Groundwater unaffected by shale gas production in Arkansas

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A new study by scientists at Duke University and the U.S. Geological Survey (USGS) finds no evidence of groundwater contamination from shale gas production in Arkansas.

"Our results show no discernible impairment of groundwater quality in areas associated with natural gas drilling and hydraulic fracturing in this region," said Avner Vengosh, professor of geochemistry and water quality at Duke's Nicholas School of the Environment.

The scientists sampled 127 shallow drinking water wells in areas overlying Fayetteville Shale gas production in north-central Arkansas. They analyzed the samples for major and trace elements and hydrocarbons, and used isotopic tracers to identify the sources of possible contaminants. The researchers compared the chemical composition of the contaminants to those found in water and gas samples from nearby shale gas drilling sites.

"Only a fraction of the groundwater samples we collected contained dissolved methane, mostly in low concentrations, and the isotopic fingerprint of the carbon in the methane in our samples was different from the carbon in deep shale gas in all but two cases," Vengosh said. This indicates that the methane was produced primarily by biological activity in the region's shallow aquifers and not from shale gas contamination, he said.

"These findings demonstrate that shale gas development, at least in this area, has been done without negatively impacting drinking water resources," said Nathaniel R. Warner, a PhD student at Duke and lead author of the study.

Robert Jackson, a professor of environmental sciences at Duke, added, "Overall, homeowners typically had good water quality, regardless of whether they were near shale gas development."

Vengosh, Warner, Jackson and their colleagues published their peer-reviewed findings in the online edition of the journal *Applied Geochemistry*.

Hydraulic fracturing, also called hydrofracking or fracking, involves pumping water, sand and chemicals deep underground into horizontal gas wells at high pressure to crack open hydrocarbon-rich shale and extract natural gas. Accelerated shale gas drilling and hydrofracking in recent years has fueled concerns about water contamination by methane, fracking fluids and wastewater from the operations.

Previous peer-reviewed studies by Duke scientists found direct evidence of methane contamination in drinking water wells near shale-gas drilling sites in the Marcellus Shale basin of northeastern Pennsylvania, as well as possible connectivity between deep brines and shallow aquifers, but no evidence of contamination from fracking fluids.

"The hydrogeology of Arkansas's Fayetteville Shale basin is very different from Pennsylvania's Marcellus Shale," Vengosh noted. Far from contradicting the earlier studies, the Arkansas study "suggests that variations in local and regional geology play major roles in determining the possible risk of groundwater impacts from shale gas development. As such, they must be taken into consideration before drilling begins."

Human factors—such as the drilling techniques used and the integrity of the wellbores – also likely play a role in preventing, or allowing, gas leakage from drilling sites to shallow aquifers, Vengosh said.

"The take-home message is that regardless of the location, systematic monitoring of geochemical and isotopic tracers is necessary for assessing possible groundwater contamination," he said. "Our findings in Arkansas are important, but we are still only beginning to evaluate and understand the environmental risks of shale gas development. Much more research is needed."

More information: "Geochemical and Isotopic Variations in Shallow Groundwater in Areas of the Fayetteville Shale Development, North-Central Arkansas," Nathaniel R. Warner, Timothy M. Kresse, Phillip D. Hays, Adrian Down, Jonathan D. Karr, Robert B. Jackson, Avner Vengosh. *Applied Geochemistry*, May 15, 2013. DOI: 10.1016/j.apgeochem.2013.04.013

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