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# Duke study finds methane in well water near gas drilling sites

By Sandy Bauers, Inquirer Staff Writer

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A Duke University study has found that methane levels in private water wells are, on average, 17 times higher when within 1,000 yards of a natural gas drilling site.

Of 60 wells that the researchers tested for methane in northeastern Pennsylvania and New York, they found the gas in 85 percent.

When they fingerprinted the methane - comparing the chemistry of the methane in the wells with that from natural gas wells in the region - "the signatures matched," said Robert Jackson, a professor at Duke and a study author.

"At least some homeowners who claim that their wells were contaminated by shale gas extraction appear to be right," he said.

The authors said it was the first "systematic evidence" of methane contamination of private drinking wells in areas where gas extraction is occurring.

The industry, which has said the methane in wells is mostly natural, disputed the study, saying the data set was insufficient, there was no adequate baseline for reference, and the conclusions were flawed.

The researchers agreed that more work needed to be done. Jackson called the study "a strong starting point" but added that "people need to do this in many other locations. I suspect the answer won't always be the same."

Typically, shale gas has about 90 percent methane, which is colorless, odorless and tasteless - but is also explosive and can cause asphyxiation. It has long been a touch point in the debate over natural gas drilling.

Residents and others have blamed the industry. A much-viewed scene from the Josh Fox documentary *Gasland* shows a man holding a lighter to water coming from a kitchen sink faucet, causing a burst of flames.

The Duke researchers say they saw a similar small explosion in northeastern Pennsylvania when they were conducting the study.

They did not find evidence of well-water contamination from fracking fluids or from the flow-back water, which contains high levels of salts and other contaminants, including radioactivity, that are naturally occurring in the Marcellus Shale formation.

But in at least nine wells, they found methane at levels exceeding what the U.S. Department of the Interior calls an "action level," indicating that the wellhead should be vented immediately.

The testing occurred in July and September, mostly in the northeastern Pennsylvania counties of Susquehanna and Bradford, but also in Wayne and Lackawanna, plus Otsego County in New York.

The area includes Dimock, which has been plagued by contaminated water wells. One well has exploded.

A year ago, the DEP fined a driller \$240,000, ordered it to plug three wells, and banned it from drilling in the area for one year.

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The Duke researchers pointed out in a separate white paper on the effects of hydrofracking, which included research and policy recommendations, that there is "essentially no peer-reviewed research on its health effects at lower concentrations in water or air."

They recommended an independent medical review.

They also called for more study, the establishment of a comprehensive database on methane and other hydrocarbons in water, industry-driven approaches to develop safer extraction technologies, and consideration of stronger state or federal regulation.

The peer-reviewed study, published Monday online in the Proceedings of the National Academy of Sciences, did not show how the methane was getting into the wells. The researchers suggested three possibilities. The first two - natural migration and migration through the new fractures that hydrofracking causes - they deemed unlikely.

They suggested leaky gas well casings as the most likely.

John Conrad, an industry consultant who is senior hydrologist and president of Conrad Geoscience Corp. in Poughkeepsie, N.Y., said that because the researchers also found methane in areas where no drilling is occurring, it was insupportable to say the methane was in the water due to hydrofracking.

"Based on the limited amount of data they have, that is a stretch," he said. "Not that it's not worth studying. But much more data is needed."

Jackson said that close to natural gas sites, many wells - although not all - had methane, while only rarely did a well outside of a drilling area have methane.

"All we've done is ask if you're more likely to have a problem if you live near a gas well. The answer is yes."

Conrad also criticized the study for not starting with "baseline tests for the wells they sampled, at least for ones in the gas drilling areas.

"While they point to higher methane concentrations, we don't know what the original water quality was before drilling occurred," he said. "That's a data gap that could be very significant for this study."

He said that modern well casing and cementing practices, "when done properly, are considered to be sufficient to prevent gas migration."

Other scientists praised the work.

"It's a good start," said David Velinsky, vice president of the Academy of Natural Science's Patrick Center for Environmental Research. He has led research on the effects of natural gas drilling on surface water quality.

"They confirmed what a lot of people thought, that methane from the drilling process was getting up into surface water, into well water . . . that this potential is real," he said.

"It also shows there's a good tool out there to help in furthering this study," Velinsky said. "Is it worthwhile to go to more areas to see if this is happening throughout the whole stretch of Marcellus Shale drilling? To pick key areas and do this type of study again? I think it is."

Residents of the area also praised the study, saying it was long overdue.

"I hope this is the first of many independent peer review studies addressing public health, water, air and the environment, in all shale regions being drilled," said Rebecca Roter, who lives in Brooklyn Township in Susquehanna County.

"I would be thrilled if this study set the bar for more needed independent scientific research."

The Duke researchers tested her well and found no methane, which did not surprise her because drilling has not come to her area.

But she - and most of her neighbors - have signed leases, and she expects that within months, drillers will arrive at a neighbor's property.

"My water well will be within a half-mile of natural gas wells," she said.

"I'm worried about my drinking water, my air, my spring peepers," she said, referring to small frogs. "Once the aquifer is shot, that's it."

Former DEP Secretary John Hanger said that while the sample was small, "the study seems to be well done."

He said it had two basic findings consistent with his experience at DEP. One is that no fracking fluids were found in the groundwater or in private wells.

For the other, "Duke confirms our experience that gas had migrated in some cases as a result of drilling to private water wells," he

said. "In our experience, the cause was failures in the gas drilling/gas wells."

He said the state had "confirmed problems in the gas wells in Dimock" and was able to stop the migration in 14 of 19 private water wells by December 2010 by plugging and repairing gas wells.

"Some in the industry and their allies claim that gas has never migrated from a gas well to a private water well," he said. "They are wrong. It has."

While it is not required, most drillers in the state test water wells within 1,000 feet of a site before drilling. If no testing is done, state law presumes the drilling caused any subsequent problems.

"This study provides some evidence to extend the 1,000 feet to about 1,500 feet or so," Hanger said.

The researchers suggested 3,000 feet would be an appropriate distance for ground-water and well water sampling.

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