



Kansas Independent Oil & Gas Association
800 SW Jackson Street – Suite 1400
Topeka, Kansas 66612-1216
785-232-7772
www.kioga.org

Facts About Induced Seismicity

January 2022

More often than not, activists and media continue to get it wrong when it comes to the issue of induced seismicity. Misleading propaganda exaggerates risks and incorrectly links seismicity and water contamination to injection wells. Whether this frustrating pattern is due to a deliberate mischaracterization of the facts or if an honest lack of understanding of the issue is to blame, the unfortunate byproduct in both instances is a misinformed public.

Here are some facts everyone needs to know about induced seismicity that many activists and media have failed to convey.

Fact #1: Fracking is not the cause

Contrary to what you might have read or heard, the hydraulic fracturing process **is not the cause** of earthquakes, or induced seismicity in general. Expert after expert agree with this fact, including:

- **The United States Geological Survey:** The USGS states in the very first sentence of its list of myths and misconceptions regarding induced seismicity that “**Fracking is NOT causing** most of the induced earthquakes,” further clarifying that “Wastewater disposal is the primary cause of the recent increase in earthquakes in the central United States.”
- **Stanford geophysicist Mark Zoback** said, quite bluntly, that Oklahoma’s induced seismicity “... **is not caused by the hydraulic fracturing process at all.**”
- **Former Interior Department Deputy Secretary David Hayes** has said: “We also find that there is **no evidence** to suggest that hydraulic fracturing itself is the cause of the increased rate of earthquakes.”

- **University of Texas at Austin Geophysicist Cliff Frohlich** has said: “Although there is a considerable amount of hydraulic fracturing activity in the Eagle Ford, we don’t see a strong signal associated with that and earthquakes.”
- **A 2012 Inglewood, Calif., oilfield study** concluded: “High-volume hydraulic fracturing...had no detectable effects on vibration, and did not induce seismicity (earthquakes).”
- **A Durham University study** found “...after hundreds of thousands of fracturing operations, only three examples of felt seismicity have been documented. The likelihood of inducing felt seismicity by hydraulic fracturing is thus **extremely small...**”
- **The National Research Council** – part of the prestigious National Academies —has similarly found: “The process of hydraulic fracturing a well as presently implemented for shale gas recovery does not pose a high risk for inducing felt seismic events.”
- And, as **USGS** noted in a separate report: “USGS’s studies suggest that the actual hydraulic fracturing process is only very rarely the direct cause of felt earthquakes. While hydraulic fracturing works by making thousands of extremely small ‘microearthquakes,’ they are, with just a few exceptions, too small to be felt; none have been large enough to cause structural damage.”

Just as importantly, and contrary to what you might have read or heard, fracking is a separate process from wastewater disposal - the latter which is believed to be the cause of induced seismicity.

Hydraulic fracturing (“fracking”) refers to a well stimulation process that enhances the flow of oil or natural gas from a production well. Wastewater disposal, on the other hand, refers to the injection of wastewater into a designated well, which is typically much deeper than the production well where “fracking” occurs.

It is also essential to understand that wastewater is generated from oil and natural gas wells **regardless of whether hydraulic fracturing is used**. This is because hydrocarbon bearing formations typically contain plenty of water, which is called “produced water” as well as hydrocarbons. Produced water is naturally occurring water within the Earth that co-exists with oil and gas under the ground. As oil and gas is extracted from the ground, the produced water is separated and often injected deep beneath the surface in wells designed to protect groundwater resources.

It is true that hydraulic fracturing treatments do produce wastewater, or “flowback” water, that must be disposed of. But the vast majority of wastewater disposal is produced water from day-to-day production — not “flowback” water from the fracking process.

Several activist and media accounts get this dead wrong, claiming **ALL** wastewater being injected is fracking flowback water, and therefore, directly fracking related.

Less than 5% of wastewater is from fracking operations. A recent Zoback-authored study confirms this fact. The study on induced seismicity found less than 5% of wastewater disposed of is fracking flowback water. The study's press release states,

“We know that some of the produced water came from wells that were hydraulically fractured, but in the three areas of most seismicity, **over 95 percent of the wastewater disposal is produced water, not hydraulic fracturing flowback water.**”

So to sum up, wastewater disposal is a completely separate process from fracking, and a vast majority of the wastewater being disposed of is not from the fracking process **at all**. So the bottom line, fracking is not the cause of induced seismicity, contrary to many activist and media reports.

Fact #2: Even though wastewater injection is believed to be the cause, the risk is still extremely low

Although scientists agree wastewater injection from day-to-day oil and gas production can under very specific circumstances cause induced seismicity, it is important to understand that the risk is still very low.

The Arbuckle is a 7,000-foot deep, sedimentary formation which sits well below producing formations and is the farthest formation from groundwater, making it a seemingly ideal injection location in the past. But the Arbuckle is also very permeable and sits atop the crystalline basement. Therefore, experts believe it may be in hydraulic communication with the basement rock, where unknown faults are located, and have theorized wastewater injection may be reactivating these faults. Fortunately, regulators and producers have already taken many steps to address the latter.

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 ½ of 1% (0.48%) of injection wells are even potentially linked to seismic events.

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.

Over the last few years, several activists have attempted to cast doubt on whether injection wells in Kansas were safe suggesting the oil and gas industry was not subject to enough regulation. Fortunately for the public, the facts demonstrate these wells are in fact tightly regulated and deemed safe by the EPA and the KCC. The problem with the activist's accusations is they work backwards from a conclusion. They try to support their ideas by cherry-picking and misrepresenting data and information to suggest a problem. They omit, or conveniently ignore, crucial details that would provide a more complete representation of the issues discussed. Their condemnations do not hew to strict literalism or scientific precision, but instead are hyperbole, heated rhetoric, and non-verifiable statements of subjective opinion that should not be taken literally. The reality is that state regulators, in conjunction with the EPA, carefully oversee injection wells with tight regulations and high operating standards. Neither fear-mongering nor unproven anecdotes can conceal or deny that injection wells in Kansas are safe and well regulated.

Fact #3: Producers are working with regulators to address this issue, as earthquakes have decreased

Kansas operators have taken the issue of induced seismicity very seriously investing millions to reduce earthquake risks since 2015. Industry has been actively working with state regulators since 2014 when the State Task Force on Induced Seismicity was formed. The Kansas Geological Survey (KGS), Kansas Corporation Commission (KCC), and the Kansas Department of Health & Environment (KDHE) are devoting significant resources to analyzing seismicity causes. The Kansas Independent Oil & Gas Association (KIOGA) supports increased monitoring and geophysical research to provide assurance to landowners and the public that an improved understanding of seismic issues is available to all. The Kansas oil and gas industry have also helped secure funds for additional seismic monitoring stations in Kansas and shared proprietary data with scientists and regulators.

In March 2015, the KCC issued an order limiting injection in five areas of concern in parts of Harper and Sumner counties. The reduced volume coincided with a reduction of 2.5 magnitude or larger seismic events. However, data from the KGS showed an increase in smaller seismic events outside of the original five areas of concern.

As a result, the KCC's 2016 order expanded the area subject to injection restrictions to include Harper and Sumner counties as well as parts of Kingman, Sedgwick, and Barber counties. The 8,000 barrels per day limit on the 2015 Specified Area targeted in the original order remains in effect. A 16,000 barrel per day injection limitation was placed on the expanded areas of the 2016 Specified Area.

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 seismic activity of **29.9%** from 2017-2021. Induced seismicity remains a complicated issue that industry and regulators continue to take very seriously.

Seismic activity across Kansas in 2019 led to some elected officials and environmental activists to point to Class II injection wells (wells used to inject fluid associated with oil and natural gas production) as the cause. Some have been led to believe that Class I injection wells (wells used to inject hazardous and non-hazardous industrial and municipal wastewater) were not likely contributors to seismic event because Class I injection rates had declined in recent years. The facts revealed that Class I injection rates had declined by only 0.45% over the last year and the Class I injection wells were injecting an order of magnitude or more fluid into the ground than nearby Class II injection wells.

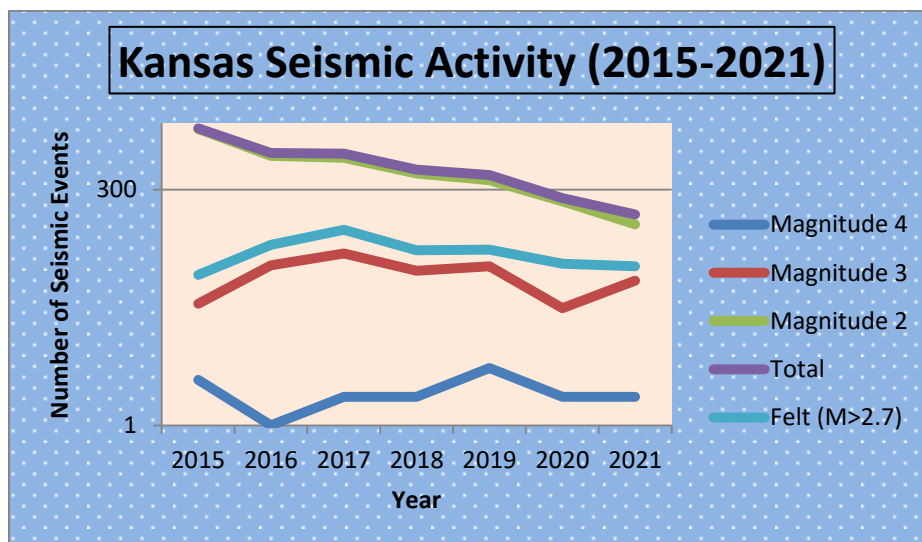
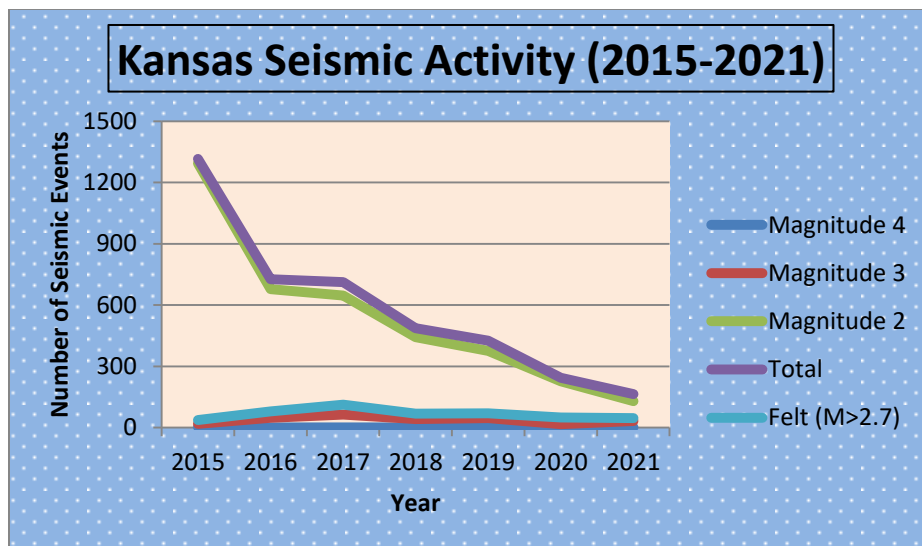
On August 21, 2019, the KCC announced that it would collect data and analyze recent injection activity in areas where seismic events had occurred. The KCC said it is conducting the investigation to evaluate whether additional action is needed to safeguard Kansans. The investigation will involve both Class II and Class I injection wells.

In late 2019, Governor Kelly formed an *Arbuckle Study Workgroup* to look into the injection well/seismic event issue. The Kansas Independent Oil & Gas Association (KIOGA) encouraged Governor Kelly to make sure any such study is accurate, scientifically-based, and limited in scope to site specific features of areas in question. KIOGA also encouraged the Governor to make sure the workgroup gathers all data and information before drawing conclusions.

KIOGA has offered industry cooperation to the *Arbuckle Study Workgroup* including offering wells for testing. Unfortunately, the Kansas Geological Survey (KGS) has turned down wells offered for testing from several operators and the KCC. It seems the KGS is cherry-picking wells for testing to support their desired conclusion.

When asked for perspective, KIOGA offered insights that included our opinion that drilling a well and injecting fluid into the granite wash (basement rock) in high seismic risk areas increases risk for seismic activity. The KCC model of regulatory response offers a proven record of success. The KCC prohibits drilling/injecting into granite wash and limits injection volumes and pressure into the Arbuckle formation in high seismic risk areas. The KCC model should apply to all Arbuckle injection wells, Class I and Class II.

Although seismic activity in Kansas and Oklahoma increased in years past, a recent [study](#) from Stanford University predicts a continuing decline in seismic activity in Kansas and Oklahoma. The result of the study is definitely good news. The study shows a 19% probability of seismic activity in Kansas and Oklahoma in 2022. This is down significantly from the 70% probability in 2015 and 2016 and shows that Kansas and Oklahoma regulatory policies are working. Despite all the alarmist propoganda and headlines, the risk of induced seismicity is small, rare, and manageable.



Fact #4: A ban on injection wells would be devastating to the economy and could lead to more earthquakes

Environmental activists have argued a complete ban or moratorium on wastewater disposal statewide or nationwide would be the only solution to induced seismic events. .

But in fact, such an action may not only increase earthquake activity, it would prove devastating to the economy.

Even if state regulators were able to put a total end to all wastewater disposal operations today, the quakes might continue all the same. Seismologists have warned that a large scale, sudden shutdown could cause an earthquake. The Oklahoma Geological Survey director Jeremy Boak explained,

“If you shut it in completely, right away, you might get more earthquakes. Because then, you’ll get a negative pressure pulse moving out in these areas. Some of these earthquakes we’re now seeing are in areas where we’ve actually shut in injection. That might be one type of response.”

Also, considering disposal of produced water from day-to-day production is an **absolutely essential component** of **ALL** oil and gas production, a ban on wastewater injection would basically be a ban on oil and gas production altogether. Considering the fact that the oil and gas industry in Kansas supports over 100,000 jobs, over \$3 billion in family income, and over \$1.4 billion in state and local tax revenue, a ban would create more problems than it would alleviate.

EPA clearly states that wastewater injection is the safest method of dealing with produced water, and even the Environmental Defense Fund has observed:

“Permanent storage using underground injection wells remains **by far the most common** disposal method. **At this point, it also appears to be the least risky**, not to be confused with ‘unrisky’.”

Considering induced seismicity is not a widespread issue, a ban would prove to be ineffective, impractical and economically devastating.

Conclusion

The issue of induced seismicity is certainly a serious one that deserves attention. But, activists and media have the responsibility of reporting and clarifying the facts regarding the issue. The facts are readily available. Facts are stubborn things; and whatever may be our wishes, our inclinations, or the dictates of our passions, they cannot alter the state of facts and evidence.