Shaky Ground:  
The Consequences of Hydraulic Fracturing

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I. Introduction

For much of our Nation’s history, America has been home to one the largest and most profitable businesses, the oil industry. New methods in the trade have been developed in response to the growing shortage supply and increase demand by the population. One method called hydraulic fracturing, is currently responsible for dramatically decreasing oil prices across the nation. Nevertheless, this method also uses millions of gallons of fluid including chemicals that are directly injecting into the ground. “Fracking” produces an enormous amount of gas that would not otherwise be produced. Consequently, many dangerous complications accompany the process. “Fracking” has become a widespread controversy due to its impact on the community, individuals, environment and most importantly its ability to set precedent for future policy. Fracking has become one of the top issues that are debated today because it combines two of America’s most valued possessions; wealth and political power. The ability for America to produce its own oil allows the country to be more self-sustaining in the area of natural resources. The purpose of this paper is to inform the reader of the numerous impacts fracking has in America and to propose a new set of policies that strictly regulate the plethora of effects the method has created.
II. Glossary

**Annulus**: The space between the casing and the wellbore or surrounding rock.

**Biocide**: An additive used in hydraulic fracturing fluids (and often drilling mud) to kill bacteria that could otherwise reduce permeability and fluid flow.

**Casing**: Steel pipe inserted into a wellbore and cemented into place. It is used to protect freshwater aquifers or otherwise isolate a zone.

**Class II injection well**: A well that injects fluids into a formation rather than produces fluids. A Class II injection well is a well associated with oil or natural gas production. Such wells include enhanced recovery wells, disposal wells, and hydrocarbon storage wells.

**Completion**: Includes the steps required to drill and assemble casing, tubes, and equipment to efficiently produce oil or gas from a well. For shale gas wells, this includes hydraulic fracturing activities.

**Flowback water**: The water that returns to the surface from the wellbore within the first few weeks after hydraulic fracturing. It is composed of fracturing fluids, sand, and water from the formation, which may contain hydrocarbons, salts, minerals, naturally occurring radioactive materials.

**Hydraulic fracturing** (fracking or fracing): A stimulation technique performed on low permeability reservoirs such as shale to increase oil and/or gas flow from the formation and improve productivity. Fluids are injected at high pressure and flow rate into a reservoir to create fractures perpendicular to the wellbore according to the natural stresses of the formation and maintain those openings during production.

**Liquefied petroleum gas (LPG)**: Hydrocarbons, primarily composed of propane and butane, obtained during processing of crude oil, which are liquefied at low temperatures and moderate pressure. It is similar to NGL but originates from crude oil sources.

**Natural gas liquids (NGL)**: Hydrocarbons, typically composed of propane, butane, pentane, hexane, and heptane, obtained from natural gas production or processing which are liquefied at low temperatures and moderate pressure. They are similar to LPG but originate from natural gas sources.

**Perforation**: A hole in the casing, often generated by means of explosive charges, which enables fluid
and gas flow between the wellbore and the reservoir. This glossary provides definitions of technical terms used throughout this paper. The first time each term is used it is italicized.

III. Background Information

History

Today’s fracturing systems are much advanced from Edward Roberts’ patents from the nineteenth century. The process began by lowering high explosives charges into oil wells in the Appalachian area to blast fractures into the oil bearing sand. While fighting in the Battle of Fredericksburg, Virginia in 1862 Roberts saw the explosives the Confederates used in a canal that obstructed the battlefield. This sparked the idea that evolved over time called “superincumbent fluid tamping.” Over the next few years the idea transformed into a method that America now uses today. Roberts was issued a patent for his invention known as the “Roberts’ Torpedo”, this idea revolutionized the young and newly started oil industry. The first commercial application took place just 10 miles from Duncan, Oklahoma on March 17, 1949. In 1953, the license became available for all qualified oil companies to use the method Roberts created.

Hydraulic fracturing or “fracking” is a primary technique that permits the economic production of natural gas from shale deposits also known as plays. Because of the metamorphosing of large-scale shale gas production in the U.S. energy market, natural gas is being used in new sectors of production such as transportation. Due to the insignificant amount of research and information provided on the long-term effects of hydraulic fracturing the processes are uncertain (Clark, Burnham and Harto).

The shale involved in these practices sustains miniscule levels of permeability, which inhibits a heavy flow of gas or water. Shale deposits permit natural gas to be stored in unconnected pores and fractures. “Fracking” is a popular technique to connect the pores and enable gas flow. The process of
fracking may be beneficial to this process and a speedier method to complete it but it encompasses an array of environmental impacts. Nevertheless, the shale gas production system (fracking) involves nine steps that devise its methods: road and well construction, drilling the well, casing, perforating, hydraulic fracturing, completion, production, abandonment, and reclamation (Clark, Burnham and Harto).

**Environmental Effects**

The method of fracking shale deposits and the large surge in producing gas in large amounts has created impacts on climate change, local air quality, water availability, water quality, seismicity and local communities (Clark, Burnham and Harto). Most of the environmental effects are not accounted for because of the exemption given under federal redhidden due to the immense amount of loopholes and relaxed regulations the federal government has created in order to promote fracking. The impacts are shielded by a number of exemptions from federal laws designed to protect public health and the environment (Nowlin).

**Leaks**

Many studies have been conducted to approximate the life cycle of green house gas emissions produced from extracting shale gas. Natural gas is heavily inclusive of the procedures involved with fracking. Its life cycle GHG (green house gas) emissions significantly affect both humans and wildlife because of the climate change, leakage and venting that occurs throughout the supply chain (Clark, Burnham and Harto) Results are differentiated due to the methodology and data variability of the studies. Nevertheless, Argonne research approximates a base case leakage rate for large-scale shale gas of two percent. Researchers have also concluded that the leakage rate associated with fracking procedures have augmented since other estimates have been done; leakage varies by the level or stage of production (i.e. transmission and distribution). Cornell researchers approximated a base case leakage
rate for shale gas of 5.8 percent Natural gas leakage mitigation is a technique that has been experimented with for the betterment of this toxic occurrence. Plunger lift systems, dry seal systems and no-bleed pneumatic controllers are a few of these mitigation methods. Using these systems, the Natural Resources Defense Council approximates that 90% of natural gas leakage may be reduced in addition to the impact of emissions. (Clark, Burnham and Harto).

**Soil and Water**

In my cases, fracking has been proven to contaminate the soil and water it comes in contact with. A prime example of contamination, is hydraulic fracturing’s effects involving ground water. In New Jersey, there are two pending bills, the AB 3313 and SB 2576 both are seeking to prohibit oil and gas companies from recklessly embarking on fracturing mechanisms without making any efforts to ensure sustainability, water quality and flexibility in terms of the movement of ground and surface water. Proper treatment and disposal of flowback water harm the soil and lackadaisical fracking processes cause ground water to be unusable (Pless).

**Humans and Wildlife**

In 2011, the EPA doubled the legal limit of Methane permitted by the U.S. natural gas industry regulations. This was done because emissions from shale gas production were considered an unavoidable happenstance of this method. It was unavoidable because flowback water was extracted from wells before the initiation of gas production; this causes natural gas to be vented into the atmosphere for several days. Benzene has been found to be a stagnant element in the “chemical cocktail”, the mixture of several chemicals necessary for the process, which is injected into oil-bearing structures in order to destroy fissures for oil and gas to be released. Benzene has been proven to be dangerous to humans and can still be found in oil field wastewater (Cart). The methods in the work over process need to be closely regulated in order to ensure both humans and wildlife are not exposed to unhealthy amounts of methane.
**Air Pollution**
Fracking has been found to produce large amounts of air pollution that have a high propensity to impact local air quality where the gases are in great abundance. GHG’s are considered “fugitive emissions” of natural gas and expel VOC’s (volatile compounds) and HAP’s (hazardous pollutants) (i.e. benzene). Nitrogen oxides are pollutants expelled when the drilling, hydraulic fracturing, and compression of equipment procedures of fracking are performed. A collection of state emission inventories have proven that oil and natural gas operations are one of the many roots of local air pollution (Alvarez). A second air pollutant is crystalline silica dust caused by frac sand a proppant that “props” the fracture open, allowing the petroleum to flow out of the rock and into the well. Mining and transporting of sand to the well sites and transporting and congealing sand into hydraulic fracturing fluid cause its formation. Crystalline silica dust can cause inflammatory lung disease or silicosis (Clark, Burnham and Harto).

**Water Consumption**
Water is one of the largest used parts in the process of hydraulic fracturing. The bulk of the water consumed during the production stage where two to five million gallons are needed in order to complete the process. Over two hundred thousand and up to three hundred and ten thousand gallons can be used to drill and cement a shale gas well as construction takes its course. Fracturing a well results in five to twenty percent of the initial amount of water reappearing at surface level by the tenth day, this is called flowback water. An additional ten to three hundred percent of the injected amount will resurface to be converted to produce water as the well ages. By the thirtieth year of the life cycle, construction and production of shale gas can use 7,090,000 and 16,810,000 gallons of water per well (Clark, Burnham and Harto).

**Community Impacts**
The impact of fracking on the community is immense. Oil and gas development are industrial
processes that impact local proximities by the chemicals and procedures used to implement them as resources. Because of the equipment, exhaust caused by work trucks, hydraulic fracturing methods and flowback water generated, the surrounding areas of fracking processes are highly affected. These are only a few examples of the stress fracking processes place on the community (Clark, Burnham and Harto).

**Transportation and Equipment**

Transportation disturbances provide another valid concern for the surrounding community. Forbes claims that in terms of transportation there is no lesser evil amongst boats, trains and pipelines used for fracking. Staff writer, James Conca, comments: “Truck worse than train worse than pipeline worse than boat”. According to Forbes, in the U.S. and in Canada there is more crude oil, petroleum products and natural gas are moved through the supply chain using pipelines than any other form of transportation combined (Conca).

In America, over seventy percent of crude and petroleum derivatives are shipped via pipeline and tankers and barges transport twenty-three percent of oil shipments. Trucking only constitutes four percent of shipments, while rail only accounts for three percent. In North America, crude oil shipping is increasing at rapid rates. Trains are supposedly increasing in size and more tanker cars are being used for towing. The consequence is that crude oil is spilling from these vessels into the surrounding environment. It is toxic to humans and animals (Conca).

Because of the aforementioned, rail transport is encouraged for heavy tar sand crude transportation. The second largest refinery in America (Marathon Oil’s GaryVille Louisiana facility) transports over five hundred thousand barrels of crude a day. Thirty three of the fifty states have refineries that are accountable to tens to hundreds of thousands of barrels of crude per day with the largest volumes emanating from the Gulf Coast and California. As crude is concentrated in few
locations, it must be transported to more locations (Conca).

Reportedly, the contamination of water is the worst form of environmental hazard, even more than contamination of land. This reason being is that it affects more species and habitat. Because of the common occurrences of train derailments costing billions in loss of human life, this method of transportation is not favored either (Steingraber). The same may be said of pipeline cost as the Exxon Valdez pipeline incident although no life was lost, the clean up alone cost over a billion dollars. Forbes calculates the cost of each American human life to be approximately $250,000 (Conca).

A rail train carries approximately 30,000 gallons of crude. The amount of crude on these railways puts an excessive amount of pressure on the rail as companies increase the cars per train as much as possible. This deems rail transportation dangerous as well. Research performed by The Congressional Research Service estimates that transporting crude is the cheapest manner by which to transport with a cost of less than five dollars a barrel in comparison to ten to fifteen dollars a barrel using pipeline or train. Nevertheless, the dangers to the environment and people are far more expensive and hazardous than these savings (Conca).

IV. Regulation and Studies

Federal Regulation

The fracking industry was allotted an undeserving exoneration from the ecosystem guidelines set for by the Clean Air and Clean Water Acts. This exemption should be revoked as there are certain measures set forth in the Clean Air Act that monitor air emissions given off by hydraulic fracturing. By April 17, 2012, the Environmental Protection Agency disbursed upgraded source performance standards and national emissions standards for various air pollutants in the oil and natural gas industry (SourceWatch.Org). The regulations created by these new provisions are inclusive of first Federal air standards for the purposes of hydraulically fractured gas wells and other oil and gas industry pollutants.
These pollutants were not monitored at the Federal level, at the time (Clark, Burnham and Harto).

In January of this year, flaring and/or green completions on all workable natural gas wells developed before January 1, 2015 permitted the development of wells on and after that date. The rules are projected to lessen VOC emission by over ninety percent and reduce natural gas VOC, HAP, and CH4 emissions by an estimated ten percent. Currently, The BLM’s Department of the Interior constructed regulatory measures for oil and gas production on “public lands”. These measures included companies relinquishing all information pertaining to the chemical elements used in hydraulic fracturing fluid in combination with other groundwater protective measures (Clark, Burnham and Harto).

One must also attribute an adequate level of attention to the federal government’s lack of participation at the Presidential level. In 2013, the Obama administration confirmed plans for new regulation for 756 million acres of “public and tribal lands”. Allegedly, the President planned to promote fracking using protective practices that are superficial in nature. The Interior Department’s Bureau of Land Management, the governmental agency responsible for managing public lands, disclosed information proving that “old regulation” required oil operators to dispel non-routine techniques. Since, hydraulic fracturing is considered “routine”, perhaps this is why state regulatory agencies are experiencing such trepidation with oil companies disclosing information pertaining to fracking practices (Rugh).

Furthermore, the White House visitor logs indicate that President Obama’s top adviser on energy and climate conducted a meeting with the American Petroleum Institute Petroleum Association of America and other industry groups in efforts to draft a proposal for the regulations of fracking. Supposedly, the rules indicated that drillers are required to log fracking activities onto FracFocus.org. The downfall of this is that they are not required to do this until fracking processes have already been
completed. Also, there were no Presidential mandates indicating that the records would be supervised for accuracy (Rugh). Also, some chemicals do not have to be disclosed as they are considered trade secrets. These same “rules” allotted for the drilling now taking place in close range to homes and educational facilities, as well as the wastewater being stored in exposed outdoor vats. How can fracking be monitored if the President’s administration sets provisions for some of the most dangerous elements of the system? (Wall Street Journal).

**State Regulation**

Several states have created special laws and benefits to the petro-industry. Still there are provisions with which all states must comply. The BLM also requires operators to also relinquish the necessary information to solidify wellbore integrity plans before, throughout the course of, and after operations. Before fracking, companies – to remain in compliance with Federal law – were required to self-certify that their fluids are in accordance with Federal, state and local laws, rules and regulations. After fracking, companies are required to submit summaries of their operational endeavors including chemical makeup reports of their hydraulic fracturing fluid (Clark, Burnham and Harto).

In Western Virginia, oil and gas pipeline construction and maintenance a “public use” for which private land can be taken and damaged. Utah has initiated eminent domain that may be pursued to condemn land for “gas, oil or coal pipelines, tanks or reservoirs” and for road construction to access oil and gas resources. Washington has an underground storage of natural gas which will influence the economic progress of the state and pave the way for increased economic distribution of natural gas to the domestic, commercial and industrial consumers of the state. This was done for the benefit of the public, resulting in state companies obtaining “eminent domain rights” (F&W).

The Environmental Protection Agency does not withhold jurisdiction to mandate that shale gas companies disclose all ingredients used in chemicals of fluids utilized in hydraulic fracturing activities.
Nevertheless, it is the State that has the influence to encourage and/or demand this disclosure. In 2010, Wyoming was the first state to mandate that companies disclose chemical constituencies as a part of fracking fluid functions. Still, there was an exemption for confidential commercial information. Drilling companies began to inquire if 150 chemicals could be concealed from said disclosure agreements. Texas’s disclosure law was initiated on February 1, 2012 and the state mandated that information pertaining to these practices be disbursed to the public by means of the FracFocus.org website, where fluid and water volumes and chemical additives could be viewed (Clark, Burnham and Harto).

Various states have forwarded rules in combination with fluid disclosure standards. For instance, Pennsylvania has initiated rules that mandate the level of dissolved solids in discharged water. This ensured proficiently prevented direct disposal of produced well water to surface water bodies. In March of 2011, Maryland designed a two year agreement to grant the state sufficient time to complete a study on hydraulic fracturing. About this time, Vermont also became the first state to prohibit fracking, completely. These are merely some examples of the regulatory dealings on the level of the state (Clark, Burnham and Harto).

**Studies**

Recently, a field study inclusive of eleven varied hydraulic fracturing locations in five different states completed by the National Institute for Occupational Safety and Health identified levels of crystalline silica that surpassed recommended exposure levels in 79% of samples evaluated. Samples also surpassed the REL by ten or more in 31% of all samples analyzed. This led researchers to believe that appropriate safeguards are not being implemented to screen workers from potential health hazards (Clark, Burnham and Harto).

In 2008, Colorado emission inventory studies disclosed that emission inventory was responsible
for 48% of VOC’s, 18% of NOx, and 15% of benzene while shale gas operations were observed to cause increased levels of ozone and HAP’s near production sites (Clark, Burnham and Harto). In 2013, California mandated that oil manufacturers assess their wastewater infused with chemicals, which had been pumped from wells. It was an extreme method to help those involved better comprehend the health hazards of oil fracking. Within the first year, test results revealed a human carcinogen by the name of benzene, which has become known as “flowback fluid”. Frequently, the fracking waste liquid is reused in the groundwater process which then exacerbates the benzene level to that of perhaps thousands times what state and federal governments have deemed a cautious level (Cart).

Hundreds of wells were tested and results implied benzene levels of seven hundred times higher than federally regulated levels. Benzene is now considered a health danger to the public sector. Nevertheless, it has been found that California companies have been reusing the fluid in their flowback water for the purpose of an aquifer in bottle water for years. The Environmental Protection Agency refers to this occurrence as “shocking”, as the regional director for the agency admits that California’s method of waste water injection have been ill managed and do not align with the Safe Drinking Water Act. The state Division of Oil, Gas and Geothermal Resources, which controls the field of petrochemicals has taken much more interest in these practices (Cart).

False record keeping and data collection are what state officials are blaming the issue on. Self-reported test results from 2014 indicate that the new fracking regulations fashioned in 2013 were being followed. Nevertheless, government requires well operators to use steam injection and acidizing during the fracking method as well as transferring water testing results via a database of the internet cloud. Pure data collected by the Center for Biological Diversity proved that over ninety five percent of wastewater mock-ups extracted from three water wells well-surpassed federal and state water worth principles for benzene saturation. But, were these improvements solely made because of the “whistle
blowing” circulating throughout the fracking regulatory community? (Cart).

The LA Times attests that the data that many petrochemical manufacturing participants have reported to state regulators may not include all remnants of benzene levels found in fracking flow operations, which would prove that reporting requirement standards are still not being met. Supposedly, each oil well in California fashions over ten gallons of water per gallon of petro that emerges from the ground. Operators are to discard water waste by injecting it into appropriate disposal wells or pits.

Reportedly, potentially illegal disposal methods are highly attributable to fallible record keeping. In turn, Jared Blumenfeld (EPA regional administrator) discloses that he and other state officials are apprehensive to state that record keeping systems are erroneous because he feels that “there isn’t [really] any system”. Hollin Kretzmann, biological diversity attorney, appointed to monitor the injection program, believes the program is in complete disarray and officials are now scrambling to observe and repair a system that has been well under way for decades (Cart).

Originally the EPA withheld power to regulate federal water laws but in 1983, California was bestowed the responsibility. Understandably, the state has been demanded to transfer frequent accounts to the EPA and documents have failed to be submitted by their deadline. A 2011 audit disclosed system related problems within the Division of Oil, Gas and Geothermal Resources control of well injection systems throughout the entire network of companies. Reports also indicated poor training of inspectors and missing information pertaining to location sources. Issues as such are alarming because oil operators’ failure to include all substantial information and as a result it interferes with the understandability of the flow of waste within the system. On December of 2014, EPA released to the Division of Oil, Gas and Geothermal Resources a deadline to devise and tender an arrangement to better protect drinking water processes for an excess of two years and reminded them of their authority to withdraw California’s entitlement to control water contingent on state extensive industry operations
Local

Local regulations have played a comparable role in fracking, very similar to those at the State and Federal level, in the area of mandates and law making. It is the efforts that are closest to the people and companies that are oftentimes the most efficient. In the case of the municipal courts in New York, Pennsylvania and other states the prohibition of fracking by zoning has proved this statement to be true. The State Supreme Court of New York has completely banned fracking at various times in recent dealings. Pennsylvania has increased restriction of noise standards and other important efforts necessary for fracking. On April 14, 2012, the state initiated a new state law to control such activities. In Fort Worth and Southlake, Texas, green completions are required when operating with any all natural gas well. These are only a few examples of this form of authorization (Clark, Burnham and Harto).

V. Biblical Perspective

There is a significant viewpoint associated with the Biblical perspective that warrants consideration when discussing fracking, as well. Fracking is not only a political issue but should also be considered an important topic for Christian’s when considering the environmental ethical issues and responsibility of the individual. Fracking is not the most natural or Earth-preserving process used by the petrochemical arena. For this reason, the Bible is worth seeking viewpoints involving the subject.

Christine Bess

Christine Bess is the wife of an oilman who has recently found herself ashamed to speak of her husband’s profession. Because of the Christian faith of her peers, she has received less than positive reactions concerning his line of work and now chooses to speak of it as little as possible. Her husband has been employed by the petrochemical industry for three decades and an affiliate of Enduring Resources, an oil and gas resource company in Texas and Utah. Because of the negative flack caused
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by stereotypical documentaries and naysayers, fracking has obtained a negative light that many do not agree with, most particularly many Christians (Horst).

The film *Gasland* created a counter-democracy surrounding the practices of fracking. The film portrayed oil barons in the Persian Gulf that provided funds for the cinematic production to promote anti-fracking. Adversaries of the United States petrochemical field were the producers and had a feat to destroy the credibility of U.S. oil and gas producers by their use of hydraulic fracturing. It was one of many anti-fracking films that presented all of the negative aspects of the procedure.

It is not only Christians that do not agree with fracking. In 2013, the University of Texas conducted a poll that concluded that over forty percent of United States residents do not support fracking. For these reasons and others, a woman in Mrs. Bess’s position has been put to shame by even those of her same faith (Horst).

**Fracking God’s Creation**

The Bible attests several chapters lined with verses that may be viewed as God’s disagreement with the practices of fracking. As stated in Deuteronomy, 11:26 states “See, I set before you this day a blessing and a curse”, speaking of God’s creation of a good world, of which humans, his most prized creation are to take care. Genesis 1:28 and 9:1 clearly state “And He blessed them, be fruitful and multiply and replenish the Earth”. This implies that the Earth is to be respected as a creation of God and thus comes with a great responsibility.

The Bible also plainly states that humans are to be stewards of the Earth and as such, human beings have an obligation to do so. There is a parable of good stewardship in Luke 12:41-48 as well as in Matthew 25:14-30. They both summarize the concept of good stewardship to the Lord through respecting and replenishing His Earth. Luke 12:48 protests “Everyone to whom much was given, of him much will be required, and from him to whom they entrusted much, they will demand the more.”
First Peter 4:10-11 confirms “Each of you has received a special gift, so like good stewards responsible for all the different gifts of God, put yourselves at the service of others”. Similarly, Genesis 1:26 speaks of the original creation ordinance when God said: “Let us make man in our image, after our likeness. And let them have dominion over the fish of the sea and over the birds of the heavens and over the livestock and over all the earth and over every creeping thing that creeps on the earth.” Many could conclude from these verses that the Earth is to be respected by man and managed responsibility. One avenue to responsibly managing this gift is by creating regulation that provides protection for the environment and its’ citizens.

VI. Policy Recommendations

Although fracking may easily appear to be a complex system of procedures to mitigate for its surroundings, there are many strategies and policy recommendations that may be implemented to render hydraulic fracturing a more bearable method of use. Firstly, we must acknowledge that perhaps the oil industry must be held to the same regulatory standards of other industries. It is a balance and proper use of said strategies and possible policy changes that must be made in order for harmony to occur where this type of industrial processing is used. Below are some recommendations and strategies that one may find sufficing for these endeavors.

However, there are several difficulties that must be confronted to achieve change. In some states that have the larges shale gas deposits, they do not possess accurate or contemporary historical records of oil and gas production. This is the primary reason for regulatory dysfunction and denial of policy acceptance. Some state agencies are not properly organized to handle the quickly growing oil and gas industry. Also, areas lacking recent historical records of oil and gas activities have a tendency to be far more hesitant to devise new processes and procedures that are inclusive of risk than other states. Because of this hesitation, public opposition may arise and cause excessive expenses to arise for
operators. There is also much scientific experimentation and investment necessary to advance coordination, planning, regulating and stakeholder accumulation when changing policy and improving fracking strategy. This prohibits many states from participating as well. In sum, states are forced to value lower risk and cost at the expense of their residents’ health, the environment and other elements affected by procedures like hydraulic fracturing (Clark, Burnham and Harto).

Policy Recommendation: Creating a system of accountability for both the oil companies and government by hiring a third party to perform environmental testing and provide full disclosure to the public.

**Clean Water and Safe Drinking Water Act**

The Safe Drinking Water Act of 2011, was conceived to explore more possibilities of devising regulatory devices under the Toxic Substances Control Act. This legislation was created in order to control reporting fracking fluid information. These laws were first introduced to preserve and improve the water quality of all of America’s wetland by requiring all industry participants to obtain permits for “all discharges of pollutants” into the wetlands. Previously in 2005, the Energy Policy Act provided one major exemption to oil and gas outfits: an exemption from storm water discharge from oil and gas production activities. In order to avoid any health consequences that may arise from this exemption, new policy should be implemented in order to closely monitored companies and encourage compliance with these guidelines.

**Federal Level Regulation**

It may help to increase federal regulation in order to combat the increased drawbacks of fracturing as well. However, as previously stated, many companies are not complying with these dictations. Nevertheless, the Bureau of Land Management may further enforce their authority and/or perform audits to ensure that companies are complying with operators submitting operational plans.
before “fracking” may even take place. By increasing their authority and more comprehensively monitoring petrochemical organizations, the BLM would be able to more easily analyze groundwater protective designs, evaluate surface disturbance and approve management and disposal of recovered fluids. The BLM and EPA should improve upon and create more programs to monitor these processes, as companies have not been adequately reporting and submitting information regarding their procedures (Clark, Burnham and Harto).

A series of failed policy actions has also paved the way for much of the strife caused by fracking. The National Gas Act demonstrates fallibility in regard to its attempt to regulate pipelines across state borders. This authority has been placed in the hands of the Federal Energy Regulatory Commission. This means that states rely on them to decide if a community will benefit from a pipeline. Premises of these decisions must be reasonable in regard to safety and livelihood, but this agency has proved itself to be more concerned with private interest rather than its citizens. For instance, the FERC permitted Tennessee Gas Pipeline Company to use eminent domain to steal a man’s property in New Jersey in order to transport Pennsylvania’s Marcellus Shale case because the Court considered this decision to be for the benefit of the public sector (Roberts). A feasible policy recommendation would be allow states to decide if a major pipeline will be placed in a community rather than the FERC.

**Greenhouse Gas Emission Reduction**

Application has shown that one of the most successful ways to reduce methane emissions is by flaring. This is a process where the flowback water is sent to an open pit or tank, in which gas is combusted. This causes an average of a ninety percent reduction in GHG emissions because CO$_2$ is produced by the flare. Flaring is also used to mitigate air pollutants, carbon monoxide, nitrous oxides, combustion emissions and loss of natural gas. Reduced Emission Completions(REC’s) or “green completions” are the most contemporary form of reducing emissions. This process is used to collect
and separate natural gas throughout the process of well completion and reworking existing wells following the fracking process (EPA.gov). This technique helps to minimize methane, VOC’s, and HAP’s. REC’s utilize portable equipment that permits operators to adequately collect flowback water. Once the mixture releases through the sand trap, it is a three step separator that extracts the natural gas liquids and water from the gas. Ultimately, the mixture travels to sales pipelines to be disbursed. REC has been proven to be an inexpensive way to complete this process with low natural gas prices (Clark, Burnham and Harto).

**Water Quantity and Quality**

As previously referred to, water consumption is a relevant factor pertaining to the detriments of fracking. Operators have found that recycling flowback water is a method by which water used during the process may be minimized. A secondary method to reduce water consumption is reducing the volume of wastewater that must be discarded. This essentially relies on the accessibility of fresh water, the expense of discarding wastewater and the eminence and volume of supposed wastewater. The prerequisite of recycling water depends on the amount of treatment required for recycling, which fluctuates. Operators must take this into account because they may need to either settle or filter the water and possibly perform reverse osmosis or thermal treat processing – both of which are highly costly procedures. Nevertheless, these treatments extract unnecessary salts and minerals (Clark, Burnham and Harto).

States that are now participating in monitoring water sources are at a total of six and are accompanied by fourteen bills and resolutions applied for the protection of water supplies, limiting of water withdrawal, and mandating of proper water quality dealings. States participating in these endeavors are New Jersey, Michigan, New York, Pennsylvania and West Virginia (Pless). More states participating in these efforts will surely ensure decreased water quantity as well as increased water
quality. A possible solution to improve water quality across the board is to pass legislation-incorporating states to participate in these types of water monitoring programs.

**Well Regulation and Inspection**

In order to more intensely monitor and normalize the system of hydraulic fracturing, well regulation and inspection must also be considered. Policy requiring frequent well inspections and appropriate spacing between wells can drastically increase the safeness and credibility of hydraulic fracturing. States such as New York (pending AB 3579) and Pennsylvania (pending SB 425, HB 971 and SB 680) have taken drastic measures to ensure that well regulation and inspection are inherent in the fracking process of their state’s leading industry contributors. A mass of groups summoned for the purposes of inspection of gas wells per annum and regulation of chemicals used in such wells are two worthy tactics that more states should thoroughly consider utilizing. Financial backing for wells exceeding certain depths and supervising certain kinds of fracturing fluids would also behoove those seeking to improve the devices of hydraulic fracturing (Pless).

**Moratorium**

There is a collection of states that have also elected to completely ban the practices of fracking until more is learned about its processes and the processes that are known about it are made safer for its environmental surroundings and population. In West Virginia, hydraulic fracturing is prohibited in Morgantown and within one mile of the proximity of the city limits. In New York, Senate Bill 1230 is seeking to follow through with a moratorium on granting permits for issuing permit for drilling new wells; AB 5547 is seeking to follow through with a moratorium on fracking for natural gas or “until 120 days after EPA issues its report on the effects of water quality and public health”; AB 5547 seeks to initiation the “Look Before You Leap Act of 2011” which would establish a moratorium on high volume fracking to last five years; AB 5677 would ban fracking and horizontal drilling for the purposes of obtaining natural gas or oil on land used within one mile of recreational parks and those parks
reserved for the conservative value of historical sites; and SB 4220 and AB 7218 both seek to ban fracking for oil and gas extraction in its entirety (Pless). Legislation needs to be proposed in order to maintain a system of checks and balances, this policy would allow the community to partake in decisions that affect them such as fracking.

**Community Impacts**

In order to alleviate the impact hydraulic fracturing poses on the community, public engagement is highly suggested. Short and long term effects of shale gas activities can be better addressed with the cooperation of the very public that will be affected. Every community will not be able to follow the same plan as the other but it is important to try an array of strategies involving the local population. Another attribute to combine with communal involvement is drilling several wells using one well pad. This lessens footprint levels of shale gas activities. Researchers have found that sound barriers have also been found to reduce the noise pollution up to over eighty decibels to background levels of over sixty decibels up to over two hundred feet. This is highly beneficial as the Environmental Protection Agency dictates that seventy decibels is a level of environment noise that may inhibit hearing “over a lifetime” (Clark, Burnham and Harto). Policy should be proposed for mandatory sound barriers at every site in order prevent harmful effects on humans and wildlife.

**VIII. Conclusion**

In conclusion, hydraulic fracturing is a popular method used by oil and gas companies of this contemporary industry. Unfortunately, the techniques it utilizes are damaging to the community, the earth and the long-term economy. Lack of regulation and government support have allowed this “fracking” to continue as community property values decrease, roads are destroyed, residents’ homes are taken and harmful emissions are dispelled into the air of the surrounding areas of fracking sites. Despite the efforts of various politicians, oil and gas CEO’s, public interest groups and various publications, the activities of this “new and innovative” methodology persist.
Hydraulic fracturing is truly a moral dilemma that we must question and improve. Although it is a proven technique to advance the petrochemical field and create increasingly impressive cash flow in the short run, its long-term effects on the environment and the American economy should be of grave concern to all parties involved. Researchers have accumulated information disclosing the lack of required reporting by industry participants; the egregious costs involved with pipelines, railways, trucks and boats involved in the process of shale oil production; and the effect the entire process has on human and wild life. Still, not enough concrete regulation has been solidified to ensure safe extraction by hydraulic fracturing.

Some hope lies in a few states that have utilized legislation to hold oil companies accountable to current regulations and standards. However, more public support will be needed as the federal government and presidential administration have condoned these practices. Considering this information, one may perceive that this “money making mechanism” will not be done away with in the near future. Again, the moral question concerning short term economic advancement and long-term damage to socioeconomic conditions arise.

In a country where issues as such have circulated for years, one may pose the question: will the people and environment ever be a main priority to the federal government? How long will individuals have to fight for their rights, safety, health, prosperity and livelihood in a country that boasts that it is free and fair and just? How long will processes such as fracking be allowed to destroy the United States and the world?

In sum, this dissertation was merely an introduction to the necessary prerequisites for an argument that could be everlasting. The nature of this issue is essentially a collection of issues that have yet to be tended to within the bounds of this nation. Fracking is dangerous and harsh for several reasons that should not be ignored, but are because of two primary reasons: wealth and political power.
Perhaps, more states will become involved in the fight to secure their land and protect its citizens.

Perhaps the next administration will not see processes as such fit for the future of the United States.

Perhaps, oil companies will find that the sustainability of this nation is far more important than the amplification of prime stakeholders’ revenue streams contingent on their company’s activities. Only time will reveal the answers to any unanswered questions concerning this work. Historically, research suggests that money and power hold more weight than morals and righteousness. The power lies in the future generation to ensure a sustainable environment for generations to come.
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