# Protecting Water Resources During Gas Drilling

Sue Smith-Heavenrich

*Energy companies have been drilling for natural gas in parts of New York and neighboring states for the past several years, and the companies continue to seek even more leases to allow more drilling, especially in the huge underground shale formation called the Marcellus Shale. Because drilling may fundamentally affect water supplies, water quality, forest integrity, and agriculture, it's a concern even if there are no wells in the area where you live. This article focuses on water-related issues; in the Summer issue, writer Sue Smith-Heavenrich will address the impacts of industrial drilling on the agricultural landscape.*

There's lots of gas in the black shales beneath our feet, but is it possible to protect water resources while drilling through the aquifers to get to the gas? The projected increase in the number of gas wells in our state has people concerned about the quantity of water that will be used in drilling and the effects of drilling on the quality of their drinking water.

## Regulating Water Use

Drilling a well into the Marcellus shale requires a lot of water—from 3 to 7 million gallons. It's one major difference from a conventional gas well, where drillers tap into a reserve of natural gas trapped in pockets. Gas in the Marcellus is held tightly between the particles of clay that make up the shale. To release the gas, drillers pump water into the well under high pressure to break the shale apart. This process is called hydraulic fracturing, or "fracking." Drilling operators add sand and chemicals to the water to help hold the fractures open so that gas can escape through the fractures.

The amount of water used to drill a single well may not seem significant, but with hundreds of wells projected to begin operations over the next year those millions of gallons add up fast. Last November one reporter followed water-hauling trucks to the banks of the Monongahela River in Masontown, Pennsylvania. The company operated nine trucks, filling each of them 24 hours a day until the drilling was completed. Each truck could haul 20,000 gallons. At 40 trips per truck, that's a lot of water, not to mention wear and tear on local roads.

Drillers claim we don't have to worry; our region is blessed with plenty of water. Still, in August 2008, two streams in Washington County, Pennsylvania, were "pumped dry."

Who regulates water use? The Susquehanna River Basin Commission (SRBC) and the Delaware River Basin Commission (DRBC) are charged with managing their respective basin's water resources through planning, development, and regulation.

In July, the SRBC notified all natural gas operators in New York and Pennsylvania drilling in Marcellus or Utica shales that they must apply for permits before taking any water, regardless of amount. According to Deputy Director Thomas Beauduy, permits for "cons`1umptive use" are based on historic low-flow records. The permits are for consumptive use because "Every drop of water put down a gas well is lost to the watershed," says Beauduy.

To avoid purchasing permits from SRBC and other agencies, some drilling companies have arranged to purchase water from municipal water suppliers or have proposed drilling for water. This raises concerns about aquifer depletion and how communities might protect their groundwater resources.

## Protecting Drinking Water Sources

In addition to water depletion, farmers and other landowners are concerned about potential contamination of water resources. One concern is the chemicals added to water used in fracking the wells. The Independent Oil and Gas Association (IOGA) of New York, an organization of gas industry representatives, describes the chemicals in generic terms: a friction reducer "similar to cooking oil," a bactericide "like Chlorine used in swimming pools," or surfactants similar to detergents and fabric softeners.

Industry representatives claim that fracking chemicals are no more hazardous than common household cleaning products. However, over the past half dozen years, hydraulic fracturing has been linked to more than one thousand incidents of water contamination in the western United States, according to the nonprofit news organization ProPublica.

Gas industry representatives say that the geological formations underlying New York and Pennsylvania are different than the formations in Colorado, but many of the same chemicals are being used in the eastern half of the U.S. Dr. Theo Colborn, honored by *Time* magazine for her work on human health impacts of toxic chemicals in the environment, has spent the past couple of years analyzing chemicals used in drilling.

Drillers on the western slope of Colorado use 215 or more products to drill the wells, frack the rock, and process the gas. These products contain some 278 chemicals, Colborn says. Of these chemicals, 93 percent are known to have adverse effects on health.

Forty-two percent of the chemicals that have been studied are known endocrine disruptors—synthetic chemicals that disrupt the body's normal function by mimicking hormones or blocking hormone function. Even at very low concentrations these chemicals have a pronounced effect

on human health. Some of the problems that have been related to these synthetic chemicals include infertility, attention deficit/hyperactivity disorder (ADHD), autism, diabetes, and thyroid disorders. Even childhood and adult cancers have been linked to fetal exposure to endocrine disrupters.

Who protects our water supplies from contamination by such chemicals? While SRBC regulates water withdrawal, it does not regulate wastewater—that is left to state agencies such as the New York State Department of Environmental Conservation (DEC).

Fortuna Energy Inc. is planning to test the nonproducing Mallula well in Van Etten, New York, as an underground waste disposal site for drilling wastewater. *Photo by Sue Smith-Heavenrich*

Gas industry experts say that their "safe drilling practices" prevent contamination of aquifers and surface water. Despite claims that concrete casings do eventually crack, Fortuna Energy Inc. operations manager Rick Kessy said, "I am confident there will be no leaking," in answer to concerns of Van Etten residents this March. Kessy detailed the series of steel and concrete casings put down the well bore to a depth that, he claimed, "isolates the well from the groundwater layers."

Kessy also said that an aquifer is more likely to be polluted from a spill on the surface than from fracking chemicals. This is not reassuring news, because many drilling operations use open pits to store frack water and flowback, which is water that comes back out of a well during the drilling process. Even though DEC requires pits to be lined and all water to be transported offsite, there are many opportunities for a liner tear.

Landowners are also concerned that chemicals—or natural gas—could migrate upward through cracks in the strata and into the aquifer supplying their drinking water. Indeed, several water wells in Dimock, Pennsylvania, were contaminated by natural gas this January while Cabot Oil & Gas Corporation was drilling in the area. Though the Pennsylvania DEP has found no evidence of fracking chemicals in the wells, there still remains a concern that drilling activity may have contributed to the migration of gas into the aquifer supplying residential drinking water.

## Disposing of Drilling Wastewater

Drilling wastewater from Marcellus wells will consist of not only the "briny" water produced by the rock layers, but also heavy metals and chemicals used in the fracking process. Where does this water go once it comes out of the ground? Out West, where the air is dry, it is allowed to evaporate and the residual chemicals are buried. But here in the Northeast, there is too much rainfall to allow such evaporation. Thus, well wastewater must be taken somewhere for disposal.

Drilling operators in the Southern Tier have been trucking the brines produced from deep wells (Trenton-Black River formation) to wastewater treatment plants in Auburn, New York, or Pennsylvania. A couple of farmers have reported seeing brine haulers simply turn on the spigot at the back of the tank and use the brine to settle the road dust.

The brine contains high levels of sodium and chloride, with levels as high as 397,000 ppm (parts per million). Salt levels this high can kill the beneficial bacteria integral to a waste treatment facility. Another concern is the presence of heavy metals such as lead, arsenic, and barium.

Jeff Soule, chief operator for Ithaca Area Wastewater Treatment Plant, says that well brines contain levels that are too high for his facility to handle. "We would ask the companies to run a TCLP [Toxicity Characteristic Leaching Procedure] test for hazardous waste," Soule said, and indicated that well operators may have to pretreat their wastewater before it can be taken by a public water treatment facility.

Some entrepreneurs are hopping on the disposal bandwagon and applying for permits to construct treatment plants that will be able to handle the type of hazardous wastewater that wells produce. In the meantime, however, the DEC is allowing well operators to pursue options such as underground injection wells—storing the water in nonproducing gas wells.

For gas companies, the idea of turning nonproducing wells into disposal wells is attractive—the crucial question is whether the rock formation in the nonproducing well will accept the wastewater. Fortuna Energy is one of the companies investigating this option, and they currently have a permit to test this disposal technique.

The test worries residents, and not just because of potential problems with the disposal well. They are concerned about future drilling in the disposal area, too. Two gas-bearing strata, the Utica and Marcellus shale, lie above the proposed disposal well. Although Fortuna assured residents that the Utica shale is impermeable and will serve to "contain" the injected wastewater, company representatives did not rule out the possibility of extracting gas from Utica shale in the future. Landowners are concerned that hydro-fracking above a disposal well will create fractures that could provide an opportunity for stored chemicals to migrate into the aquifer.