Committee: Environmental Commission (EC) (Sub-Commission 2)

Topic: Alleviating the environmental consequences of hydraulic fracturing

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Position: Deputy President

Personal Introduction

Dear Delegates

My name is George Manios. I am 17 years old and attending Year 13 (IB2) at Campion School. It is a pleasure for me to have the position of Deputy President in Campion's 13th MUN conference, having also participated in many Campion conferences in the past, including my first ever conference 6 years ago. Ever since, I have become more eager to be proactive during conferences and this is something that my fellow chairs and I will encourage you to do, as participating in debate enhances speaking skills, understanding of global issues and teamwork as you discuss possible solutions with your like-minded allies during lobbying. This guide provides you with information on this topic; however, I strongly encourage you to conduct further research on your own to discover more details on the topic. If you have any questions about the topic and how it concerns your country or the guide, please feel free to contact me at gmanios@campion.edu.gr. I am looking forward to meeting you all and observing your vibrant debates!

Yours,

George Manios

Topic Introduction

Hydraulic fracturing has become one of the most prominent methods of extracting oil and natural gas around the world. This guide will discuss how to alleviate the environmental consequences of hydraulic fracturing or more commonly referred to as 'fracking', a term used to describe the process of injecting a mixture of sand, water, and chemicals into a drilled well to create cracks in

underground rock, (the rock is called “shale”) allowing oil and natural gas to flow out.[1] This method provides access to energy resources that power homes, vehicles, and infrastructure, while also boosting the economy through energy sales. Preparing and drilling a well can take several weeks, depending on its depth[2], while the extraction process typically lasts 3 to 5 days.[3] The reason ‘fracking’ has become such a common oil extraction process is because countries are becoming more self-reliant in their energy sectors due to a reduction in imports and an increase in exports.[4] It provides an increase in employment because of the workers needed for all the stages of fracking, and there are lower energy costs for consumers. USA, Canada, China, and Argentina are the main producers and sellers of shale gas, while Russia, Mexico, South Africa, and Algeria are coming up fast in shale production[5], due to its benefits on domestic economies. However, hydraulic fracturing also has multiple drawbacks.

The main concern with hydraulic fracturing is its impact on local communities, especially on their water quality. If fracking fluids (consisting of 90 to 97% water, 2% sand and 1% chemical additives like acids) enter drinking water, harmful chemicals like benzene, toluene, ethylbenzene, and xylene (referred to as ‘BTEX’) can pose serious health risks.[6] Additionally, heavy machinery and the release of hazardous air pollutants (HAPs) during drilling can degrade air quality.[7] Moreover, the wastewater injected during hydraulic fracturing has been found to induce seismicity, causing more earthquakes in areas around the drilling.[8] These environmental risks have led countries like France, Germany, and Switzerland to ban fracking. We need to move quickly to find a balanced solution, one that lets the

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[1] Chen, James. “Hydraulic Fracturing: Meaning, History, Controversy.” *Investopedia*, 6 Sept. 2021, www.investopedia.com/terms/h/hydraulic-fracturing.asp.

[2] *British Columbia Energy Regulator*, British Columbia Energy Regulator, Jan. 2025, www.bc-er.ca/files/publications/Factsheets/Hydraulic-Fracturing.pdf . Accessed 28 June 2025.

[3] *Hydraulic Fracturing*. www.ipaa.org/fracking

[4] Department of Energy Releases Report on Economic and National Security Impacts of a Hydraulic Fracturing Ban.” *Energy.gov* , 14 Jan. 2021, www.energy.gov/fecm/articles/department-energy-releases-report-economic-and-national-security-impacts-hydraulic?

[5] Chacin, Aixa. “In What Count ries Is Fracking Done?” *SGK-Planet*, 28 Feb. 2021, sgkplanet.com/en/in-what-countries-is-fracking-done.

[6] FracTracker Alliance. “Health and Environmental Effects of Fracking - FracTracker Alliance.” *FracTracker Alliance*, 3 Nov. 2020, www.fractracker.org/resources/oil-and-gas-101/health-environmental-effects-of-fracking/

[7] National Institute of Environmental Health Sciences, www.niehs.nih.gov/health/topics/agents/fracking?utm_.

[8] Hydraulic Fracturing and Induced Seismicity | Ground Water Protection Council.” Ground Water Protection Council, www.gwpc.org/topics/hydraulic-fracturing/hydraulic-fracturing-induced-seismicity.

domestic energy sector grow without damaging the environment, by focusing on sustainable alternatives that support both our future and the economy.

Artificial intelligence has definitely affected the overall process of hydraulic fracturing, from the AI scoping out where the well will be drilled to extract the most oil and gas to designing the pumps used for injecting the liquid to make them even more efficient, and these are just a few of the many contributions that AI has had on hydraulic fracturing. Artificial intelligence is very helpful in outsourcing tasks and time-consuming labour; however, it is important to remember that the standard procedure ensures that AI is always supervised while working, and its work is checked over for errors by specialists.

Definition of key concepts

Hydraulic fracturing

"Hydraulic fracturing, or fracking, is a technique for recovering gas and oil from shale rock. It involves drilling into the earth and directing a high-pressure mixture of water, sand and chemicals at a rock layer, to release the gas inside."[9]

Hazardous air pollutants (HAPs)

"Hazardous air pollutants (HAPs), also known as toxic air pollutants or air toxics, are air pollutants that are known or suspected to cause cancer or other serious health impacts. They are associated with elevated cancer levels and other adverse health effects, such as reproductive effects or birth defects."[10]

[9] BBC News. "What Is Fracking and Why Is It Controversial?" *BBC News*, 6 Aug. 2011, www.bbc.com/news/uk-14432401?os= .

[10] US EPA. "What Are Hazardous Air Pollutants? | US EPA." *US EPA*, 3 Dec. 2015, www.epa.gov/haps/what-are-hazardous-air-pollutants.

BTEX Chemicals

"BTEX is a group of monoaromatic hydrocarbons, consisting of benzene (C6H6; CAS Registry Number 71-43-2), toluene (C7H8; CAS RN 108-88-3), ethylbenzene (C8H10; CAS RN 100-41-4) and xylene"[11] BTEX are highly carcinogenic, as well as flammable and toxic.

Ethylene glycol

Ethylene glycol is an odourless industrial compound used in products like antifreeze, brake fluids, inks, pens, solvents, paints, plastics, and cosmetics. It also serves as a pharmaceutical vehicle. In the body, it breaks down into toxic compounds that affect the central nervous system, heart, and kidneys, and can be fatal if ingested.[12]

Groundwater contamination

"Groundwater contamination occurs when man-made products such as gasoline,oil, road salts and chemicals get into the groundwater and cause it to become unsafe and unfit for human use"[13]

Air pollution

"Air pollution is contamination of the indoor or outdoor environment by any chemical, physical or biological agent that modifies the natural characteristics of the atmosphere."[14]

Induced Seismicity

"Induced seismicity (IS) refers to an earthquake resulting from human activity, such as mining, dam impoundment and oil and natural gas development."[15]

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[11] "Federal Environmental Quality Guidelines - Benzene, Toluene, Ethylbenzene, Xylene (BTEX) - Canada.ca." *Canada.ca* , 2024, www.canada.ca/en/environment-climate-change/services/evaluating-existing-substances/cepa-feqg-benzene-toluene-ethylbenzene-xylene.html.

[12] ---. "Ethylene Glycol." *PubChem*, pubchem.ncbi.nlm.nih.gov/compound/Ethylene-glycol.

[13] The Groundwater Foundation. "Groundwater Contamination – the Groundwater Foundation." The Groundwater Foundation, 10 Sept. 2022, groundwater.org/threats/contamination/#:~:text=Groundwater%20is%20also%20one%20of,and%20unfit%20for%20human%20use

[14] World Health Organization: WHO. Air Pollution. 30 July 2019, www.who.int/health-topics/air-pollution#tab=tab_1.

[15] "Induced Seismicity." *BC Energy Regulator (BCER)*, www.bc-er.ca/news-publications/trending-topics/induced-seismicity/#:~:text=Seismicity%20refers%20to%20th

Shale

A very fine-grained, clastic sedimentary rock that forms when mud, silt, and clay-size mineral particles are consolidated and compacted into relatively impermeable layers. Shale is characterised by a finely laminated or stratified structure and is the most abundant sedimentary rock. Shale can contain varying amounts of organic matter, so it has the potential to become a hydrocarbon source rock. The pore size of shale reservoirs ranges from nanometers to micrometres. Hydrocarbons in some shale reservoirs can be extracted using hydraulic fracturing.[16]

Background Information

Hydraulic fracturing's origin and historical development

Hydraulic fracturing is a process that can be traced back to the 1860s in multiple states in the United States (USA), where nitroglycerin was used to create wells in order to "shoot" the oil or natural gas out of the well. Hydraulic fracturing started being used on a larger scale in the early 1930s, and acid injection replaced the explosives. Due to the Great Depression, the economy was in decline, and thus unemployment was rapidly rising, so hydraulic fracturing allowed for the creation of jobs in a period of crisis. Furthermore, it allowed the US to majorly reduce its oil and natural gas imports and instead start exporting oil and natural gas in the mid-1930s, to European countries that required oil and natural gas.

Modern hydraulic fracturing was conducted and brought up by a man called Floyd Farris at Stanolind, who in 1947, conducted the first hydraulic fracture experiment using gelled gasoline and sand at the Hugoton gas field in Kansas. In March 1949, Stanolind, together with Haliburton Cement Co, performed the first commercial hydraulic fracture in Stephens County Oklahoma which allowed for the boom of oil and gas productions in the 50s and 60s, where Stanolind and Haliburton performed thousands of fracking operations a year, the peak being in 1955, when approximately 45000 fracking operations had taken place, with fluids now more water based and containing hazardous chemicals.

e%20geographic%20and%20historical,impoundment%20and%20oil%20and%20natural%20gas%20development.

[16] "Glossary for Shale." US Environmental Information Administration Glossary, US Environmental Information Administration, www.eia.gov/tools/glossary/index.php?id=shale. Accessed 5 Aug. 2025.

In the 1960s, fracturing spread to other countries, as the UK had its first operation in the mid-60s. Moreover, the 1960s brought advancements in fracking technology, such as pumps increasing from 75hp to 1200hp. The evolution of drilling technology and research on hydraulic fracturing continued in the 1970s, as the process of hydraulic fracturing was still not fully understood.[17] In the 1980s and 1990s, technological advances and new techniques, such as horizontal drilling, allowed for the USA to boost its oil and gas production and Mitchell Energy and Development was at the forefront of experimenting with horizontal drilling and new technologies, which allowed them to be one of the first companies to extract oil and gas in vast quantities[18] and use the techniques that are the basis of the methods used today.

In 1997, an engineer at Mitchell Energy, Nick Steinberger, used a new technique called the slickwater fracturing technique, using more water and higher pump pressure than previous fracturing techniques. The new method was found to be a success as gas production increased in the first 90 days of its use.[19]

In the 2000s, the slickwater technique was advanced by Mitchell engineers, and this allowed for the shale boom in 2005, leading to a drastic rise in oil and gas production. This led to shale gas growth going from 1.6% in 2000 to 23% in 2010.[20] Crude oil imports fell from 12.5 million in 2005 to 4.7 million in 2010 while US exports of oil and gas increased.[21] The 2010s also saw a massive increase in production as, between 2009 and 2019, 245000 new oil and gas wells were drilled in the US alone. Throughout the 2010s, the consumption of coal declined due to oil and natural gas being considered a cleaner and more profitable source of energy, and today the oil and natural gas markets are continuing to thrive, generating humungous amounts of wealth for the companies and countries selling oil and natural gas.[22]

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[17] "The Explosive Evolution of Fracking: A 75-Year Journey | Hart Energy." *Hart Energy*, 16 Dec. 2024, www.hartenergy.com/exclusives/explosive-evolution-fracking-75-year-journey-211326?utm_.
[18] Wells, Bruce. "Shooters – a "Fracking" History." *American Oil & Gas Historical Society*, 21 May 2025, aoghs.org/technology/hydraulic-fracturing/?utm_.
[19] "Fracking: Drilling Down on the Evolution of the Industry." *https://www.cat.com/en_US/blog/fracking-drilling-down-on-the-evolution-of-the-industry.html*, www.cat.com/en_US/blog/fracking-drilling-down-on-the-evolution-of-the-industry.html?utm_.
[20] "The Housing-Market Impacts of Shale-Gas Development." *CEPR*, 9 Feb. 2014, cepr.org/voxeu/columns/housing-market-impacts-shale-gas-development. Accessed 28 Aug. 2025.
[21] Rapier, Robert. "How the Shale Boom Turned the World Upside Down." *Forbes*, 21 Apr. 2017, www.forbes.com/sites/rrapier/2017/04/21/how-the-shale-boom-turned-the-world-upside-down/?utm_.
[22] "After a Decade of Fracking, Billions of Dollars Lost and a Climate in Crisis." *DeSmog*, 5 May 2021, www.desmog.com/2020/01/21/2010s-decade-fracking-shale-climate-crisis/?utm_.

The advantages of hydraulic fracturing

Despite all its drawbacks, hydraulic fracturing has some advantages. Firstly, as previously stated, natural gas that is extracted from shale produces 50% less carbon dioxide and less HAPs as compared to coal (making it somewhat cleaner than coal by allowing for less production and emission of greenhouse gases). Additionally, because of fracking, investments and time have been spent building infrastructure to scale up renewable alternatives.[23] Secondly, an advantage of hydraulic fracturing is the access it gives us to unreachable pockets of oil and natural gas in the shale pores in different parts of the world allowing for countries to increase their domestic production of oil and natural gas meaning they import less and export, making them more autarkic and because of the increase in supply, market prices go down meaning people pay less.[24] Additionally, the process of hydraulic fracturing requires a significant amount of manpower, meaning that jobs are created to conduct hydraulic fracturing properly, jobs ranging from the workers operating the pumps, to the truck drivers, driving the tankers from the site to the area where the oil will be stored till it's sold. In the US, it is estimated that in a 100-mile radius of a fracking site, 1 million in production value brings an increase in wages by $243000 and 2.49 new jobs.[25] Moreover, fracking can prompt economic growth on a local level, as there is investment in local infrastructure to ensure no problems, such as conditioning of roads or new facilities like water management in the area and this can lead to more future projects.[26]

The health and environmental impacts of hydraulic fracturing

Although hydraulic fracturing has its benefits, it also has multiple severe drawbacks that are said to outweigh the advantages. Firstly, hydraulic fracturing does produce a significant amount more methane than coal combustion, so it does contribute to air pollution due to the production of methane, and this is very harmful as methane heats the planet 80 times more than carbon dioxide of

[23] UNEP. "Is Natural Gas Really the Bridge Fuel the World Needs?" *UNEP*, 12 Jan. 2023, www.unep.org/news-and-stories/story/natural-gas-really-bridge-fuel-world-needs.
[24] "Advantages and Disadvantages of Hydraulic Fracturing." *Oil and Gas Overview | Your Guide to Oil and Gas Industry!*, 26 Nov. 2020, oilandgasoverview.com/advantages-and-disadvantages-of-hydraulic-fracturing/?utm_.
[25] "The Impact of Fracking on Local Economies." *CEPR*, 16 Nov. 2015, cepr.org/voxeu/columns/impact-fracking-local-economies.
[26] Chief, Editor in. "19 Major Advantages and Disadvantages of Hydraulic Gas Fracking." *ConnectUS*, 20 Feb. 2019, connectusfund.org/19-major-advantages-and-disadvantages-of-hydraulic-gas-fracking ?utm_. Accessed 6 Aug. 2025.

the equivalent volume.[27] The rise in methane in the atmosphere in the past couple of decades has been linked to the increased use of hydraulic fracturing.[28] Secondly, another impact is that hydraulic fracturing can lead to the contamination of water sources in the vicinity of the well as when the wells transporting the injected fluid that contains BTEX chemicals or ethylene glycol, are poorly made, the liquid can escape into aquifers that supply communities with fresh water causing major health issues for the people drinking and using the water from the aquifer such as permanent nerve damage and blindness.[29] Moreover, another impact of hydraulic fracturing can be induced seismicity as the fluid injected into the shale-rock formation is injected into the rock with high pressures, meaning sometimes it causes micro-tremors.[30] However, it is said that the micro-tremors are generally too small to be felt and have little to no impact, and it is said that the wastewater injection is the main seismic risk as pressure levels are raised when the liquids in the wastewater are in the wells.[31]

Major countries/ organisations and alliances

United States of America

Hydraulic fracturing, better known as fracking, got its start in the United States back in the 1930s. Early experiments took place in parts of the country during the Great Depression, when oil companies were looking for new ways to boost production. At first, the process was fairly basic, but it quickly proved effective at reaching oil and gas that had been trapped deep underground.

Fast forward to today, and fracking has completely reshaped the U.S. energy industry. It's one of the main reasons the country is now the world's largest producer of oil and natural gas. In fact, by 2024,

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[27] *Greenly*, 12 Dec. 2024, greenly.earth/en-gb/blog/industries/everything-you-need-to-know-about-fracking?utm

[28] Leahy, Stephen. "More Methane in the Atmosphere Linked to More Fracking." *National Geographic*, 15 Aug. 2019, www.nationalgeographic.com/environment/article/fracking-boom-tied-to-methane-spike-in-earths-atmosphere.

[29] Vaidyanathan, Gayathri, and ClimateWire. "Fracking Can Contaminate Drinking Water." *Scientific American*, 20 Feb. 2024, www.scientificamerican.com/article/fracking-can-contaminate-drinking-water.

[30] British Geological Survey 1998 - 2019 (c)UKRI http://www.bgs.ac.uk mailto:www-bgs@bgs.ac.uk. *Hydraulic Fracturing and Induced Seismicity*. www.earthquakes.bgs.ac.uk/research/FrackingInducedSeismicity.html?

[31] "How Is Hydraulic Fracturing Related to Earthquakes and Tremors?" *USGS*, 31 May 2018, www.usgs.gov/faqs/how-hydraulic-fracturing-related-earthquakes-and-tremors#:~:text=Reports%20of%20hydraulic%20fracturing%20causing,and%20Misconceptions%20about%20Induced%20Earthquakes.

the United States made up roughly 77.5% of all hydraulic fracturing taking place worldwide — a staggering share that shows just how much the industry relies on American production.[32]

Canada

Canada is the world's second-largest producer of oil and natural gas, with much of that production tied to hydraulic fracturing. The majority of oil and gas operations that rely on fracking are located in British Columbia and Alberta, where vast shale formations hold enormous reserves. These provinces have become the centre of Canada's energy industry, providing jobs, revenue, and economic growth for local communities.

Fracking has played a major role in helping Canada compete on the global energy stage. By extracting resources that were once too costly or difficult to access, it has allowed the country to expand production and reduce reliance on imports. At the same time, the practice has raised environmental and social concerns. Many Canadians worry about the long-term effects of fracking on water quality, wildlife, and the stability of local ecosystems, while others point to the economic benefits as a reason to keep investing in the industry.

China

China has been heavily investing in hydraulic fracturing as part of its broader strategy to reduce its reliance on foreign energy. Currently, 70% of the country's energy supply comes from imports, which leaves it exposed to global price fluctuations and geopolitical risks. By expanding domestic natural gas production through fracking, it can become more self-reliant in its energy sector.

With its growing population and rapidly expanding industries, China's energy demand continues to rise every year. Developing its own shale gas reserves is a way to keep up with that demand and a solution to cut its costs on imports.

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[32] "Hydraulic Fracturing Market Size, Forecast | Statistics by 2032." *Fortunebusinessinsights.com*, 2025, www.fortunebusinessinsights.com/industry-reports/hydraulic-fracturing-market-100419?utm . Accessed 25 Aug. 2025.

China faces some challenges when it comes to fracking. Unlike the United States and Canada, where shale deposits are often more accessible, much of China's shale gas lies in geologically complex regions, making extraction more difficult and expensive. On top of that, water scarcity in some areas adds another layer of concern, since hydraulic fracturing requires significant amounts of water.

Greenpeace

Greenpeace is an environmental activist group based in Amsterdam, Netherlands that is against the use of hydraulic fracturing and thus has taken many actions around the world to end its use. An example of this was in July 2024, in Pungesti, Romania, where 25 Greenpeace activists chained themselves to the gates of a Chevron shale gas exploration site in Pungești, eastern Romania. They displayed banners reading *"Stop fracking"*, demanding a national ban on the practice.[33]

Earth Justice

Earth Justice is a non-profit environmental law organisation based in San Francisco, California, that is actively opposing hydraulic fracturing taking place all around the USA. Earthjustice have been acting against hydraulic fracturing for several decades, one example being when Earthjustice represented a coalition of environmental groups in 2015 defending the Bureau of Land Management's (BLM) fracking rules (which required well-approval, chemical disclosure, and waste safeguards) against legal attacks from states and industry.[34]

Previous attempts to solve the issue

Pavillion, Wyoming Groundwater contamination (January 2010)

In 2008, complaints were made in the Pavilion, Wyoming region about foul-smelling groundwater. The Environmental Protection Agency (EPA) was sent, and they opened an investigation in order to find the source of the foul smell between 2008 and 2013, and came to the conclusion that the water had been contaminated by fracking fluids. In 2013, the Wyoming state department installed two monitoring wells to monitor contamination and helped citizens get cleaner alternative water sources,

[33] Chiriac, Marian. "Greenpeace Protest Fracking Plans in Romania." *Balkan Insight*, 28 May 2018, balkaninsight.com/2014/07/08/greenpeace-protest-fracking-plans-in-romania/?
[34] Earthjustice. "Defending the BLM's New Fracking Rules - Earthjustice." *Earthjustice*, 12 Oct. 2022, earthjustice.org/case/defending-the-blm-s-new-fracking-rules.

meaning that overall the action was a success; however, trust between the citizens and the state was eroded as it took years to deal with the contamination that posed a major health risk.[35]

Colorado, Community setbacks and health protocols (November 2019)

Oil and gas companies in Colorado illegally drilled next to communities, ignoring the 2000-foot barrier that restricts them from drilling close to homes. Colorado's Energy and Carbon Management Commission ignored multiple proposals in its council and instead gave a loophole for companies to drill within the boundaries of homes. Rules were set in place by the state of Colorado in court in order for the companies to inform about their process, but the rules don't limit the amount of harmful substances companies can emit during the process, meaning companies can drill with no need to think about the environment. Even though regulations were placed, the people of Colorado are unsatisfied with their government's attempt to aid them, as companies are still able to drill within the boundaries, so overall, the attempt could be classified as a failure.

Pennsylvania, Site reclamation and ecosystem protection (January 2024)

Pennsylvania Department of Environmental Protection and the Shapiro administration[36] are enforcing new policies requiring natural gas operators to publicly disclose the chemicals used in drilling and hydraulic fracturing earlier in the process, as well as submitting pre-drilling plans that need to be verified to move on with drilling operations. Furthermore, companies from now on have to disclose the air quality of the area around the operation and follow rules set in place by the DEP on controlling methane emissions, improved drilling waste and corrosion safeguards to keep the pipes intact, and all the activity will be monitored by the DEP.[37] This is overall a success to a big extent, as the policies put in place by DEP and the Shapiro administration cover all the aspects of the hydraulic fracturing process, as well as monitor and enforce the rules.

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[35] "Pavillion Wyoming , Ground water investigation." *US Environmental Protection Agency*, EPA, 13 Aug. 2010, www.epa.gov/sites/default/files/documents/PavillionWyomingFactSheet.pdf#:~:text=Pavillion%2C%20Wyoming%20is%20located%20in%20Fremont%20County%2C%20about,was%20first%20contacted%20by%20community%20members%20in%202008 . Accessed 17 July 2025.

[36] The Shapiro administration is the administration of the governor of Pennsylvania , Josh Shapiro.

[37] "Shapiro Administration, DEP Requires All Fracking Companies to Be More Transparent About Chemicals Used in Drilling." *Department of Environmental Protection | Commonwealth of Pennsylvania*, www.pa.gov/agencies/dep/newsroom/shapiro-administration-dep-requires-all-fracking-companies-to-be-more-transparent-about-chemicals-used-in-drilling.

Possible solutions

Water recycling

Instead of using freshwater to create the water-based liquid needed in hydraulic fracturing, companies should aim to reuse water from previous wells, which can help reduce water usage and water waste. However, one main issue with this is that the past water from the wells tends to have a lot of chemicals in it, which can increase the water's toxicity.[38] Toxic water poses a threat to wildlife, as it can contaminate their water source. To mitigate this effect, the reused wastewater should undergo a multilayered process of detoxification, which includes filtration, coagulation, oxidation and neutralisation. A sample of this water should be sent to laboratories to undergo further testing before it is used in hydraulic fracturing, to ensure that it has low levels of toxicity and thus poses minimal to no risk to wildlife.

Alternative fracturing fluids

An alternative to using high-pressure liquid with harmful chemicals can be to use liquified propane gas (commonly referred to as ''LPG'') to recreate the high-pressure liquid, which would allow for less harmful spills and would improve air quality. This is because it prevents fracking chemicals, which pose a risk to the ozone layer and worsen air quality, from being released into the atmosphere, but instead are left under the surface of the Earth. The main reason for this is that the liquid propane gas does not need to be "pumped back up to the surface after the fractures have been made."[39] Another benefit of using LPG is that it does not require any water to be used in the fracturing process. This minimises the effects of fracturing on communities' water supplies and ensures their minimal contamination (as less toxic 'wastewater' that needs to be disposed is produced). Additionally, unlike water-based fluids, LPG can be recaptured and thus reused after the process is done, making it more economically applicable and often more environmentally friendly (as it uses fewer resources). Even

[38] Esimtech, and Esimtech. "Advances in Hydraulic Fracturing (Fracking) Techniques - Esimtech." *Oil & Gas Simulator - China Petroleum Simulator I Esimtech*, 1 July 2024, www.esimtech.com/advances-in-hydraulic-fracturing-fracking-techniques.html?utm_.

[39] *What Are Alternatives to Make Fracking Less Impactful?* www.api.org/oil-and-natural-gas/energy-primers/hydraulic-fracturing/what-are-alternatives-to-make-fracking-less-impactful?utm_.

though the use of LPG comes with its disadvantages (potential methane leaks and explosions), it is typically seen as a preferred option in hydraulic fracturing with the potential to improve the process.

Ensuring proper testing

Another way of minimising the impact of alleviating the environmental consequences of hydraulic fracturing is by ensuring that proper testing is done. Firstly, infrastructure like the well and the cement need to be checked by specialists to ensure that there aren't any chances of a leak occurring (through cracks or structural faults). Tests include the Formation Integrity Test and the Cement Bond Log (per the EPA). The fracturing fluids used also need to undergo testing of basic qualities, like pH and viscosity, as well as pressure and temperature stress tests to ensure they are fit for the process and reduce the chance of issues occurring. Furthermore, other structural materials like the rocks need to undergo stress, tension and strength tests. Lastly, as previously mentioned, the wastewater needs to be checked to ensure minimal toxicity and thus alleviate the potential risk of contamination it poses to water supplies (a major environmental and ethical concern surrounding fracking). This can be done by setting up local councils, laboratories and offices near fracking sites, whose job is to ensure that the site is adhering to the standard requirements and is completing the standardised testing needed. Though the willingness of implementation by companies is a potential issue, the existence of these offices puts more pressure on companies to follow the rules, ensuring that the process of hydraulic fracturing is carried out in the safest way possible, with minimal impacts and consequences on the local communities and environment.

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National Institute of Environmental Health Sciences, www.niehs.nih.gov/health/topics/agents/fracking?utm_.

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https://www.canada.ca/en/environment-climate-change/services/evaluating-existing-substances/cepa-feqg-benzene-toluene-ethylbenzene-xylene.html

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