

Marcellus researchers expand focus to other fracking hot spots

Pamela King, E&E News, 12-3-15

DURHAM, N.C. -- After five years spent studying oil and gas development in Appalachia, Duke University scientist and professor Avner Vengosh is setting his sights on North Dakota.

In a basement laboratory on the Duke campus, Vengosh sorts through a collection of disks containing water and sediment samples taken during a summer trip to the Bakken Shale. Ph.D. students Nancy Lauer and Jennie Harkness are subjecting the samples to a battery of tests, and Lauer has already presented some preliminary findings on the long-lasting impacts of brine spills in North Dakota oil country (*EnergyWire*, Nov. 4).

The reason for the quick turnaround? "People, they need to know," Vengosh said.

When shale production first started to flourish in nearby Pennsylvania, Vengosh, a geologist and geochemist by training, saw applications for his skills in the study of fracking. The process, which remains relatively little-understood by the public, sends a mixture of water, sand and chemicals into tight rock formations to release trapped hydrocarbons. Because those mechanisms take place unseen underground, Vengosh and his fellow researchers saw an opportunity to demystify the processes by which fracking could potentially lead to groundwater contamination.

As a graduate student at the Hebrew University of Jerusalem in his native Israel and later as a Ph.D. candidate at the Australian National University, Vengosh had begun to explore the use of isotopic techniques to determine the source of water pollution. Using those methods, Vengosh and three research partners published a 2011 paper linking shale gas extraction to methane contamination in drinking water (*Greenwire*, May 9, 2011). Since then, Vengosh and his colleagues have published a total of 20 papers on fracking, mostly focused on the shale formation that stretches through New York, Pennsylvania, Ohio and West Virginia.

Duke's fracking studies are not part of any grand orchestrated research plan, said Alan Townsend, dean of the university's Nicholas School of the Environment. The work is exactly what an administrator would hope for: Vengosh is a classically trained scientist who is applying his expertise to a controversial topic, Townsend said.

"These are the issues of our time," Townsend said.

Because fracking is such a hot-button issue, Duke's scientists have found themselves at the center of a raging debate over the safety of domestic shale development. He doesn't intend to stop fracking, but Vengosh's message to regulators is: "If you do it, do it right."

That's a belief Vengosh and his former colleague -- Rob Jackson, now at Stanford University -- have held since they began their research.

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"It would be inaccurate and unfair to say our study proves that fracking should be banned," Vengosh and Jackson wrote in a May 2011 op-ed in *The Philadelphia Inquirer*. "Instead of just safer, though, we would like to see shale gas become largely unnecessary, along with coal and oil. The faster we develop and adopt renewable energy technologies, the less we will have to worry about whether it's safe for people to drink their water."

Ripple effect

Duke's first fracking study and the following *Inquirer* op-ed incited industry and regulatory backlash for drawing too-broad conclusions from a too-small sample set.

Michael Krancer -- a partner at Blank Rome LLP and former secretary of the Pennsylvania Department of Environmental Protection -- was chief among those critics. He points to the op-ed as an indicator of the Duke team's bias.

"That's the death knell for any credibility for any scientist," Krancer said.

After Duke released its first fracking study, Chesapeake Energy Corp. offered Syracuse University hydrology professor Don Siegel the opportunity to do his own research on the Oklahoma gas firm's larger, more comprehensive sample set of water wells in the Marcellus. Siegel said Chesapeake paid him a salary to do the work but put no constraints on how he conducted his research or what he ultimately published. He continues that work to this day; his first paper found there was no correlation between methane concentrations in drinking water and proximity to shale extraction.

Siegel attributed the different conclusions to sample size.

When scientists go into the field after contamination and collect samples around a well that has already failed, "all you come up with is a snapshot, and you can't really interpret anything," he said.

Had Duke designed its studies to pinpoint issues with failed wells, that would be one thing, Siegel said. But the way the team had written its papers implied that it was embarking on systematic, regional studies, and sampling for those kinds of studies needs to be randomized, he said.

But sometimes -- despite questions around sampling technique -- if the science is good, researchers can still reach strong conclusions. Duke's techniques for identifying frack fluid in the environment are catching industry attention, Siegel said.

And if it weren't for Duke's early work, the massive Chesapeake data set may not even exist, said Terry Engelder, a Pennsylvania State University geosciences professor who served as a reviewer on a separate Duke study. That paper found that natural pathways exist that link the Marcellus formation to aquifers close to the surface (*EnergyWire*, July 10, 2012).

"One almost had to precede the other, and if you were to ask me what was one of the larger or greater goods that came out of the Duke paper, I would point to those Chesapeake data," he said.

History is a little more complex than that: "By the time that the Duke paper had been published, Chesapeake was already in the process of taking large or extensive samples," Engelder said. "In fact, the chronology was one that involved a number of different drivers in getting to that large data set."

But in terms of understanding the total earth system in oil and gas production, "the Duke papers have more or less moved us as an energy-consuming nation in the right direction," Engelder said.

Even industry will acknowledge that gas can flow through abandoned or poorly constructed wells, said Tom Myers, a researcher and consultant in hydrogeology and water resources. Duke's studies illustrate the mechanisms that cause that flow to occur.

Duke's "work is foundational in laying the groundwork that these pathways could exist and that we need to look harder for them," he said.

Regulatory impact

So far, Duke has not widely shared its North Dakota findings, and the university's conclusions about brine spill contamination have matched dangers identified by state regulators.

But even in places where there has been contention over Duke's science, Jackson says there have been signs of its reach. He points to a section of Pennsylvania's Act 13 as one example.

Following the release of the university's first study, Jackson, Vengosh and three other co-authors wrote a policy piece that said, among other things, that 3,000 feet would be an appropriate distance over which to sample groundwater before fracking.

When Pennsylvania passed its drilling law in 2012, the state increased the presumption of liability for water contamination from unconventional wells to 2,500 feet.

Jackson said he saw the move as a small step in the right direction.

"The states are doing more," he said. "Are they doing enough? Not always, in my opinion."

Duke hasn't had any say on fracking regulations in North Carolina, which is considering opening its doors to oil and gas operators (*EnergyWire*, Sept. 29). The government hasn't asked for insights from Vengosh, who sees himself more as a data collector than a regulatory influencer.

"To be involved, that's not what we do," Vengosh said.

North Carolina's position as a nascent shale producer is a plus when it comes to Duke's position in fossil fuels research, Jackson said. In other parts of the country, energy regulators have been accused of being too cozy with industry. In the Tar Heel State, there's time for science and regulation to get ahead of production, he said.

"The advantages are that you can take an objective look at an industry away from history and any relationships between the companies and the regulatory agencies," Jackson said.

What's next

In the coming months, Vengosh and his graduate students aim to continue their work in North Dakota and to build out a more detailed version of a water use analysis published this summer (*EnergyWire*, Sept. 17).

Aside from expanding into the Bakken, Vengosh said he hopes to do more research on oil and gas development in California and internationally. He said he sees opportunities to work with Chinese officials to apply lessons from the U.S. shale boom abroad.

The ability of Vengosh and his students to conduct more lab work is contingent on funding. Duke has been criticized for accepting funding from the Park Foundation, an organization that has been accused of fueling anti-fracking rhetoric. More recent studies have been funded by the National Science Foundation, and Vengosh said he is open to working with industry funders. A small amount of university funding is available for the students Vengosh advises, but aside from that, options are limited.

"We can do more," Vengosh said. "Because of funding, we are not doing that."