

How fracking water is used is 'green' driven

Written by Don Hopey



Drillers plumbing the Marcellus Shale still use millions of gallons of water per well to bust up the deep subterranean rock strata and release the natural gas it contains, but more and more they're reducing the amount of chemical additives used in the fracturing fluid and they're recycling wastewater.



Foam used to bring drill cuttings to the surface pours into a drill pit before being taken away for disposal at a Rice Energy Marcellus Shale site in Lone Pine, Washington County. Michael Henninger/Post-Gazette

And some are even considering pumping water from abandoned mines to augment their waste or "flowback" water for the next well's fracking job.

Those changes could eventually address some of the risks to water quantity and quality from developing the Marcellus Shale that environmental advocates raise, but they're also driven by drilling economics: reducing the amounts of water and chemicals may cut the cost of developing one of the biggest natural gas plays in the world.

Here is a look at the numbers: Each Marcellus Shale well uses 100,000 to 300,000 gallons of water for drilling and an average of 4 million gallons mixed with sand and chemicals to hydraulically fracture the shale and release the gas. Approximately 20 percent of that fracking water, or 800,000 gallons, returns to the surface with the gas.

Last year alone, about 1,400 Marcellus wells were drilled in Pennsylvania. If each drew 4 million gallons of water from rivers, streams, lakes and municipal water supplies, their total water use would have been 5.6 billion gallons, without subtracting for reuse of flowback water.



Harold Westfall of Barber County, W.Va., watches as foam pumps out of the ground and into a containment area at a Rice Energy Marcellus Shale drilling rig in Lone Pine, Washington County. Michael Henninger/Post-Gazette

For perspective, the state's coal-fired power plants use approximately 300 million gallons of water a day, or just under 110 billion gallons a year.

While the number of Marcellus wells drilled in the state is expected to climb steeply this year and for many years to come, Dave Yoxtheimer, a hydrogeologist with [Penn State University's Marcellus Center for Outreach and Research](#), said there's little chance, given the stream-withdrawal regulations in place, that the state will come close to running out of water. Not when the total daily withdrawal of ground and surface water in the state is approximately 10 billion gallons a day.

And drillers' water use per well is going down.

"The majority of companies are working toward reusing 100 percent of their flowback water for several reasons. Environmentally it makes sense and economically it makes more sense even though they have to treat some fairly significant dissolved solids," Mr. Yoxtheimer said.

He said some companies actually prefer to reuse the briny flowback water containing salts dissolved from the shale because it's "heavier" with dissolved solids, metals and salts and can more effectively fracture the shale.

Kelvin Gregory, assistant professor of civil and environmental engineering at Carnegie Mellon University, has studied Marcellus Shale gas extraction technologies and said treatment of the flowback water is a significant cost that is driving drillers — like [Range Resources](#), one of the state's biggest Marcellus operators — to reuse wastewater.

According to Mr. Gregory and Range, the company recycled 80 percent of its wastewater, also called "produced water," in 2009, 90 percent in 2010, and has set a goal of 100 percent for 2011. [Chesapeake Energy](#) and [Atlas Energy](#), other big drilling operators in the state, are also moving in that direction, Mr. Gregory said.

Also much reduced in the Marcellus Shale drilling is the amount of chemical additives — including biocides, corrosion inhibitors, acids and friction reducers — mixed with water and sand to create the fracking fluid.

"Chemicals cost money," Mr. Yoxtheimer said. "The less the companies can use without compromising production, the more it would add to their bottom line."

He said companies coming into Pennsylvania from the Barnett Shale play in Texas initially used the same chemical mixture they used there but have since "fine-tuned" the proportions to match the differences in the shales.

- [Fracking 101: A look at the process](#)
- [Are more accidents on the way?](#)
- [Register for Shale Talk and share your opinion](#)

Range has reduced both the number and amount of chemicals it uses for fracking in its Marcellus wells. The chemical parts of the fracking fluid dropped from one-half of 1 percent to approximately one-tenth of 1 percent. That's because the gas in the Marcellus formation is held differently than gas in other plays, Mr. Gregory said.

"Range may be one of the more environmentally sensitive, but at some point it needs to do something with disposal, and the question is who is taking that water to municipal sewage plants and brine treatment facilities," said Conrad Dan Volz, director of the University of Pittsburgh's [Center for Healthy Environments and Communities](#) and an assistant professor of environmental and occupational health.

"It's the soft underbelly of the industry here. There is not adequate treatment to handle all of the wastewater and it raises questions about why the DEP is continuing to hand out [drilling] permits."

But Scott Perry, director of the DEP's Oil & Gas Bureau, said new oil and gas drilling regulations that went into effect in early February will strengthen protections for the state's water resources.

Tougher well construction and casing-cement rules will better protect groundwater, and limits on the concentrations of dissolved solids in discharges by treatment facilities will help surface water quality. New quarterly reporting rules require well operators to list how much water they used for each well, where the water came from, and the volume of freshwater and recycled water used.

Don Hohey: dhopey@post-gazette.com or 412-263-1983.