E&E PUBLISHING, LLC

Fracking fluid isn't likely to migrate from shale wells, geologists say

Gayathri Vaidyanathan, E&E reporter - Friday, Nov. 16, '12

CHARLOTTE, N.C. - **One of the enduring fears about shale gas extraction is that the millions of gallons of chemical-laden water drillers pump into the ground will, over time, migrate into aquifers and contaminate groundwater supplies.**

About 11 percent of the injected water returns to the surface after drilling, according to industry data from the Marcellus Shale.

About 90 percent remains underground, and no one quite knows what happens to it.

Some residents near wells worry the wastewater may move through fractures created during hydraulic fracturing to one day emerge in their water supply.

But within the ivory towers of academia, a consensus is slowly emerging that the injected fluids will remain sequestered in the formations for what geologists would call a 'long' period of time, and what the layperson would call 'forever'.

That means that the greatest danger to groundwater is not hydraulic fracturing itself.

The threats instead are from improperly cemented and cased new wells and from abandoned wells whose steel casings were stripped out during World War II's manufacturing rush or from an even earlier era when oil wells were cased in wood.

"There is a fair amount of agreement among the scientists on many of the basic findings, and different groups are starting to etch out things here and there about what is going on," said Mark Engle, a geologist with the U.S. Geological Survey in El Paso, Texas.

The issue is of interest to geologists because hydraulic fracturing, or fracking, is a significant alteration of the Earth's subsurface with many unknowns.

Fracking involves pumping water, chemicals and sand at high pressures to create fractures in formations through which trapped gas can migrate out of shale rock. Some of the water returns to the surface as flowback.

Within days, the nature of the wastewater changes.

It becomes ‘produced water’, saltier and containing radioactive decay products of uranium, as well as toxic metals spanning the periodic table.

The injected fracking fluid will likely remain sequestered in the ground, said Terry Engelder, a researcher at Pennsylvania State University who works closely with industry.

He proposed a theory of fluid movement underground based on real-world data from oil companies.

The companies operating on the Marcellus Shale are increasingly shutting down their wells for up to year after they frack them, Engelder said.

While the well lies dormant, the fracking fluid moves in the earth, governed by pressure gradients. It bumps into methane trapped in nano-sized pores in the shale.

The water gets pulled into the pores, where it displaces methane, said Engelder.

The same pulling force is at work when you prop a straw into soda can and the liquid climbs up the walls of the straw, above the level of the surrounding fluid.

Once production starts, the methane that was displaced by the water flows out of the well.

The fracking fluid remains in the pores.

The longer companies shut in a well, the greater the displacement and, eventually, gas production.

Other geologists acknowledged that Engelder's theory for underground flow is possible.

If so, it would be good news for homeowners, Engelder said, because it means that once the fracking fluid gets trapped in pores in relatively impermeable rock, it will not migrate through into aquifers.

Produced water

The situation muddies with time.

At first, the wastewater coming out of the well, called flowback, is pretty much the fracking fluid.

As days go on, the wastewater becomes more saline, rising to about 300,000 milligrams of salt per liter, up from 100 milligrams.

The ocean contains 35,000 milligrams of salt per liter of water.

This water contains toxic metals including bromine, strontium, barium, manganese and radium.

The liquid, at this point, is ‘produced water’ or brine naturally occurring in the deep surface, said Jennifer McIntosh, a geologist at the University of Arizona.

When the well begins operating, the natural brines flow up the well bore. Geologists think some of the brines may be coming from formations above and below the Marcellus Shale.

The liquids have been documented to migrate to aquifers near the surface over thousands of years, according to a recent study out of Duke University.

These migrations are naturally occurring and happen even in the absence of fracking (*EnergyWire*, July 10).

Water on fire

Since the documentary ‘Gasland’, tap water catching on fire due to dissolved methane has been one of the defining images of the shale gas revolution.

The Duke researchers had earlier found that drinking water wells within a kilometer of shale gas sites contain 17 times more methane and other hydrocarbons than water wells farther away (*E&ENews PM*, Oct. 5, 2011).

Since then, one of the larger questions confronting the researchers has been the mechanism by which the stray methane gets into the water supply.

In this context, the significance of the finding that brines can migrate naturally into aquifers is that stray methane released during fracking may very well use the same conduits.

But the group is now pretty sure that the mechanism for stray methane contamination of water wells is poorly constructed wells, or older abandoned wells, according to Duke researcher Avner Vengosh.

When drilling a well, companies place a steel pipe, called casing, into the well bore.

The casing is cemented on the outside.

The setup is supposed to isolate the well from the surrounding groundwater supplies and prevent contamination.

Faulty casing and cementing can be fixed with regulation, said Vengosh.

But the gas can easily migrate through older abandoned wells, of which nearly 200,000 dot the Pennsylvania landscape, according to a recent report by NPR.

Shell Exploration & Production Co. is now doing flybys with a helicoptor in Pennsylvania to help the Department of Environmental Protection find these abandoned wells.

It uses magnetic sensors for well deduction, with a 69 percent success rate, said Bryce McKee, a geologist with the company.

The danger from methane leaking out from improperly cased wells is significant, said Scott Bair, a geologist at Ohio State University.

In October 2007, a company drilled a gas well in Bainbridge Township in northeast Ohio but did not case it properly.

Over two months, methane began moving out of the well and collected in shallow water wells about 1,000 feet away.

Then one night, at about 2:45 a.m., methane exploded in the basement of a nearby home.

A water well outside the house spouted like a geyser, 15 feet into the air.

The entire neighborhood was evacuvated.

The problems only ceased after the company redid the cement job on its well.