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Hydraulic Fracturing
Regulatory & Policy Considerations

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January 2022

Our nation's 21st century oil and natural gas renaissance has made domestically produced oil and natural gas economical and abundant. New and evolving technologies like 3D seismic, horizontal drilling, and hydraulic fracturing have allowed oil and gas companies to access reserves of previously-unrecoverable oil and natural gas. This market-driven success has also helped our nation achieve significant emission reductions reducing U.S. greenhouse gas emissions, which are now near 25-year lows. The U.S. emitted 14% fewer energy-related CO_2 emissions in 2019 than in 2005. Contrary to what many activists espouse, fossil fuels and environmental stewardship are not and never have been mutually exclusive. Oil and natural gas are the lifeblood of our country fueling American innovation and ensuring the security of all Americans. But the oil and natural gas found in tightly-packed rocks can be extracted only by using hydraulic fracturing.

For more than 70 years, America's energy producers have relied on an innovative technique known as hydraulic fracturing (HF) to enhance the production of oil and natural gas. While the first commercial "frac job" was conducted in 1947, the technique quickly became the most commonly used method of stimulating oil and natural gas wells. The technology has been deployed more than 1.2 million times over the course of more than 70 years.

Because oil and natural gas have a significant role to play in terms of our nation's energy security, this paper discusses and clarifies some misperceptions about the oil and natural gas industry, and reviews federal and state HF regulatory and policy considerations.

What is Hydraulic Fracturing

HF is a proven technology to increase the recovery of crude oil and natural gas from underground formations. Developed in the late 1940s, HF is a process consisting of pumping a water/sand mixture at high pressure into isolated zones to enhance the natural fractures that exist in the formation. During the process, long, narrow cracks are created to serve as a flow channel for oil and natural gas trapped in the formation. Proppants (usually sand) in the fluid keep the fractures open to create a pathway for oil and natural gas to migrate to the well bore. HF treatments are designed to specific conditions of the target formation (thickness, rock characteristics, reservoir geochemistry, etc.) to optimize the development of a network of fractures. Their design is based on an understanding of the in-situ conditions present in the reservoir.

Why is HF necessary?

HF is essential for recovering crude oil and natural gas resources from formations that would be unavailable through other completion practices. Without HF, existing wells would deplete very quickly or would have never been commercially productive. HF is applied to the majority of America's oil and natural gas wells to enhance well performance, minimize drilling, and recover otherwise inaccessible resources. In fact, a vast majority of the wells in operation today have been fractured, and the process continues to be applied in new and innovative ways to boost production of American energy. As a result, HF has aided in the extraction of more than 600 trillion cubic feet of natural gas and 7 billion barrels of oil.

What's in fracturing fluid?

According to the U.S. Department of Energy (DOE) and Ground Water Protection Council, HF fluids consist of 99.5% water and sand. In addition, there are small amounts of other compounds, each of which play a critical role in the process. The vast majority of these materials can be found in the food we eat, beverages we drink, and household cleaning items. State regulators are made aware of those chemicals, and have access to all information they need regarding their safe use.

Does HF pose a risk to public health?

The United States Environmental Protection Agency (EPA) released a report in 2004 concluding that the technology poses "no threat" to underground drinking water. Clinton Administration EPA chief Carol Browner testified in 1999, finding "no evidence that . . . hydraulic fracturing . . . has resulted in any contamination or endangerment of underground sources of drinking water." More than 25 scientific, peer-reviewed studies conclude hydraulic fracturing does not pose a major risk of groundwater pollution.

The American Council on Science and Health (ACHS) released its list of the "Top Ten Unfounded Health Scares." Number four on that list was hydraulic fracturing. The ACHS say their goal is to increase people's awareness of actual threats to their health without their having to spend time worrying about things that pose no danger at all. Unfortunately, the goals of some politicians, the media, and certain activist groups can be somewhat different as they frequently aim to create a sensation and gain publicity without much regard for actual scientific evidence. ACHS's annual list aims to quell fears by discussing the real evidence about these unscientific scares. The bottom line found by the ACHS is that fears of environmental degradation are hypothetical and water contamination from hydraulic fracturing is highly unlikely.

Fact-Checking Some Common Environmental Assertions – Environmental activists often make assertions about the impact of HF to public health. Many times the statements are out of context and need additional information to help promote a more complete and informed discussion. Here are a few common assertions:

Assertion: *"Chemicals used in fracturing are a threat to groundwater and streams."*

Facts: U.S. Environmental Protection Agency Administrator Lisa Jackson testified before Congress in May 2011 stating "I am not aware of any proven case where the fracking process itself affected water." U.S. Department of Interior Bureau of Land Management Director Robert Abbey testified before Congress in June 2011 stating "We have not seen any impacts to groundwater as a result of hydraulic fracturing." On April 28, 2012, U.S. EPA Administrator Lisa Jackson once again stated "In no case have we made a definitive determination that the fracturing process has caused chemicals to enter groundwater." In July 2013, a landmark federal study conducted by the National Energy Technology Laboratory on hydraulic fracturing showed no evidence that chemicals from the natural gas drilling process moved up to contaminate drinking water aquifers at a western Pennsylvania drilling site. In August 2013, U.S. Energy Secretary Ernest Moniz said "I have still not seen any evidence of fracking per se contaminating ground water." A USEPA study in 2015 found no evidence of widespread water contamination from HF. More than 25 scientific, peer-reviewed studies conclude hydraulic fracturing does not pose a major risk of groundwater pollution. When pressed for concrete evidence during a U.S. Senate roundtable discussion in May 2013, neither the Natural Resource Defense Council nor the Sierra Club could identify any specific example of HF contaminating water aquifers.

Environmental activists across the nation continue to cite a compendium of disproven anti-fracking reports and recycled talking points as proof that hydraulic fracturing contaminates the air and water. *Rolling Stone* magazine published an article in 2018 attacking hydraulic fracturing claiming that oil and gas development is harmful to human health. That *Rolling Stone* article was picked apart and debunked by numerous researchers and scientists as using flawed methodologies and overplaying weak and even contradictory conclusions. Conversely, two peer-reviewed studies came out that contradicted environmentalist claims. A multi-year

University of Cincinnati groundwater study was published in the scientific journal *Environmental Monitoring Assessment* in May 2018. The study found no impacts from hydraulic fracturing. Also, an Oregon State University study published in May 2018 found that those with a higher level of education are more likely to be familiar with and supportive of hydraulic fracturing.

These are just two of more than two dozen scientific studies published since 2010 that concluded hydraulic fracturing is not a threat to groundwater. No fewer than 10 peer-reviewed studies examining more than 3,000 water wells across the U.S. have been released in the past five years, with each one finding no evidence that hydraulic fracturing has contaminated groundwater. The bottom line is there is simply no credible scientific evidence to support environmental activists' claim that hydraulic fracturing contaminates groundwater.

In September 2019, a new report by the *Health Effects Institute* (HEI) *Energy Research Committee* examined 25 studies published from 2000 to 2018 aimed at linking oil and natural gas development to poor health. The HEI examination found no direct association between hydraulic fracturing and illnesses, dealing another blow to activists who try to link the two together. In reality, monitoring of air and water near well sites continue to find that the U.S. oil and natural gas industry is operating in a way that is protective of public health, while powering the American economy.

Activists across the nation continue efforts to disrupt orderly oil and gas development. They work backwards from a conclusion using an innuendo-filled collection of unfounded allegations to generate anxiety about oil and gas development in general. Mischaracterizing oil and gas activity is a common practice and strategy of activists across the nation. Activist attacks on oil and gas development often do not hew to strict scientific precision, but are instead hyperbole, heated rhetoric, and non-verifiable statements of subjective opinion that should not be taken literally. They have no evidence and use weak logic.

Assertion: *"There are thousands of cases linking HF to ground water contamination"*

Facts: HF technology has been deployed more than 1.2 million times over a course of 70 years without a single verified or documented instance of harm to groundwater. Many reports of

contamination can be traced to above-ground spills or other mishandling of wastewater produced from wells - not from hydraulic fracturing.

In December 2016, the EPA released the final results of its report on hydraulic fracturing and groundwater contamination. The EPA report found no evidence that hydraulic fracturing has any systemic groundwater impacts. The December 2016 EPA report only reinforced what it found previously – that **"hydraulic fracturing activities have not led to widespread, systemic impacts to drinking water resources.**"

If hydraulic fracturing were a major threat to drinking water supplies, the data gathered by EPA would show it – but they don't. If hydraulic fracturing were contaminating water on a widespread level, the evidence would also have been found in the dozens and dozens of peer-reviewed studies that have been conducted over the past decade. The EPA's failure to find any systemic problems leading to water contamination vindicates the idea that when operations are performed correctly, hydraulic fracturing poses essentially no risk to water supplies. That flies in the face of wild charges about hydraulic fracturing made by environmental groups. The Sierra Club, for instance, says "Fracking has contaminated the drinking water of hundreds of thousands of Americans." Not so, based on the evidence compiled and studied by the EPA. The EPA study officially closes the book on the environmental activists' deliberate misinformation campaign.

The question of underground drinking water contamination from hydraulic fracturing is a settled issue. The EPA report is very much in line with the scientific consensus on hydraulic fracturing. Numerous peer-reviewed studies have shown that the process poses an exceedingly low risk of impacting drinking water sources. Here are a few that stand out:

- **The Academy of Medicine, Engineering and Science of Texas (TAMEST)** (2017): Fracking has not contaminated groundwater in Texas.
- **United States Geological Survey (USGS)** (2017): Oil and gas production not affecting drinking water quality.
- **Duke University**, funded by Natural Resources Defense Council (NRDC) (2017): Groundwater not affected by HF in West Virginia.

- **University of Cincinnati** (2016): Water quality not impacted by fracking or natural gas drilling in Ohio.
- **German Federal Institute for Geosciences and Natural Resources** (2016): No threat of fracking contaminating water in North German Basin.
- **University of Texas-Austin** (2016): Groundwater not affected by fracking in Parker County, Texas.
- **Syracuse University** (2016): No evidence of fracking harming groundwater in Appalachian Basin.
- **Wyoming Department of Environmental Quality** (2016): Groundwater not affected by fracking in Pavillion, Wyoming.
- **Proceedings of the National Academy of Sciences, Yale University** (2015): Fracking has not contaminated drinking water in the Marcellus Shale.
- **U.S. Environmental Protection Agency** (2015): No evidence of widespread water contamination from fracking.
- **U.S. District Court, Wyoming** (2015): Experts have confirmed no water contamination from fracking.
- **Syracuse University** (2015): No evidence of fracking contaminating groundwater in heavily drilled areas of Pennsylvania, West Virginia, and Ohio.
- **California Council on Science & Technology** (2015): Fracking has not caused groundwater contamination in California.
- **Stanford University** (2015): No evidence of fracking fluids leaking up into drinking water aquifers.
- **U.S. Department of Energy, National Energy Technology Laboratory** (2014): No evidence of gas or brine migration from hydraulic fracturing in Marcellus Shale.
- **U.S. Geological Survey** (2014): No water contamination from fracking in West Virginia.

- **Duke University, U.S. Geological Survey** (2013): Fracking had no effect on groundwater wells in Arkansas.
- **Gradient** (2013): There is "no scientific basis" for the claim that fracking fluids will contaminate water aquifers.
- **National Groundwater Association** (2013): Fracking not affecting groundwater in northeastern Pennsylvania.
- **Cardno Entrix** (2012): Fracking has not caused groundwater contamination in Los Angeles.
- **U.S. Government Accountability Office** (2012): The fracking process has not been identified as a cause of groundwater contamination.
- **New York State Department of Environmental Conservation Revised Draft Supplemental Generic Environmental Impact Statement** (2011): Groundwater contamination has not occurred as a result of hydraulic fracturing.
- **Massachusetts Institute of Technology** (2010): Risk of water contamination is low due to distance between groundwater and where fracking occurs.

The Sierra Club and other activist groups, however, continue their fear-mongering campaigns to mislead the public. They continue to allege that HF not only poses a serious risk of contamination, but that the process has been linked to such contamination on numerous occasions. This is not based on scientific evidence, but rather a tool to eliminate development and use of oil and natural gas. They try to mislead the public into thinking there is a widespread problem using anecdotal information attempting to link unrelated incidents in an innuendo-filled collection of unfounded allegations. Their comments are often based not on reality, but a perception that assumes there is a problem, a problem they try to create by using fear. This pattern of accusation without scientific evidence is intended to create anxiety and opposition to oil and natural gas production.

A consensus of regulatory and scientific opinion contradicts claims that hydraulic fracturing has contaminated or poses a serious risk of contaminating underground drinking water supplies. The EPA study released in June 2015 and finalized in December 2016 represents a triumph of science and fact over fiction and emotional anecdotes.

Assertion: *"The actual text of the thousand-page EPA study is a testament to how, at every turn, EPA's efforts to evaluate the 'frequency and severity' of the impacts of fracking on drinking water resources were thwarted by significant 'data limitations and uncertainties."*

Facts: EPA's study, which took five years and $33 million to complete, is by far the most thorough report ever to be done regarding potential groundwater impacts from hydraulic fracturing. As EPA's Thomas Burke said in a press release,

> "It is the *most complete compilation of scientific data to date*, including over 950 sources of information, published papers, numerous technical reports, information from stakeholders and peer-reviewed EPA scientific reports."

The study text itself explains the sheer breadth of the research that was conducted:

> "The EPA used a broad search strategy to identify approximately 3,700 sources of scientific information that could be applicable to this assessment. This search strategy included both requesting input from scientists, stakeholders, and the public about relevant data and information, and thorough searching of published information and applicable data."

Assertion: *Three major EPA investigations into water contamination near drilling sites were scuttled by EPA higher-ups.*

Facts: These three cases - which occurred in Pavillion, Wyoming; Dimock, Pennsylvania; and Parker County, Texas - were already investigated by the EPA, and the theories about groundwater pollution from hydraulic fracturing have long been put to rest. In each case, regulators and scientists have determined that oil and natural gas development was not the cause of water contamination.

The case in Pavillion (where poor water quality has been documented since the 1960s) hinged on a single draft EPA report from December 2011, which theorized a link between hydraulic fracturing and water contamination. According to a breakthrough report released on November 10, 2016 by the Wyoming Department of Environmental Quality (WDEQ), there is no evidence that hydraulic fracturing contaminated groundwater in Pavillion, Wyoming. WDEQ said:

> *"Evidence does not indicate that hydraulic fracturing fluids have risen to shallow depths utilized by water-supply wells. Also, based on an evaluation of hydraulic fracturing history, and methods used in the Pavillion Gas Field, it is unlikely that hydraulic fracturing has caused any impacts to the water-supply wells."*

The report is a devastating blow for the national environmental activist groups who have been campaigning against hydraulic fracturing. These activist groups made Pavillion a key talking point in its effort to shut down oil and gas development across the country. For years, anti-hydraulic fracturing activists have misrepresented and exaggerated the EPA's initial conclusions to support their calls for a nationwide fracking ban. They also ignored serious criticisms of the EPA's work by state environmental regulators and even other federal agencies, namely the U.S. Geological Survey and the Bureau of Land Management, in their desperate attempt to build a case for banning hydraulic fracturing.

Those criticisms from state and federal officials focused on a pair of water-quality monitoring wells, drilled by the EPA, which were poorly constructed and likely introduced the very contaminants that some have tried to blame on hydraulic fracturing. Eventually, under the weight of these criticisms, the EPA backed down. The agency never submitted its draft report, released in late 2011, for peer review and handed the Pavillion case back to state regulators.

Later, the EPA completed a much larger nationwide study on hydraulic fracturing. Contrary to the claims of "ban fracking" activists, the EPA's five-year study found no "widespread, systemic impacts to drinking water resources." The November announcement from the WDEQ doesn't just close the case on Pavillion – it's a knock-out blow for the "ban fracking" agenda.

In the case in Dimock, the Pennsylvania Department of Environmental Protection (DEP) investigated whether oil and natural gas activity was responsible for contamination. To resolve the issue, the DEP ultimately issued a consent decree with the operator, and the agency determined in November 2011 that the operator had fulfilled its obligations under that order. The U.S. EPA agreed in late 2011 "The data does not indicate that the well water presents an immediate health threat to users." Nonetheless, even with no new data in the case, EPA reversed course shortly thereafter and began a high-profile investigation that attracted significant attention from the news media. The EPA ultimately released four sets of sampling data and concluded in July 2012 that "there are not levels of contaminants present that would require additional action by the agency."

The Parker County case made news on December 7, 2010, when then-EPA Region 6 administrator Al Armendariz issued an unprecedented "endangerment order" against Range Resources, alleging that its gas drilling operations had caused methane to enter groundwater. But even before EPA's press release went out, emails show that Armendariz tipped off the activists about the order telling them, "We're about to make a lot of news" and "time to Tivo channel 8." The case had been brought to EPA after video surfaced of a landowner igniting water coming out of a garden hose. However, a district judge later ruled in early 2012 that a consultant named Alisa Rich had convinced the property owner to hook a garden hose up to a gas vent – not the water line – "to provide local and national news media a deceptive video, calculated to alarm the public into believing the water was burning." The judge also noted: "This demonstration was not done for scientific study." Rich had advised the property owner to do this because "it is worth every penny if we can get jurisdiction to EPA." Subsequent scientific testing, however, proved that the methane was naturally-occurring (from the shallow Strawn Formation, not the Barnett Shale), and multiple state investigations determined gas drilling was not to blame. A few weeks later, Armendariz was forced to resign after video surfaced of him bragging that his method of regulating the oil and gas industry was similar to how the Romans used to "crucify" villagers. With a mountain of scientific evidence showing EPA's order to be baseless, the EPA withdrew the order in the spring of 2012.

Assertion: *"Studies from Duke University and Cornell University link hydraulic fracturing to ground water contamination and demonstrate that HF contributes to global warming more intensely than CO_2 emissions."*

Facts: Duke University released a study in May 2011 that many thought linked methane migration to HF. However, the study in fact found that HF was not responsible for methane migration into water wells, additionally stating that neither brine nor fracturing fluids were detected in any of the water wells they sampled, even in areas where development operations were most active. A team of Duke researchers took a series of water samples from drinking water aquifers across Northeast Pennsylvania. They found no trace of fracturing fluids in those samples. They did find traces of saline, and theorized that it may have originally come from deep underground pockets of salty water, called brine. The saline was not found anywhere near oil and gas wells, and therefore, the researchers concluded it was naturally occurring and not caused by hydraulic fracturing. But, the researchers further theorized that if the saline was naturally occurring, and if it originally came from deep underground, then it's possible that some of the fluids used in hydraulic fracturing and some of the natural gas released from deep shale formations could someday migrate upward, through thousands of feet and billions of tons of rock, to shallow drinking water aquifers. Try as they might, the authors of the paper could find no evidence of fluids from the fracturing process in, near, or anywhere close to shallow sources of drinking water underground. Politics obviously played a central role in guiding the direction of the paper as reflected in the comments from the paper's authors when they told the *Philadelphia Enquirer* "We would like to see shale gas become largely unnecessary, along with coal and oil. The faster we develop and adopt renewable energy technologies, the less we will have to worry about whether it's safe for people to drink their water." Against that backdrop, the Duke University authors released a second installment in July 2012 that again found no fracturing fluids in water wells, and no correlation between the phenomena they report and activities associated with natural gas development. According the latest Duke paper, "The occurrences of saline water **do not correlate with the location of shale-gas wells** and are consistent with reported data before rapid shale-gas development in the region." Those who oppose American energy development are already pointing to the new Duke paper

as evidence that facturing fluids may someday migrate to drinking water sources, denying the facts of science, a history of experience and even the views of the researchers themselves.

Cornell University researcher-activists, Professor Robert Howarth et. al., released a study in early 2011 that attempted to argue that HF releases substantial amounts of methane that is a 70 times more potent global warming gas than CO_2. The study received intense peer criticism. At least 11 university and research groups questioned the Cornell study including other Cornell University professors who said the study was seriously flawed and relied upon unrealistic assumptions of emissions and improper time intervals to determine warming potential. The peer criticism can best be summed up by a University of Maryland study that concluded the Cornell study was "largely unjustified". In response to the criticism, Howarth et.al., released a second installment of their study in early 2012 that essentially just regurgitated their previous study, without offering substantive response to virtually any of the conclusions and criticisms posed by more than 11 university and research groups. Dr. Lawrence M. Cathles, professor of Earth and Atmospheric Sciences at Cornell University, said this about the Howarth paper: "Here we reiterate and substantiate our charges that **none of these conclusions are warranted**, especially in the light of new data and models."

According to EPA Greenhouse gas (GHG) reporting data, oil and gas methane emissions account for only 1.22% of total U.S. GHG emissions. Some other noteworthy findings from the EPA include: 1.) oil and natural gas systems now emit fewer methane emissions than waste facilities including landfills and water treatment plants, 2.) total GHG emissions from petroleum and natural gas systems are roughly 10 times smaller than power plants, and 3.) overall GHG emissions in the U.S. declined by 10% since 2005.

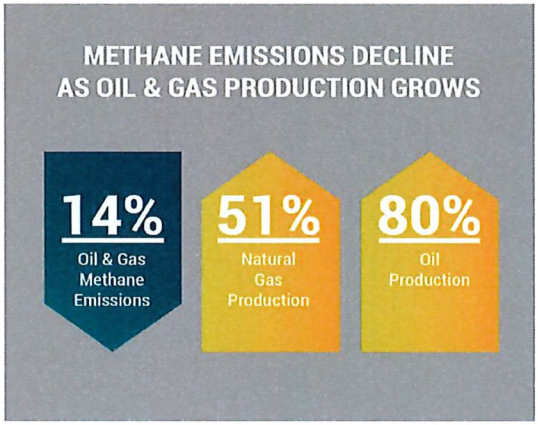
In the latest report from the Energy information Administration, total U.S. energy-related carbon emissions fell 14% while global energy-related emissions increased nearly 24%. Emissions relative to oil and natural gas production were down nearly 70% between 2011 and 2019 and are expected to continue to trend downward.

A study released in September 2013 by the University of Texas confirmed that methane leakage from natural gas wells is 50 times lower than previously estimated by the EPA. The research team revisited their study in 2014 and published their study results in December 2014.

The revised study found methane emissions from the upstream portion of the supply chain were about 10% lower than the same research team found in their September 2013 study. The researchers noted that the study suggests that technologies already in use across the industry are effectively managing methane leakage.

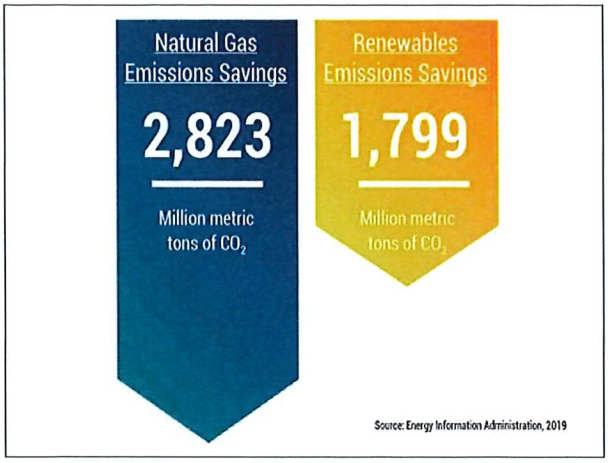
These studies are welcome news for those interested in protecting the environment. The activist fear-mongering about methane emissions has been exposed as fraudulent by the most comprehensive research of the subject to date.

Despite the media's penchant for alarmist headlines and what often appears to be an insatiable need to link every aspect of oil and gas development to hydraulic fracturing, the facts are clear: EPA's real data on GHG emissions made several reassuring observations, including declines not only in GHGs across the entire country, but also in methane emissions from oil and gas systems specifically. The oil and natural gas industry has proven that over the long-term it is possible to lead in energy production and in environmental stewardship. Despite efforts by some to discredit the emission benefits of increased natural gas production, it is clear that the U.S. has been able to continue producing the energy we all rely upon each day while ensuring the continued safety of our environment and air quality alike.



Source: U.S. EPA, U.S. EIA 1990-2017

The latest Energy Information Administration (EIA) data (2019) show natural gas is responsible for 2.8 billion metric tons of carbon dioxide emission reductions since 2005. That represents 61% of overall power sector reductions during that time-frame and 57% more than reductions attributable to renewables.



The men and women of the oil and gas industry reject the stale mindset of last century's thinking peddled by some that oil and gas production and environmental stewardship are not compatible.

Also in October 2013, *Environment America,* an environmental activist group, released an anti-fracking paper. The *Environment America* report claimed that fracking released 450,000 tons of pollutants into the air. However, a Pennsylvania Department of Environmental Quality report found that 500,000 tons of air emissions have been eliminated from the air thanks to the use of natural gas. So, even if the *Environment America* were accurate (and they are not), more emissions were removed from the atmosphere last year than were added. The *Environment America* report also claimed that completion of wells fracked produced global warming pollution of 100 million metric tons of CO_2 equivalent from 2005 to 2012. However, a report from the *Breakthrough Institute,* another environmental activist group, said natural gas actually reduced CO_2 by 300 million to 500 million tons since 2007.

Assertion: *"Hydraulic fracturing causes earthquakes"*

Facts: More often than not, activists and media continue to get it wrong when it comes to the issue of induced seismicity. Contrary to what you might have read or heard, HF is not the cause of earthquakes, or induced seismicity in general. Expert after expert agree with this fact.

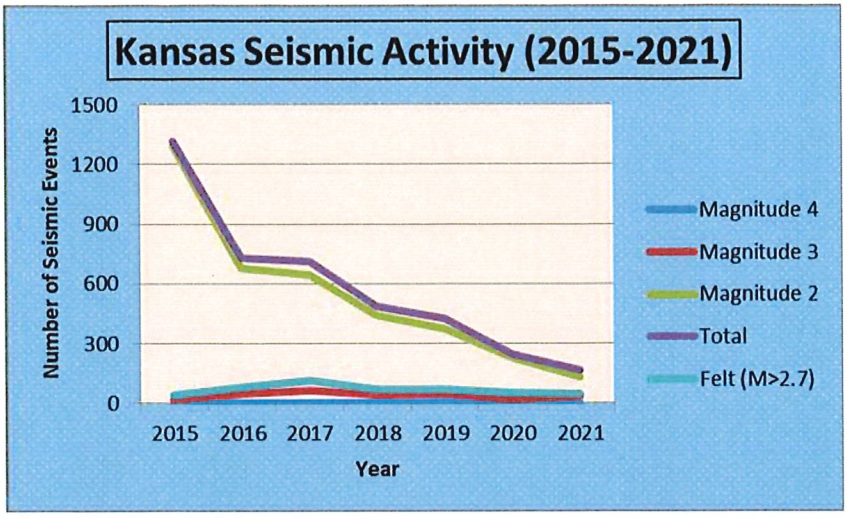
The State Task Force on Induced Seismicity was formed in 2013. The task force released a *Kansas Seismic Action Plan* in 2014. In addressing oil and gas activity, the report noted that "most agree that the physical act of hydraulic fracturing does not cause measurable seismic activity."

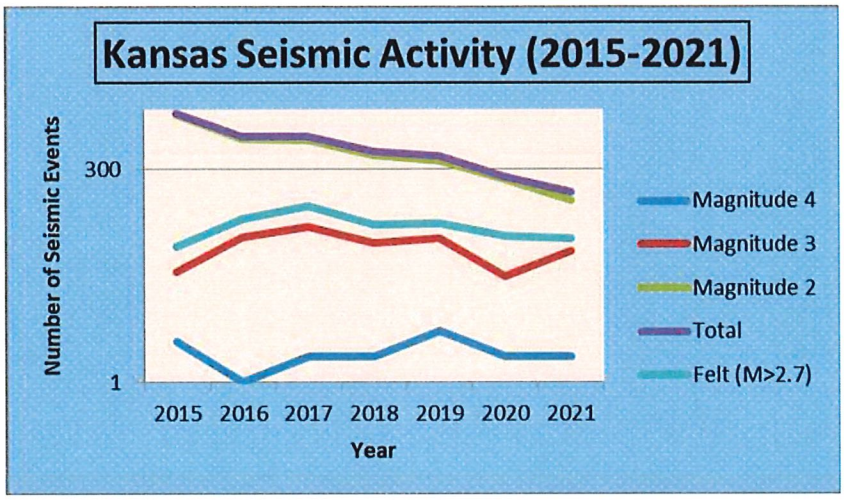
While hydraulic fracturing is an unlikely source of discernible seismic activity, considerable attention is being focused on Class I and Class II injection wells. Given the long history of successful underground injection operations across the nation, the likelihood that induced seismic events will occur in properly permitted and operated injection wells is very small. Too often, the mere presence of nearby oil and gas wells or injection wells results in allegations that they are the source. When looking at the epicenters of seismic events in Kansas and corresponding injection volumes in the vicinity, there is not always an obvious correlation. This fact combined with the varying, and at times sensational, media coverage highlights the need for more scientific research and explanations in a sea of misinformation.

While HF treatments do produce wastewater, or "flowback" water, that is disposed of in injection wells, the vast majority of wastewater disposal is produced water from day-to-day production. Less than 5% of wastewater is from HF operations.

In early 2015, the Kansas Corporation Commission (KCC) ordered oil companies in 5 areas of Harper and Sumner counties in Kansas to reduce the amount of brine fluid they injected. To continue that trend, the KCC in 2016 expanded the area subject to injection restrictions to include parts of Kingman, Sedgwick, and Barber counties.

Kansas oil and gas companies have taken the issue of induced seismicity very seriously. Industry has actively worked with state regulators, Kansas Geological Survey, and other government officials since 2014 when the State Task Force on Induced Seismicity was formed. Industry has shared data and offered resources in efforts to reduce induced seismicity. Efforts have also been made to ensure the assumptions and results of the numerous studies and reports are correct, scientifically-based, and limited in scope to the site-specific features of the areas in question. The efforts are producing results. The latest data shows an **87%** decline in seismic activity in Kansas from 2015 through 2021 with an average annual decline of **27.7%** from 2015-2021. Felt seismic activity (M>2.7) in Kansas has declined **58.4%** since 2017 with an average annual decline in felt seismic activity of **29.9%** from 2017-2021.





Several recent studies and reports have found very few injection wells have been linked to induced seismicity, and the risk from these wells is low.

The USGS states in its list of Myths and Misconceptions About Induced Earthquakes (usgs.gov) that **"Most injection wells are not associated with felt earthquakes."**

A report conducted by StatesFirst, an initiative of the Ground Water Protection Council and Interstate Oil & Gas Compact Commission, takes a comprehensive look at potential induced seismicity associated with injection wells. The report finds that seismicity linked to oil and gas development is rare; that the risk associated with these rare occurrences are minimal; and that understanding of induced seismicity is growing and mitigation techniques are proving effective. The report also notes that a "vast majority of earthquakes are tectonic, or attributable to natural causes."

The most recent comprehensive study based on data from the USGS and peer-reviewed studies, found that less than one percent of injection wells across the nation and in Kansas have been linked to induced seismicity. As a matter of fact, the study found that only 0.15% of all Class II injection wells and 0.55% of all federally regulated disposal wells in the United States have been even tangentially associated or suspected to be linked with a seismic event of any size. In Kansas, the report shows that less than one-half of one percent (0.48%) of injection wells are even potentially linked to seismic events.

A recent study from Stanford University predicts a continuing decline in seismic activity in Kansas and Oklahoma in 2020. The result of the study is definitely good news. The new study shows a 19% probability of seismic activity in Kansas and Oklahoma in 2020. This is down significantly from the 70% probability in 2015 and 2016 and shows that Kansas and Oklahoma regulatory policies are working.

The bottom line is these studies and more confirm what have long been true - that seismicity induced by injection wells is rare and certainly not a widespread issue. Despite misleading claims exaggerating risks and incorrectly linking seismicity to injection wells, the risk of induced seismicity from injection wells is small, rare, and manageable.

Is HF regulated?

HF has been effectively regulated by state governments and oversight agencies since its inception. At both the federal and state level, all of the laws, regulations, and permits that apply to oil and natural gas exploration and production activities also apply to HF. These include all laws and regulations related to well design, location, spacing, operation, and abandonment as well as environmental activities and discharges, including water management and disposal, waste management and disposal, air emissions, underground injection, surface disturbance, and worker health and safety. The process of HF is subject to a rigorous and well established process, developed in accordance to the geology, hydrology, climate, topography, industry characteristics, development history, state legal structures, population density, and local economics unique to each state.

The Ground Water Protection Council (GWPC), considered one of the nation's leading groundwater protection organizations, released recently released a report underscoring this record of safety and performance on the state level finding the "current state regulation of oil and gas activities is environmentally proactive and preventive." GWPC additionally found that the "regulation of oil and gas field activities is managed best at the state level where regional and local conditions are understood and where regulations can be tailored to fit the needs of the local government." The GWPC released a comprehensive analysis of state oil and gas regulations on October 1, 2014. The GWPC found that state regulatory agencies have increased their oversight of rules and regulations pertaining to oil and gas exploration and production. "Since our report, states have continued to update and strengthen their rules addressing the critical areas in nearly every subject area we examined," said Mike Paque, GWPC executive director. "In addition, state oil and natural gas regulatory agencies have adopted new practices to address the technological, legal, and practical changes in oil and gas exploration and production."

Well operators not only work with state regulators, but also comply with numerous federal requirements. The Occupational Safety and Health Administration, the Environmental Response Compensation and Liability Act and the Toxic Substances Control Act all contain record keeping and reporting rules followed by energy producers. These regulations ensure all chemicals used in the extraction process are properly handled and stored, and that workers and first responders are made aware of the substances they handle.

How is the risk of ground water contamination further reduced?

Underground aquifers containing potable water typically reside from 50 to 1,000 feet below the surface while HF operations typically occur between 2,000 and 10,000 feet below the surface. In addition to state requirements, the GWPC notes in its report that the potential risk of endangerment to ground water is further reduced by physical factors such as the vertical distance between the fractured zone and ground water; presence of other zones between the fractured zone and the deepest ground water zone that may readily accept fluid; and the presence of vertically impermeable formations between the fractured zone and the deepest

ground water zone, which act as geological barriers to fluid migration. HF technology has been deployed more than 1.2 million times over a course of 70 years without a single verified or documented instance of harm to groundwater.

The GWPC and the IOGCC developed a web-based database (www.FracFocus.org) that allows companies to voluntarily disclose chemical constituents in frac fluids. FracFocus and/or other disclosure systems can be a significant factor in refuting the arguments that a federal reporting program is needed. KIOGA and other state and national oil and gas associations across the nation encourage operators to voluntarily disclose information to appropriate sources. As of the end of 2020, FracFocus registered over 177,000 HF operations nationwide and the number is growing.

Hydraulic Fracturing Water Usage

Water and sand make up more than 99.5% of the fluid used to hydraulically fracture a well. Water acts as the primary carrier fluid in HF. Because HF can use hundreds of thousands to millions of gallons of water, it is critical that large quantities of relatively fresh water be reasonably available. In Kansas, a typical HF operation on a vertical well may use anywhere from 10,000 gallons to 100,000 gallons. Horizontal wells may use as much as 1 million gallons or more. The quality of water is very important because impurities can reduce the efficiency of the additives used in the process. Most water used in HF comes from surface water sources such as lakes, rivers, and municipal supplies. The amount of water used in HF may appear substantial, but it is small when compared to other water uses such as agriculture, manufacturing, and municipal water supply. All oil and gas operations, of which HF is a part, comprise less than 1% of the total water used in the U.S.

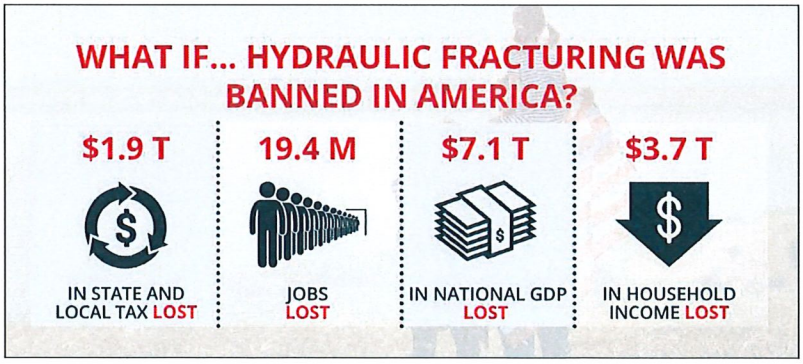
In October 2014, the University of Texas released a study on water use and hydraulic fracturing. The study states, "Although the public perception is that there are huge water demands for HF, results from this study indicate that HF water use to oil production ratios (WORs) for unconventional oil production are within the lower range of those for conventional oil production, considering the well lifetime." The report concludes, "Therefore, increased water use in recent years is attributed to expanded oil production using HF and not because HF

is more water intensive per unit of oil production." With this research, people can understand that the method for generating energy is not necessarily what's causing more water use. While anti-fracking activists will no doubt continue to repeat their tired talking points on water use, this report is yet another indication that they just don't have the facts.

Economic Impact of Hydraulic Fracturing

Few advents have had more impact on this country in the last century than the current oil and natural gas renaissance created by the oil and gas industry. From the creation of millions of jobs, to huge reductions in gasoline and electricity costs, to a manufacturing renaissance, to giving the U.S. much stronger footing on the geopolitical stage, our nation's oil and natural gas revolution has reshaped America.

However, we have seen far too many politicians bow to extreme environmental special interests and call for a ban on hydraulic fracturing (HF). Banning HF would cause every American family to face higher prices for the energy they consume and the products and services they buy, and almost 15 million Americans would be out of work.



Without HF, studies by IHS Global Insight indicate 50% of America's oil wells and 33% of America's natural gas wells would be closed. Domestic oil production would be slashed by 183,000 barrels per day and domestic natural gas production would be slashed by 245 billion cubic feet per day. By 2025, our nation's real GDP would be lowered by $7.1 trillion, $1.9 trillion in state and local tax revenue would be lost, $3.7 trillion in household income would be lost and more than 19 million jobs would be lost, including 10,000-14,000 Kansas jobs.

A ban on HF would also damage America's standing in the world. We would surrender our status as a global energy superpower and weaken our national security as we become more reliant on foreign sources of energy.

Policy Considerations

HF has been extensively studied since its first commercial application in the 1940s, not only in EPA's five year comprehensive study released in 2015 and finalized in 2016, but also in numerous studies by other prestigious institutions. In fact, in 2004, EPA published a separate comprehensive assessment of potential groundwater impacts from HF. Here is what the EPA concluded in 2004:

> "Based on the information collected and reviewed, EPA has concluded that the injection of hydraulic fracturing fluids into CBM [coalbed methane] wells **poses little or no threat to USDWs** and does not justify additional study at this time."

To avoid any doubt about what the EPA has concluded in its previous research, former EPA administrator Lisa Jackson acknowledged in May of 2011 that she was "not aware of any proven case where HF itself has affected water." One year later, Ms. Jackson told the press: "In no case have we made a definitive determination that the HF process has caused chemicals to enter groundwater."

EPA's findings in its 2015/2016 report mirror what the agency has previously found, and its conclusion that there is no evidence of widespread contamination from hydraulic fracturing aligns with what scientists have repeatedly found in peer-reviewed research.

If there were anything to suggest widespread or systemic impacts to drinking water as a result of hydraulic fracturing, such evidence would have been uncovered during the past decade of extensive study of the process, including the EPA's latest comprehensive report. The lack of such evidence means the EPA's conclusion is scientifically sound.

According to the EPA, a "key priority" for the Agency is to "base Agency actions on sound scientific data, analysis, and interpretations." There is nothing in the latest EPA report

from a "scientific and technical" standpoint that suggests EPA's finding of no "widespread, systemic" groundwater impacts from hydraulic fracturing is incorrect.

Those opposed to American energy development continue to manufacture debate about HF and generate unreasonable anxiety around the country over chemicals used in the HF process. Despite a clear and compelling history that state regulation of the environmental risks of HF protects drinking water supplies, environmental group's unyielding accusations create demands for more information on chemicals. Responding to the concerns and politics, the GWPC and IOGCC developed the FracFocus website.

The IOGCC established a state review process in the 1990's and management of the process was shifted to a non-profit corporation known as the State Review of Oil & Natural Gas Environmental Regulations (STRONGER). Since 1999, STRONGER has been active in reviewing state regulations on oil and natural gas and reporting on the progress of state regulation. STRONGER has reviewed 22 state regulatory programs, including Kansas, accounting for over 90% of the national oil and natural gas production.

The ongoing battle over hydraulic fracturing should not be a negative development. It should be simple - investigate, find nothing, and move on. But add in attempts to link hydraulic fracturing to contamination of groundwater and environmental activist propaganda, and the media falls all over themselves to instantly and widely report incorrect sensational sounding stories that are long on anecdote and short on facts.

Those who oppose American energy development continue to offer ideas about HF that are contradictory or otherwise separated from reality. They often manufacture debate and offer ideas that confuses the public and policymakers with assertions that are out of context and need more information to promote a more complete and informed discussion. Despite the fact that HF has been used over 1.2 million times since 1947 without a single verified or documented instance of harm to groundwater, they try to mislead the public into thinking there is a widespread problem using anecdotal information attempting to link unrelated incidents in an innuendo-filled collection of unfounded allegations.

Several groups try to use media to provide misleading information. New York City filmmaker Josh Fox tried to scare people into thinking that oil/natural gas development and HF

are new, unregulated, and dangerous through his series of *Gasland* films. These films made one Pennsylvania mom embark on a voyage to find serious and credible answers to serious questions. She came back with a lot of facts, a lot of answers, and the peace of mind you get from having both those things close by. The video highlighting her search is titled *Truthland.* HF is well-regulated and has been declared safe by independent experts, state regulators, and even the EPA.

As the public becomes better informed about HF we are seeing more and more groups come out in support of the technology. The American Farm Bureau Federation (AFBF) adopted a policy on hydraulic fracturing. The AFBF policy states: "We support the oil and gas industries' use of hydraulic fracturing in the exploration and recovery process. Hydraulic fracturing should continue to be regulated by the states, rather than the Environmental Protection Agency (EPA)."

KIOGA remains fully engaged in federal and state advocacy on HF concerns explaining how states have regulated HF effectively for decades and providing a wealth of science-based information separating fact from fiction, reality from myth, and proven practices from hyperbole.

Conclusion

Some environmental groups have been campaigning for years to subject HF to a host of new regulatory burdens that could discourage exploration, slow production, reduce oil and natural gas supplies, raise energy costs, and erode high-paying jobs. These environmental groups propose to subject all HF of oil and natural gas wells to the requirements of the federal underground injection control (UIC) program under SDWA, despite language excluding this in the Energy Policy Act of 2005. Despite its longstanding record of safety and widespread utilization in the United States, many of the hard facts about HF are not widely known, or have been misrepresented in the public light. For decades, HF oversight has remained with states, which continue to compile a remarkable record of oversight and enforcement. The EPA confirmed as much to the U.S. Senate in 2010 when they said there existed no evidence that

states aren't doing a good job already when it comes to regulating HF activities and that there was no evidence the process causes water contamination.

An extensive regulatory apparatus at all levels of government, including the federal level, is in place to ensure HF continues to be well regulated. Because they understand the regional and local conditions and have every motivation to protect the environment in which they and their family's live, state regulators are in the best position to protect groundwater and drinking water sources. Industry also has strong incentives to maintain a high level of environmental performance, and works hard to review and improve operations and communication with the public. With the development of FracFocus and other state-based information portals along with communication efforts underway across the nation, environmental groups are seeing their ability to scare the public erode.

HF is of critical importance to our national energy security and economic recovery. HF technology today is better than it's ever been and regulations are broader and more stringent. HF is a proven technology that industry has demonstrated time and gain can be used safely. In July 2013, U.S. Interior Secretary Sally Jewell said **"Fracking has been done safely for decades"**. We could not agree more. And that is the whole fracking story.

Understanding Fracturing Fluid

The fluid from the hydraulic fracturing process is nearly **99.5%** WATER & SAND.

9.5% SAND

0.5% CHEMICAL ADDITIVES

90% WATER

Typical Additives Used in Fracturing Fluid and COMMON HOUSEHOLD ITEMS

SODIUM CHLORIDE
used in table salt

ETHYLENE GLYCOL
used in household cleaners

BORATE SALTS
used in cosmetics

SODIUM/POTASSIUM CARBONATE
used in detergent

GUAR GUM
used in ice cream

ISOPROPANOL
used in deodorant