve the U.S. trade position by $164 billion in 2020.

Thus, by importing less energy, it will strengthen the U.S. economy in the long run making the United States less vulnerable among other nations. However, although the strengthening of the U.S. economy would enhance American economic power, oil is a fungible commodity and at this stage, we can only speculate about the geopolitical effects. Therefore, the U.S. economy will remain sensitive to shocks from sudden changes in world price.

Nevertheless, “the end of the decade, North America will be exporting more oil and liquid hydrocarbons than it imports, a remarkable turnaround for a region that was a major global importer.” Further, a boost in production will reduce dependence on foreign energy. But, because global interdependence involves both sensitivity and vulnerability, balancing energy imports and exports is only the first step to energy independence. As such, now is the time to become energy interdependent, not independent.

VII. FOREIGN OIL – ENERGY INTERDEPENDENCE

In the early 1970s, a time when the United States imported a quarter of its oil, President Richard Nixon proclaimed he wanted to secure national energy

220. Fahey, supra note 20.
222. McBride and Sergie, supra note 21.
224. Fahey, supra note 20.
independence. However, despite efforts, due to turmoil in the Middle East it was widely believed the country was running out of natural gas as Americans were importing half their petroleum needs at 15 times the price.

Following President Nixon’s energy independence proclamation, subsequent U.S. Presidents have also proclaimed energy independence as a goal. Although taking fifty years, it has been argued that by 2023, the 50th anniversary of Nixon’s “Project Independence,” the United States will be energy independent in the sense that it will export more energy than it imports. Thus, by the end of this decade, nearly half of the crude oil that America consumes will be produced at home, while eighty-two percent will come from the U.S. side of the Atlantic.

Energy independence could make this the New American Century by creating an economic environment where the United States enjoys access to energy supplies at much lower cost than other parts of the world. A balance of energy imports and exports does not produce pure independence, but it does alter the power relations involved in energy interdependence.

Power arises from asymmetries in interdependence – meaning, if the United States and other oil nations depend on each other, but the United States depends on other countries less, the U.S. bargaining power is increased. This balance of asymmetries has existed between Saudi Arabia and the United States for decades in which we depended on them as the swing producer of oil, and they depended on us for ultimate military security.

Additionally, as the United States becomes more self-sufficient, bargains will be struck on somewhat better terms from the United States’ point of view. For instance, Russia’s leverage over European nations will diminish, as the United States will have the ability to import more oil.

Moreover, due to water scarcity in East Asia, where a main focus of U.S. foreign policy lays, China will find itself increasingly dependent on Middle Eastern oil. This could strengthen American efforts by continuing working relations with Saudi Arabia to persuade China to play a greater role in regional security arrangements, as the United States limitations in producing shale oil and shale gas are more political and policy-related than technical.


227. Id.


In fact, many other countries also have considerable shale-gas potential. However because of water scarcity in China, investment insecurity in Argentina, and environmental restrictions in several European countries, the United States’ ability to produce shale oil and shale gas enhances their bargaining position in world politics. In fact, Europeans and Asians already have to pay four to six times more for their natural gas than Americans do. Therefore, by exporting more oil and gas than importing, the United States is on the way to regaining the economic strength it once had.

VIII. Conclusion

In sum, because the amount of fracking being done today is relatively new, no one can say for sure what the economic or environmental effects will be in the long-term. However, in a hypothetical situation, if we take State A – a state who opposes fracking due to environmental risks, health, and water contamination concerns, without any attempt of making sure harm will occur, we could find a state who is deeper and deeper in economic depression and cannot get out. Conversely, if we take State B – a state that proposes fracking for its economic benefits, but ignores any potential environmental and safety risks, we could end up with a state whose economy is booming but their citizens can no longer drink the water. Thus, the solution is not to completely ban fracking, nor is it to allow fracking without some oversight. The solution is to work together and end the polarization, by regulating fracking and ensuring that citizens are safe, healthy, and the state is economically improving.

Similar to trains, planes, and automobiles that can all be dangerous if built or used improperly, “there is nothing inherently dangerous about fracking that sound engineering practices cannot fix.” Thus, until we can figure out how to drive our cars, travel by train, and fly in airplanes without fuel produced from oil and gas drilling, fracking is the best option for America’s future.
