

# Studies show groundwater holding own against drilling boom

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New research suggests drinking water supplies in Pennsylvania have shown resilience in the face of a drilling boom that has turned swaths of countryside into a major production zone for natural gas.

Energy companies have drilled more than 11,000 wells since arriving en masse in 2008, making Pennsylvania the nation's No. 2 gas-producing state after Texas. Residents who live near the gas wells, along with environmental groups and some scientists, have long worried about air and water pollution.

Two new studies that looked at groundwater chemistry did not find much of an impact from horizontal drilling and hydraulic fracturing—or fracking—the techniques that allow energy companies to extract huge volumes of oil and gas from shale rock deep underground. The results suggest that, as a whole, groundwater supplies appear to have held their own against the energy industry's exploitation of the Marcellus Shale, a rock layer more than a mile underground that holds the nation's largest reservoir of natural gas.

In a study published Monday, a team from Yale University installed eight water wells and drew samples every few weeks for two years—during which seven natural gas wells were drilled and fracked nearby—to measure changes in methane levels at various stages of natural gas production. Methane is not toxic to humans, but at high concentrations it can lead to asphyxiation or cause an explosion.

Researchers found that methane spiked in some water wells but attributed rising methane levels to natural variability, not drilling and fracking. Their findings were published in the journal *Proceedings of the National Academy of Sciences*.

Natural variability "is potentially a lot greater than previously understood," said Yale University hydrologist James Saiers, a study co-author. That's important, he said, because residential water wells are typically tested only a few times before and after the start of drilling. "Before-and-after sampling might not be sufficient and might lead to misattribution of sources of methane," Saiers said.

Rob Jackson, a Stanford University scientist who has studied the impact of drilling on groundwater, challenged the researchers' assertion that elevated methane levels in the water wells had nothing to do with natural gas development, though he agreed the gas found in the water did not come from the Marcellus Shale.

"The simplest explanation is that something associated with drilling and hydraulic fracturing caused shallower gas to migrate into the monitored aquifers," Jackson, who was not involved in the study, said via email.

Penn State University scientists, meanwhile, obtained an enormous trove of data from the Pennsylvania Department of Environmental Protection—11,000 groundwater samples collected since 2010—and, using what they said was a novel data-mining technique, concluded that water quality is either unchanged or even slightly improved for substances like barium, arsenic and iron.

The authors found slightly elevated concentrations of methane near only seven of 1,385 shale wells in the study area.

"It really doesn't look like the groundwater chemistry has gotten worse, even though we've had this huge number of shale gas wells drilled," said Susan Brantley, a Penn State geoscientist and study co-author.

Their research , which also looked at a small number of water samples taken before 1990, appeared in the journal *Environmental Science & Technology*.

Allen Robinson, a Carnegie Mellon University engineering professor who wasn't involved in the study, said the large sample size represented an improvement over earlier studies, but he questioned whether researchers' focus on just one county—Bradford County, one of the state's drilling hotspots—might have skewed the results.

"Overall the data demonstrate that there is certainly not a crisis around ground water contamination and unconventional oil and gas activity. That is good news," he said via email. "However, it does document some contamination. Is 'rare' contamination around a few percent of wells acceptable? That is a policy question."

Environmental regulators have held drillers liable for tainting more than 300 residential water supplies statewide over the years, while homeowner lawsuits have accused gas companies of polluting the water with methane, heavy metals and toxic drilling chemicals. Older research linked faulty gas wells to tainted water.

The latest studies "reflect our industry's deep commitment to environmental and groundwater protection," David Spigelmyer, president of the Marcellus Shale Coalition, an industry group, said in a statement.

**More information:** E. Barth-Naftilan et al., "Methane in groundwater before, during, and after hydraulic fracturing of the Marcellus Shale," *PNAS* (2018). [www.pnas.org/cgi/doi/10.1073/pnas.1720898115](http://www.pnas.org/cgi/doi/10.1073/pnas.1720898115)

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