RESEARCH HIGHLIGHTS

Internalizing Externalities: Disclosure Regulation for Hydraulic Fracturing, Drilling Activity and Water Quality

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What impact does increased transparency into industrial activities and processes have on pollution?

Context

The discovery of hydraulic fracturing is considered by many to be the most important change in the energy sector since the introduction of nuclear generated electricity more than 50 years ago. As a result of its discovery, U.S. production of oil and natural gas has increased to unforeseen levels. This has led to lower energy prices and lower air pollution and carbon dioxide emissions by displacing coal in electricity generation.

As drilling activity has increased, however, a robust debate has begun within communities where development is occurring—and those where it could occur—regarding the pros and cons at a local level. Potential harm to water quality is one key concern because of the unique hydraulic fracturing process where water mixed with chemical additives and propping agents like sand are injected at a high pressure to create fractures in rocks to allow oil or gas to flow. In addition to concerns surrounding the hydraulic fracturing fluid itself, these wells produce large amounts of wastewater—flowback from the hydraulic fracturing fluid and produced water from the deep formations. The latter is naturally occurring water into which organic and inorganic constituents from the formation have dissolved, resulting in high salt concentrations. A 2021 study provided the first evidence that hydraulic fracturing is related to increased salt concentrations in surface waters across several U.S. shales and many watersheds.[1]

Because of local health and environmental concerns, many states began requiring that newly-fractured wells disclose details on their drilling activity and the chemical composition of the hydraulic fracturing fluids starting in around 2010. In this study, the 2021 study authors go on to provide the first empirical analysis evaluating whether these state mandates requiring transparency are effective in changing operating procedures and reducing water pollution.

Research Design

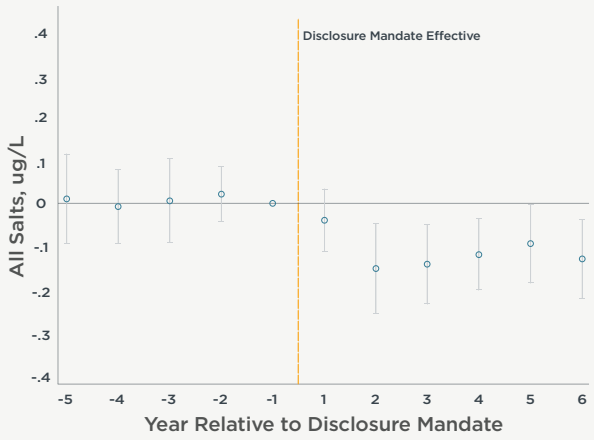
The study first investigates whether water pollution associated with hydraulic fracturing activities, measured by the concentration of salts associated with the process, improves after the state disclosure rules go into effect. The authors used a large geo-coded database that combined 325,351 surface water-quality measurements with data from 154,324 hydraulic fracturing wells from 16 states and from 2,209 watersheds with and without hydraulic fracturing activity from 2006-2019. They specifically analyzed concentrations of bromide, chloride, barium and strontium because these salts are usually found in high concentrations in flowback and produced water from wells, they do not biodegrade, and they have been found several years after spills. The authors are able to discern the disclosure effects from differences in the pre- and post-disclosure evolution of salt concentrations between watersheds with hydraulic fracturing activity and close-by control watersheds without hydraulic fracturing activity that are in the same state or in the same sub-basin. The authors then studied the mechanism through which disclosure regulation operates. Disclosure regulation can enable social movements, environmental groups, local communities, and the media to exert pressure on hydraulic fracturing operators. The authors looked at the amount of fracking-related news coverage, Google searches about hydraulic fracturing as well as the number of local anti-fracking NGOs to see whether the results are more pronounced in areas where public pressure is higher.

Key Findings

Water quality in watersheds with hydraulic fracturing activity improved after the state disclosure mandates became effective. The authors found consistent declines in salt concentrations in surface water after the disclosure mandates went into effect, with declines ranging from 4.4 percent for strontium to 17.8 percent for chloride. To rule out that their results are driven by other changes in water quality that may have occurred around the time the mandates were introduced, they studied other forms of surface water pollution that are not specific to hydraulic fracturing activities—dissolved oxygen, phosphorus and fecal coliforms—but did not find declines. They also showed that there are no significant declines in areas with conventional oil and gas development to which the disclosure mandates did not apply.

1 Bonetti et. al, Large-Sample Evidence on the Impact of Unconventional Oil and Gas Development on Surface Waters, *Science*, August 2021

Figure 1 · Mapping Out the Effect of Hydraulic Fracturing Disclosure Regulation



A decline in the drilling of new wells after the disclosure mandates contributed to a portion of the water quality improvement. The authors found that the rate of new hydraulic fracturing wells being drilled declined by roughly 5 percent after the disclosure mandate went into effect. This decline contributed to roughly 14 percent of the overall decrease in water pollution in the post-disclosure period.

After the mandatory disclosure, firms improved their hydraulic fracturing practices in several important ways, reducing the impact on local surface water from new wells. The authors studied what changes firms made to their operating practices and technology following the disclosure mandate, and whether these changes had an impact on water quality. They found several factors led to a decrease in pollution: 1) firms changed their drilling practices such that wells drilled after the disclosure mandates had a smaller effect on salt concentrations than wells drilled before the mandates, and the amount of oil and gas produced per unit of pollution increased after the disclosure mandates; 2) firms used fewer hazardous chemicals and chloride-related chemicals in hydraulic fracturing fluids after the disclosure mandate; and 3) the number of hydraulic fracturing-related incidents (e.g., spills, leaks and accidents related to wastewater) that would be likely pathways by which wells affect water quality declined.

Water quality improvements after the disclosure mandate were greater in areas where public pressure for change was higher. The authors found that targeted transparency was more successful in producing change if public pressure was a factor. Several results support this conclusion: 1) Hydraulic fracturing-related salt concentrations decreased the most in areas with a greater presence of local environmental NGOs and in counties with more local newspapers; 2) Public pressure, measured by media coverage and internet searches, intensified after the disclosure regulations, and the improvements in water quality were more pronounced in areas with more news articles discussing hydraulic fracturing and water pollution and with more Google searches for hydraulic fracturing after the disclosure mandate; 3) Water quality improved in areas where a larger fraction of wells was owned by publicly traded firms, consistent with the idea that listed firms likely face more public scrutiny than private operators.

The water quality improvements were the greatest in states where disclosure mandates required timely disclosure and offered fewer trade secret exemptions. Some of the state disclosure mandates exempted firms from disclosing trade secrets in their filings. Others provided firms with a lengthy amount of time before their disclosure was due. The authors found that these varying features of the disclosure mandates from state-to-state are associated with the magnitude of the transparency effects. When firms were given less time to disclose information and were allowed fewer trade secret exemptions, water quality saw a greater improvement.

CLOSING TAKE-AWAY

Disclosure mandates can be effective in preventing local water pollution caused by hydraulic fracturing activities and more generally play a role in reducing other environmental impacts, even when they are dispersed such as carbon emissions. However, the extent of the mandates' effectiveness depends on the accessibility and dissemination of the information and on how much the public creates pressure on firms to make changes.

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