

Study looks at water quality in private wells near Marcellus drilling

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A study of more than 200 drinking-water wells near Marcellus Shale natural-gas wells in 20 counties did not find statistically significant evidence of contamination from hydraulic fracturing — a process used by gas drillers to release natural gas using a high-pressure mixture of water, sand and chemical additives.

The study was conducted by researchers and extension educators in Penn State's College of Agricultural Sciences. The research was funded by the state General Assembly's Center for Rural Pennsylvania and the Pennsylvania Water Resources Research Center at Penn State.

"This is the first project to provide an unbiased and large-scale study of water quality in private water wells used to supply drinking water to rural homes and farms both before and after the drilling of Marcellus gas wells nearby," said project leader Bryan Swistock, water resources extension specialist.

Conducted from February 2010 to July 2011, the study found methane in about a quarter of the water wells before any drilling occurred, but the concentrations were generally below advisory levels for treatment, Swistock said. The presence of methane can be naturally occurring or related to drilling activity.

"We really didn't see any significant changes in methane levels after drilling or hydraulic fracturing," he added.

There is no federal drinking water standard for methane as it can be ingested without harm, but high levels can cause an explosion hazard as the dissolved methane escapes from water.

Elevated levels of dissolved bromide were measured in some water wells and appeared to be a result of the gas-well drilling process and not hydraulic fracturing.

"Bromide was not detected in any of the water wells before drilling, but it did show up in several wells after drilling, which needs to be investigated further," Swistock said.

The study's modest number of samples for methane and bromide and the relatively short length of the study speak

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to the need for additional data collection and analysis, Swistock pointed out.

"Future research should look at a broader number of water contaminants over a longer period of time," Swistock said. "More detailed and longer-term studies are critical to ensuring that Pennsylvanians' private water supplies are protected."

Wells in the study were not randomly selected. Project publicity solicited participation from well owners who knew gas drilling was going to occur near them, and many responded by contacting Swistock or other project investigators working for Penn State Extension.

"Our network of Penn State Extension educators throughout the state was absolutely critical to the efficient completion of this project," Swistock said.

The first phase of the study included 48 private water wells located within about 2,500 feet of a Marcellus well pad. These wells were tested by Penn State researchers both before and after gas-well drilling. Twenty-six of the 48 were near Marcellus wells that were drilled and fractured, 16 sites had drilling but no fracturing, and six sites were controls where no drilling or fracturing occurred.

These wells were tested for 18 common water-quality parameters that could occur from gas-drilling activity, including chloride, barium, sodium, iron, manganese, methane, ethane, bromide, and oil and grease.

The second phase was comprised of 185 additional private water wells located within about 5,000 feet of a Marcellus well pad. Homeowners provided water test results collected by independent, state-accredited laboratories prior to Marcellus gas-well drilling. These tests then were compared with samples collected by Penn State personnel or by homeowners trained by Penn State personnel after gas drilling and hydraulic fracturing occurred.

Phase two included 173 sites near hydraulically fractured gas wells and 12 control sites where no drilling had occurred with five miles. These wells were tested for 14 common water quality parameters — methane, ethane, bromide and oil and grease were not included due to funding and sample-

collection constraints.

Separate statistical analyses of results from each phase of the project produced similar results, according to Swistock.

In addition to the increased bromide concentrations in some water wells, a small number of water wells examined in the study also appeared to be affected by disturbance due to drilling, as evidenced by sediment and/or increased levels of iron and manganese that were noticeable to the water-supply owner and confirmed by water-testing results.

"While most water wells, even within 3,000 feet of a Marcellus well, did not have changes in water quality after drilling or hydraulic fracturing, that was the distance where we did sporadically measure increased bromide, sediment or metals. This seems to be the distance that we need to focus on for future testing and research," Swistock said.

In addition to future research directions, the study also identified critical education needs for owners of private water wells. Most water-well owners had difficulty interpreting detailed water-test reports that they received as part of pre-drilling surveys, according to the researchers.

"As a result, most homeowners with pre-drilling water-quality problems were unable to identify them even after receiving extensive water-testing reports," Swistock said. "There is a clear need to help homeowners understand pre-drilling problems, their risks and how to solve them."

Other investigators on this project were Dr. Elizabeth Boyer, associate professor of water resources and director of the Pennsylvania Water Resources Research Center in the School of Forest Resources; James Clark, extension educator based in McKean County; Mark Madden, extension educator based in Sullivan County; and Dana Rizzo, extension educator based in Westmoreland County.

The full initial report and executive summary of this study are available on the Center for Rural Pennsylvania's website at <http://www.rural.palegislatre.us/>. The investigators currently are preparing this work to submit for publication in the peer-reviewed literature.