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Environment Commission

Limiting the negative effects of fracking on the environment

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Forum:	Environment Commission
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Introduction

Fossil fuels, especially gas and oil, have stimulated the development of the global economy over the past century. Since the industrial revolution, these finite resources are rapidly being depleted and have caused irreparable harm to the environment. Fossil fuels are the backbone of every economy being imperative to infrastructure, transportation, energy production, and business. As conventional reservoir for gas and oil are drying up, there has been an increase in producers turning to unconventional sources of gas and oil such as tar sands and *hydraulic fracturing* to meet the ever-increasing demand for fossil fuels (Piccirilli, Dorsey).

Though there has been a significant rise in sustainable and renewable energy initiatives and a rapid increase in technology, the growth in demand for fossil fuels has not decelerated. With the world population growing exponentially and economic development taking place globally, the demand for energy is so massive that sustainable and renewable sources are completely unable to meet it. The current economic inefficiency of sustainable and renewable energy sources and the technological limitations allude to the fact that at the moment, sustainable energy sources are no competition for fossil fuels (Overholt, Mark). This despite the international effort to decrease consumption of fossil fuels and the signature of the 2015 Paris Agreement. Nonetheless, the depletion of fossil fuel reservoirs has led to a split in the road for energy producers: convert to renewable sources, or turn to unconventional methods (Varro, Laszlo). The fact that they usually chose the latter has led to the introduction of the fracking technique to the global energy landscape.

The main reason of controversy for this alternative method of oil extraction is the risk of great direct and indirect negative effects. Nevertheless, great corporations are already using this method to exploit new oil and gas fields.

Definition of Key Terms

Hydraulic Fracturing

Hydraulic fracturing, colloquially known as fracking, is the process "of injecting liquid at high pressure into subterranean rocks, boreholes, etc. so as to force open existing fissures and extract oil or gas" according to the Britannica dictionary (Fracking).

Shale Oil and Gas

Natural gas and oil are decayed organic matter (fossilized plants and animals) from millions of years ago that has been deformed and compressed by the pressure and heat of the earth's crust. Natural gas and oil are hydrocarbons and can also be referred to as "fossil fuels". Oil and natural gas can be combusted to generate energy (EIA). The process of how natural gas is formed is illustrated below in Figure 1. Shale gas and shale oil are high quality natural gas and oil that is trapped between layers of shale rock, non-permeable mudstone, or siltstone deep in the ground (about two miles). Gas or oil that is extracted through methods of hydraulic fracturing is referred to shale gas or shale oil respectively (Amadeo, Kimberly).

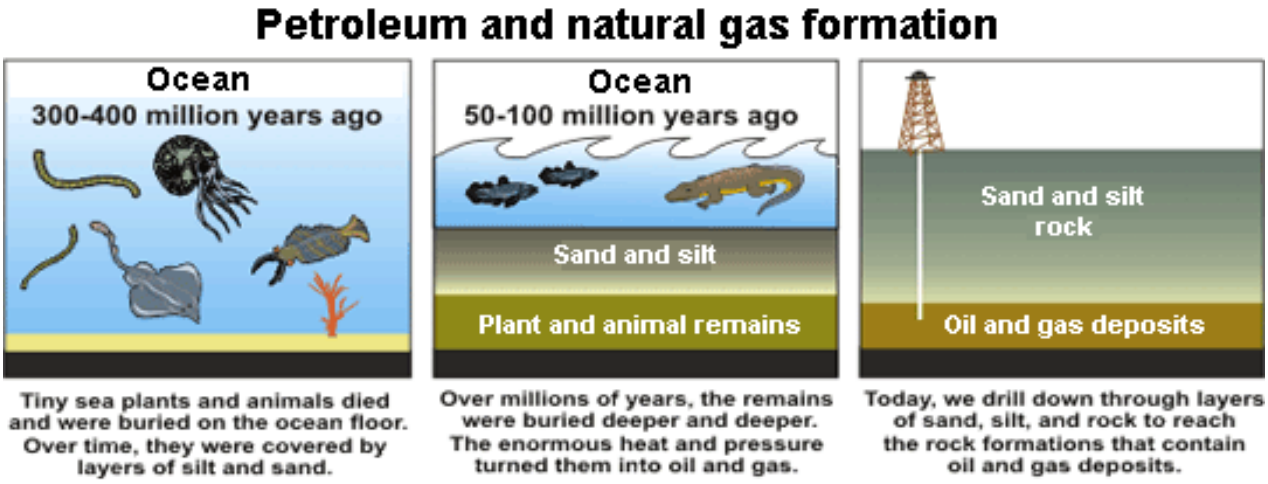


Figure 1: "Petroleum and Natural Gas formation" *EIA*, US Energy Information Administration (EIA), 25 Oct. 2017, www.eia.gov/energyexplained/index.php?page=natural_gas_home.

Ground water

According to the Collins English Dictionary, groundwater can be defined as: "underground water that has come mainly from the seepage of surface water and is held in pervious rocks". Groundwater is one of the primary sources of drinking water for both humans and animals, but it is also the source of fresh water for trees and many other plants.

Methane migration

Methane migration is the process of methane from the fracking process migrating into groundwater which potentially causes explosions and fired when excessive build-up occurs. This usually happens in buildings but can also occur in natural bodies such as rivers, harming the environment. Methane is a very dangerous greenhouse gas and is 29 times more potent than carbon dioxide and could pose a great threat to the environment.

Seismic hazard

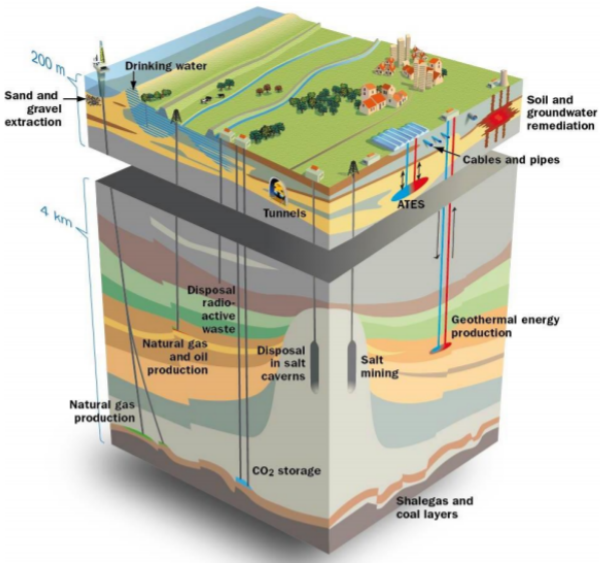
Seismic hazard, according to Kentucky Geological Survey, is “a natural phenomenon such as fault rupture, ground motion, ground-motion amplification, liquefaction, and induced-landslide that is generated by an earthquake.” Hydraulic fracturing will possibly lead to fault rupture which will generate significant seismic hazard (Earthquake Hazard and Risk).

Seismic risk

According to the Kentucky Geological Survey, seismic risk is the “probability that humans will incur loss or their built environment will be damaged if they are exposed to a seismic hazard.” This is means of measuring the effects of fracking on human infrastructure, which will subsequently have significant environmental repercussion (Earthquake Hazard and Risk).

General Overview

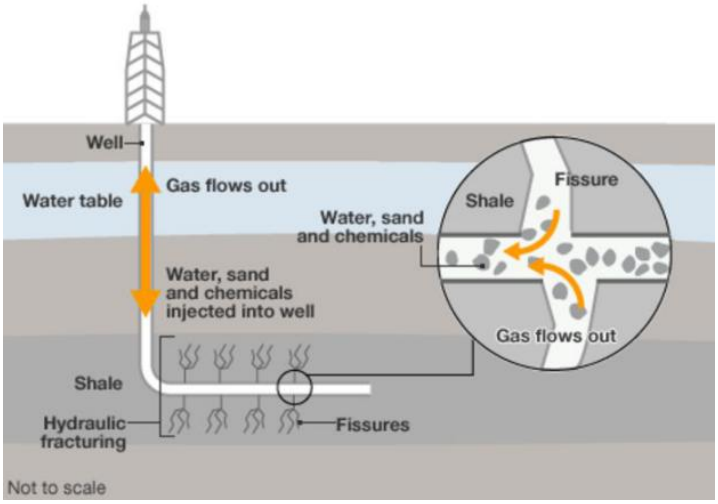
The process of hydraulic fracturing



On the left is a diagram (Figure 2) of the composition of the earth’s crust which will give you an idea of where hydraulic fracturing takes place (in the shale-gas layer at the bottom).

Fracking, as explained above, is a technique to recover gas and oil from shale reserves. It is the process of directing high pressure fracking fluid into a hole drilled into the earth to release gas or oil. The fracking fluid is a mixture of water, sand, and chemicals which force the gas to flow upwards.

Figure 2: “Earth’s crust digram” Netherlands Organisation for Applied Scientific Research (TNO), 6 Jan. 2015. file:///C:/Users/13971/Downloads/TNO-2014-R10919-Ef%20(1).pdf



The term fracking actually refers to the fracturing of the shale rock by the mixture at a high pressure. The diagram below shows the process of shale gas extraction in more detail (Figure 3) (BBC). In this digram you can see the horizontal drilling which allows for multiple wells to be drilled from one spot. This reduces the drilling area above ground to as much as 90% (American Petroleum Institute).

Figure 3: "What Is Fracking?" *BBC News*, BBC, 16 Dec. 2015, www.bbc.com/news/uk-14432401.

During the fracking process, methane, a greenhouse gas, may be released which is called *methane migration*. Furthermore, due to the extensive logistics of fracking operations, great amounts of carbon dioxide are emitted , contributing to global warming. In all, fracking emits significantly more greenhouse gases than through conventional methods (Ter Heege).

Negative environmental effects

Seismic Hazard

Generally, the seismic hazard as a result of fracking is small. However, greater seismic risk could potentially occur if large, existing faults are reactivated in the process of fracking. In areas that already have significant natural seismicity, the process of injecting large quantities of fluids is unwise and could potentially cause unwanted seismic activity.

Significant seismic risk may occur if bigger faults are reactivated due to fracking and the extraction of shale gas. These risks occur in the United States and elsewhere above all in areas with significant natural seismicity and upon injection of large quantities of fluids in a relatively small area.

Habitat destruction

The large scale implementation of hydraulic fracturing techniques will also have a significant impact on biodiversity considering building fracking sites will convert natural areas into industrial zones, destroying forests and habitats along the way. For example, fracking operations in Wyoming, USA, have fragmented a key habitat for the mule deer and pronghorn. The population of the mule dear in one area which was undergoing extensive gas

extraction between 2001 and 2010 decreased by 56% (The Cost of Fracking). Furthermore, deforestation plays a great role in the fracking industry. Thus, The fracking industry also indirectly contributes to global warming through eliciting deforestation.

Water usage

Fresh water is become a scarce resource in today's industrialized society and even more so due to the effects of global warming. Though the question of groundwater contamination is debatable and controversial, it is undeniable that the immense amount of water used in the process will have negative effects on the environment. A single well oil or gas well that uses fracking techniques will consume up to 36.3 million litres or 800 truckloads of water (Magill). This not only has repercussion on humans considering the farming and drinking resources are put at risk, but the overwhelming amount of energy required to treat and transport this water will also have negative effects on the environment. This is because most of our energy still comes from non-renewable or carbon neutral sources, and thus releases greenhouse gases into the atmosphere, contributing to global warming. Though some of the waste-water after fracking is recycled and treated after the fracking process, most of it is disposed underground, further wasting precious fresh water.

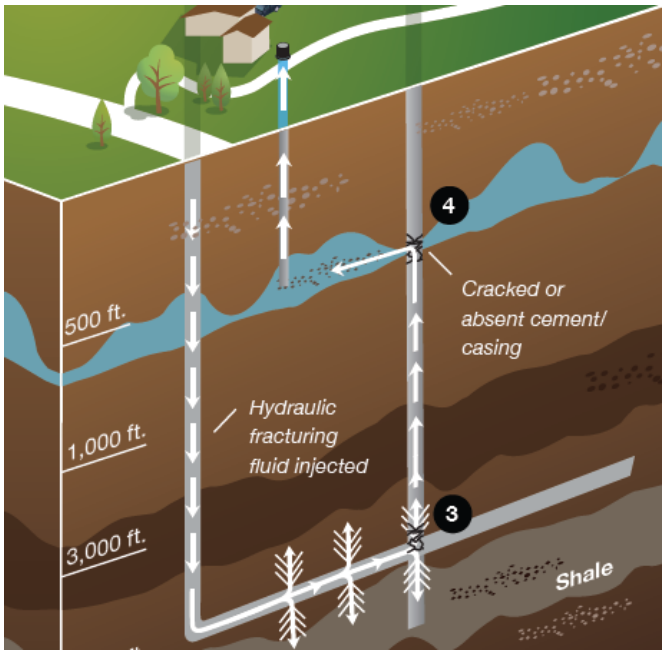
The excessive water usage could lead to droughts in particularly arid areas. In arid regions, fracking increases the demand for groundwater by up to 30 percent (Magill). Therefore, in countries that are arid, fracking should be highly discouraged because the negative effects on the environment will be exponentially stronger. In actual fact, the amount water required for fracking is relatively small when compared to other sources of major energy production such as coal power plant cooling. However, in areas that are already particularly dry, a man-induced drought could have major repercussions on the ecosystem and biodiversity (Magill).

Contamination of the water supply

The contamination of the water supply is one of the most controversial points in the fracking debate considering that there have been multiple studied contradicting each other. The issue of groundwater contamination and the extent to which it will effect the human population is also interpreted in a range of ways. Despite the fact that the effects on humans can be debated, the fact that it will effect ecosystems and animals in proximity to the extraction wells is undeniable.

The US Environment Protection Agency (EPA) has said that there are about 9.4 million people in the United States that drink from water sources in close proximity to hydraulic fracking operations and have further claimed that "residents and drinking water

resources in areas experiencing hydraulic fracturing activities are most likely to be affected by any potential impacts, should they occur" (Taillant).



There are a number of ways through which toxic fracking fluids can contaminate groundwater. Approximately 2% fracking fluid is proppants and additives which can be harmful in high concentrations (ter Heege). When leaking occurs, methane and the toxic fluid can contaminate the groundwater making the water undrinkable.

Figure 4: "Water Contamination through Hydraulic Fracturing." *Greenpeace*, Greenpeace, www.greenpeace.org/usa/global-warming/issues/fracking/environmental-impacts-water/.

Firstly, the fluid could be leaked from the storage areas. A method of prevention, is making it obligatory to systematically regulate and maintain the facilities. Contamination can also occur through leakage (as illustrated in Figure 4) from the injection wells or fracking along faults or abandoned wells. This happens when the cement cast around the well that acts as a barrier between the groundwater and the shaft breaks or fails. Even if it does hold, gas is still able to travel from the shale layer to the water table where the groundwater is located seeing. This is called gas migration. When the pressure in the hydraulic fracturing process is not high enough, seepage like this can occur and it is therefore critical that the methods used, and the standard of the process is regulated to avoid environmental damage (Greenpeace).

Waste-water and other residual products of the fracking process are often reused for other purposes such as irrigation or processing dust or de-icing. Sometimes, when the waste-water is applied to land, it will seep through the earth to reach the groundwater (Greenpeace). There is as a very high cost involved in cleaning up the drinking water with Cabot Oil & Gas in Pennsylvania, USA, reporting having spent $109,000 on removing methane from 14 households. This cost exponentially increases when you start to realize the build up of chemicals that may occur over large periods of time at a great scale (The Cost of

Fracking). There are many factors to consider when trying to make the hydraulic fracturing process safe to prevent water contamination and these risks are inherent to the process and unfortunately there are not many things that can be done to minimize the risks.

Evaluating cost vs benefit

There is clear economic incentive to use fracking to gain vast amounts of shale oil and gas, however, we must ask ourself “at what cost?”. There are undeniably significant negative environmental effects linked with the process of hydraulic fracturing such as the contamination of groundwater, increased seismic hazards, methane emission, great energy and water usage, and the possibility of droughts which will subsequently have a great effect on our ecosystems and biodiversity.

A shale boom in Europe would lead to a raise of global temperatures by 3.5C according to the International Energy Agency which would have immense environmental repercussions and furthermore infringe the Paris Agreement of 2016. (Nelsen, Arthur). To counter this, there have been claims that fracking is actually more environmentally friendly considering the fuel itself releases less carbon dioxide gases than other conventional methods such as coal combustion. However, one must also realize that fracking can cause methane migration, emitting a greenhouse gas which is 56 times more potent than carbon dioxide over a 20 year period. (Nelson, Arthur)

From another stand point, the oil and gas sector have continuously argued that fracking will significantly boost the economy, but also promote energy self-sufficiency which will subsequently curb global warming (Taillant). Furthermore, with the developing world continuously modernizing and populations booming, the energy demand is exponentially increasing. To deny them this cheap and effective method of extracting gas would set back their development. However, this effect could be curbed by nationally determined contributions as mentioned in the Paris Agreement which will allow More Economically Developed Countries and Less Economically developed countries to share resources to combat global warming (See appendix D).

Ultimately, it is up to the discretion of the countries themselves to decide whether or not they believe the negative effects of fracking outweigh the economic benefits. One must also keep in mind that the significance of the effects are also dependant on many geological, economic, and political factors and therefore “one size fits all” approach is ineffective.

Major Parties Involved

United States of America

In the USA, over 2 million oil and gas wells have been drilled using hydraulic fracturing techniques. Today, fracking accounts for over 43% of the USA's oil production and 67% of natural gas production (American Petroleum Institute). The USA has law's including, Clean Water Act; Clean Air Act; Safe Drinking Water Act; National Environmental Policy Act; Resource Conservation and Recovery Act; Emergency Planning and Community Right to Know Act; Endangered Species Act and the Occupational Safety and Health Act (American Petroleum Institute), none of which, the chemicals in hydraulic fracturing are directly subect to. Thus, corporation are under no legal obligations to publish the chemical used in fracking which subsequently inhibits our ability to analyze its negative consequences..The state of Texas, a centre of hydraulic fracturing operations in the US, has announced a *ban on the ban* of fracking. This double-negative starkly juxtaposes the policy of some other US states such as Florida. Vermont and New York which are implementing measures to limit hydraulic fracturing (Taillant). The USA is the biggest exploiter of shale gas (see Figure 5 below) and oil and have used this unconventional method to decrease Russia's ability to dictate the gas prices. The extensive usgae of fracking has also decreased the incentive to spent money on renewable energy. Fracking is therefore often political motivated and in the current American political landscape, the environment simply does not carry the same weight as national security or the economy.

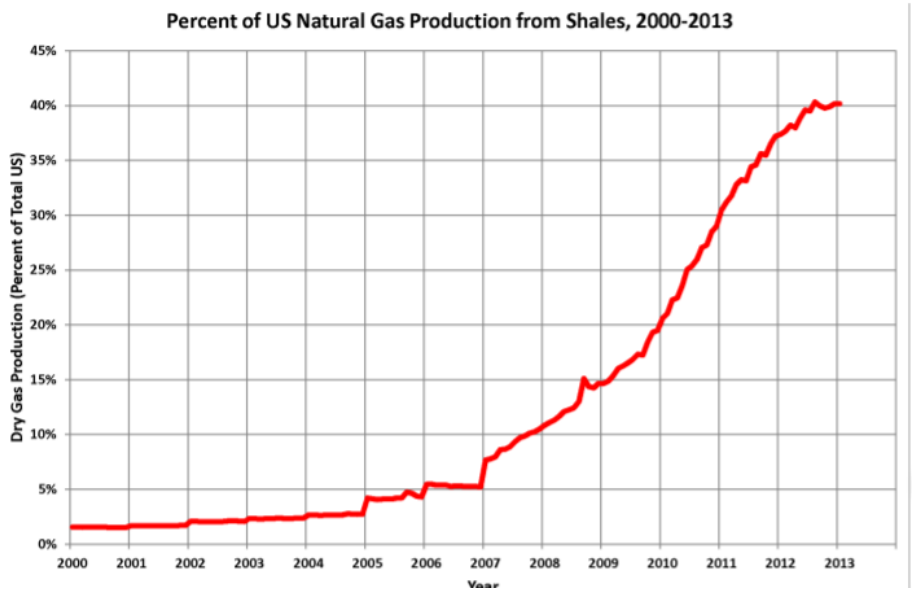


Figure 5: "Percent of US natural Gas Production from Shales" Wikipedia. Wikimedia Foundation, 08 July 2014. Web. 17 Aug. 2014

https://en.wikipedia.org/wiki/Shale_gas_in_the_United_States#/media/File:Pct_US_Natural_Gas_Production_from_Shales_2000-2013.png

European Union

To date, only exploration permits have been granted in Europe and civil society has been strongly opposed to the introduction of fracking to the energy landscape. France, Germany and Scotland have banned fracking as a whole (Nelson, Arthur). There has been exploratory drilling in Poland and Bulgaria in an attempt to decrease dependency on Russia for energy. In Bulgaria, two Canadian companies purchased rights in Bulgaria but were met with fierce opposition and organized protests. If contamination did occur in Bulgaria or other European states, the contamination would be transboundary and effect many other countries in the region as they share aquifers (UNANUMA).

An anonymous BP executive warned the energy commissioner of the EU that the US gas prices, being influenced by their extensive exploitation of shale gas, had damaged European competitiveness. He further stated: “Europe needs to exploit indigenous exploration and production resources ... including Mediterranean exploration and shale,” Unlike the USA has, EU countries are unlikely to experience a shale revolution considering the much higher population density and environmental standards.

South Africa

In South Africa, there has been a moratorium (A suspension of activity) on the question of hydraulic fracking until the environmental impacts can be thoroughly analysed. Though industry sources in South Africa have been promoting fracking as a means of achieving energy independence, with South Africa being an already water-scarce country in combination with the severe drought in Cape Town it is unlikely they will turn to fracking as an energy source. If the groundwater there were to be contaminated, this would have massive effects on the human population, but also the rich biodiversity in South Africa (Nelson, Arthur)

China

China is one of the world’s most rapidly developing economies with a great dependency on other nations for energy. This puts them at a political and economic disadvantage, which has led for China to turn to hydraulic fracturing to improve energy self-sufficiency. The director of defense studies at the Center for the Chinese National Interest reported that “In times of crisis on the high seas or war, if such energy flows were disrupted or cut off, the economic damage that would result could be quite severe”. According to the

Chinese National Bureau of Statistics, the production of shale gas increased by 50.4% in 2017. However, when you put this in some perspectives, China's monthly 3.8 billion cubic feet is insignificant compared to the USA's annual 1,476 billion cubic feet of shale gas (Follett, Andrew).

China has set a goal to increase natural gas's share of the energy supply from 6 to 10 % by 2020. Fracking is the predominant technique to extract this gas. However, it is unlikely that China's fracking industry will ever reach the same scale as that of the USA. This is because China lacks the favourable geography for fracking and though expansive, it is simply to expensive (Follett, Andrew)

Greenpeace

Greenpeace is a non-governmental organization which is an active member of civil society which fights for the protection of the environment. Naturally, it is also deeply involved in the issue, dedicating a segment of their website on the topic but also voicing their opinion through the media, and supporting small, grass-roots initiatives and protests against fracking (Gavell, Tim).

United Nations Environment Programme (UNEP)

The UNEP is involved in the issue of fracking and has released multiple statements and has initiated research. In November 2012, the UNEP Global Environment Alert stated "Hydraulic fracturing, a gas extraction technique also known as gas fracking, presents considerable environmental and health challenges" (Bo-Alex, Fredvik).

Timeline of Key Events

Date	Description of Event
1860's	First usage of liquid to stimulate shallow hard rocks in the USA
1914 - 1918	In Word War I, oil served as a strategic military asset
1930s	First attempt at hydraulic fracturing. Non-explosive fluid in combination with acid was used. Birth of fracking.
1949	Hallibutron becomes the first company to use hydraulic fracturing to extract gas after its discovery in 1947.
1950's	Governments were starting to assert authority over oil and gas resources, particularly in South America and the Middle East

1960	Organization of Petroleum Exporting Countries (OPEC) was founded
1974	The American Congress passes the Safe Drinking Water Act which protects underground water sources. However, the fracking process is unhindered.
1997	The first hydraulic fracturing process was carried out by Mitchell Energy. Boom in American oil and gas production
June 2004	The EPA (Environment Protection Agency) reports that fracking fluid is toxic and remains in the ground after the process.
2005	Fracking boomed seeing as it was exempted from many other environmental agreements unlike other sources.

Previous Attempts to Resolve the Issue

The UN has not adopted any resolutions on the topic of hydraulic fracturing but subsidiary bodies of the UN have conducted research and made statements about the subject. UN development experts have released the following statement concerning the fact that hydraulic fracturing “produces cleaner energy than oil and coal, but it is not necessarily in the best interests of the world’s poorest countries”. Furthermore the UN has published the UN Guiding Principles on Business and Human Rights. Conclusively, the UN has clearly recognized the problem of fracking and has administered research on its environmental impacts, however, it has not taken any action to limit the negative effects of fracking on the environment. A statement was made by an non-governmental organization, UNANIMA, in the Human Rights Commission regarding human rights in regard to the process of hydraulic fracturing:

• Hydraulic fracturing for natural gas: A new threat to human rights, 19 September 2011 (A/HRC/18/NGO/91) (See Appendix C)

There are national regulations on the topic of hydraulic fracturing and the European parliament has also issued a recommendation for its member states. However, this has little to no effect considering the countries that employ fracking techniques at the largest scale lack these regulations.

Possible Solutions

At the moment, the complete ban on hydraulic fracturing is highly unrealistic. Not only is it unrealistic, but also inefficient as a “one size fits all” solution is not applicable considering

countries have different geographical, economic, and political situations and level of energy self-sufficiency. To find comprehensive solutions to this multidisciplinary problem, many different perspectives need to be addressed and a clear incentive to limit fracking needs to be established.

The notion of transparency is central to the topic of fracking. Hazards need to be identified and accounted for and without the publication of processes and products used, the environment is at a great risk. Investment in research and development to identify these hazards is futile of the corporations do not share their data with the public or the national authorities. It is essential that governments have a comprehensive view on the scope of the issue before establishing policies and regulatory mechanisms.

Since the actions of corporations falls under domestic law and regulation, it is the UN's job to encourage its member states to engage in high levels of corporate social responsibility and regulate the fracking industry to mitigate its negative environmental impacts. For example, since it has been established that incidents of spillage, leaks etc at fracking sites are unavoidable, there must be clear regulations in place making the corporate responsible liable for the environmental damage and subsequently decontaminating the soil. Finding more-environment friendly and biodegradable alternatives to the chemicals in fracking fluid could also minimize the damage that would occur if a leak would take place. Furthermore, regulation should be in place to protect tanks and piping to decrease the risk of leakage. During the process itself, micro-seismic monitors could be implemented to monitor potential contamination of the groundwater. A more long-term approach could be to give the soil extra protection through geotextiles and geosynthetics on the surface.

To avoid methane migration and potentially dangerous seismic activity, it is essential that a corporation is required to undergo a site-specific geological and geomechanical analysis of the subsoil and fracks. It is also essential that the UN encourages member states to invest in research and development to produce monitors and geological equipment that can analyze the fracking as deeply as possible to minimize the risk of environmental damage.

Instead of injecting waste-water from the fracking process into empty gas fields or reusing it for further fracking operations, sustainable water treatment facilities could be introduced. These water treatment centers could purify the water so it would meet its national health standard, and salt could be used for de-icing roads and other purposes.

The fate of fracking is also closely interwoven with the incentive for governments to turn to renewable energy sources that are clean and infinite unlike fossil fuels. Therefore, a solution regarding the issue of fracking must also take renewable energy into consideration.

Appendices

Appendix A: European Parliament Commission Recommendation

The regulations on hydraulic fracturing as recommended by the European Parliament. This can act as a guideline for your resolution if your country is a member state of the European Union..

https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32014H0070&from=EN

Appendix B: UN Guiding Principles on Business and Human Rights

This document outlines the corporate social responsibility of businesses which can be applied to corporations that carry out fracking.

https://www.ohchr.org/Documents/Publications/GuidingPrinciplesBusinessHR_EN.pdf

Appendix C: HRC NGO Statement Hydraulic Fracturing

https://documents-dds-ny.un.org/doc/UNDOC/GEN/G11/160/72/PDF/G1116072.pdf?OpenElement

Appendix D: Paris Agreement 2016

A widely recognized and ratified agreement that aims to combat the effects of global warming.

https://unfccc.int/sites/default/files/english_paris_agreement.pdf

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