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As Fracking Booms, Growing Concerns About Wastewater

With hydraulic fracturing for oil and gas continuing to proliferate across the U.S., scientists and environmental activists are raising questions about whether millions of gallons of contaminated drilling fluids could be threatening water supplies and human health.

BY ROGER REAL DROUIN

An hour south of Pittsburgh, in Pennsylvania's Washington County, millions of gallons of wastewater from hydraulic fracturing wells are stored in large impoundment ponds and so-called "closed container" tanks. The wastewater is then piped to treatment plants, where it is cleaned up and discharged into streams; trucked to Ohio and pumped deep down injection wells; or reused in other fracking operations.

But tracking where the fracking wastewater from Washington County and sites across the United States ends up — and how much pollution it causes — is exceedingly difficult. In a [study conducted last year](#), researchers from the environmental consulting firm, [Downstream Strategies](#), attempted to trace fracking water — from water withdrawal to wastewater disposal — at several wells in the Marcellus Shale formation in West Virginia and Pennsylvania.

"We just couldn't do it," said Downstream Strategies staff scientist Meghan



Roger Drouin

This mobile water recycling facility treats wastewater so it can be reused in other wells.

Betcher, citing a lack of good data and the wide range of disposal methods used by the industry. What the study did find was that gas companies use up to 4.3 million gallons of clean water to frack a single well in Pennsylvania, and that more than half of the wastewater is treated and discharged into surface waters

such as rivers and streams.

Increasingly, the fracking boom in the Marcellus Shale and across the United States is leaving behind some big water worries — concerns that are only growing as shale gas development continues to expand. Pennsylvania, which has experienced a frenzied half-dozen years of hydraulic fracturing, is now the U.S.'s third-largest producer of natural gas. The Downstream Strategies report noted that from 2005 to 2012, Pennsylvania and West Virginia issued permits for nearly 9,000 natural gas wells that use hydraulic fracturing technology, which pumps a high-pressure mixture of water, chemicals, and sand deep into shale formations to extract natural gas.

The vast volume of water needed to extract that natural gas, and the large amounts of wastewater generated during the process, is causing increasing concern among geochemists, biologists, engineers, and toxicologists.

Initially, worries about fracking and water pollution focused largely on leaks of drilling fluids and other contaminants from well casings, which could potentially pollute groundwater supplies. But with engineering improvements that have reinforced well casings and reduced pollution from that source, experts now say fracking's real pollution danger comes from wastewater.

"I am more worried about wastewater management — handling, storing it, driving across the countryside with it," said Monika Freyman, a senior

manager of the water program at [Ceres](#), a nonprofit organization whose mission is to foster sustainable practices in business and industry. Freyman spent months studying the effect of the industry on water resources. "It's complicated," she said. "There are a lot of different pathways wastewater can go."

A Duke University study [conducted last year](#) showed that some of the Marcellus Shale wastewater, tainted by high levels of radioactivity, flows downstream into water sources for Pittsburgh and other cities, with uncertain health consequences.

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The huge amount of fresh water used by the industry is also a concern. The Downstream Strategies report, funded by the [Robert & Patricia Switzer Foundation](#), said that more than 80 percent of the water used in hydraulic fracturing in West Virginia is pulled directly from rivers and streams. Ninety-two percent of that water and drilling fluids remains deep underground, "completely removed from the hydraulic cycle," the report said.

Only 8 percent of those fluids are recaptured, and Betcher's research team found that because of inadequate state reporting requirements, the fate of 62 percent of that fracking waste is unknown.

Betcher and others note that Pennsylvania and West Virginia are water-rich states, but that in the arid western U.S. some of the nation's most intense fracking activity is sucking up huge amounts of groundwater for oil and gas operations. In Texas, most of that groundwater is trucked to injection wells, where it is pumped deep underground and thus lost from the already-depleted water supply. Water shortages in Texas could well push companies to recycle more wastewater.

Freyman said that the oil and gas industry's "social license" to use groundwater without limit in Texas is no longer a given, adding, "When there are restrictions put on homeowners, there is a bit more resentment at

the industry's use of groundwater."

In California, the current drought will shape some of the upcoming debate over planned fracking. "There is a ton of interest because water is already a big issue in California," said Dustin Mulvaney, an assistant professor of environmental studies at San Jose State University.

According to Betcher, millions of gallons of wastewater used in fracking comes back to the surface in three different forms: flowback fluid returns to the surface for up to a month after the mix of water, sand, and chemicals is forced into porous shale rock; brine continues to come back up after 30 days; and throughout the process drilling debris and fluids are mixed in with the wastewater.

Raina Rippel, director of the nonprofit [Southwest Pennsylvania Environmental Health Project](#) in Washington County — which has the [second highest number of shale gas wells](#) in Pennsylvania — worries most about the wastewater and potential health impacts from fracking compounds such as arsenic and chloride, as well as naturally-occurring radioactive elements, such as radium, loosened during the fracking process.

'It is highly likely that more water is withdrawn and more waste generated than is known,' says a report.

Rippel points to instances where homes are sited downhill from impoundment ponds. "In some cases, the [Pennsylvania] DEP [Department of Environmental Protection] has been made aware of contamination," Rippel said. "There are certainly more cases we don't know of." Rippel is also worried about the ability of newer, closed-container systems to securely store millions of gallons of wastewater. "It's inevitable that a closed system can only hold so much," she said.

Scott Perry, a deputy secretary of the DEP's Office of Oil and Gas Management, acknowledged that impoundment spills "have happened on some rare occasions," especially at older impoundments called open "pits."

The industry in Pennsylvania is making a shift to closed systems for holding wastewater before it is treated or shipped out of state. The companies still use large impoundment ponds to store wastewater, but the newer ponds meet [stricter requirements enacted in 2012](#) mandating double-lined walls and spill detection, Perry said.

Wastewater storage, treatment and disposal, however, remains one of the Pennsylvania DEP's "more significant environmental concerns" when it comes to fracking, Perry said. For that reason, regulators and inspectors have been "pushing the industry as far as anyone has" to improve its handling of wastewater and prevent spills, according to Perry. Industry officials say that rapidly improving treatment and storage technologies mean that the overwhelming majority of drilling operations do not discharge untreated or poorly treated wastewater.

While states such as Pennsylvania and West Virginia, working with industry, have improved reporting and data collection on fracking wastewater, the Downstream Strategies report said that "critical gaps persist," adding, "It is highly likely that much more water is being withdrawn and more waste is being generated than is known."

The U.S. Environmental Protection Agency has little oversight over fracking fluids and wastewater because a [2005 law exempts the industry](#) from the Safe Drinking Water Act.

David Brown, a toxicologist at the [Southwest Pennsylvania Environmental Health Project](#), said the close proximity of some wastewater sites to homes and schools is cause for concern, especially given the [presence of radium](#) and other pollutants in fracking wastewater. According to Brown, more than 50 families have called the center, or were referred by doctors, after experiencing rashes, gastrointestinal conditions, or other health concerns. After ruling out pre-existing conditions or symptoms triggered by other causes, Brown said, the center's medical staff concluded that 17 of the 50 cases may have

New technology includes mobile filtration plants to filter the flowback of fracking fluids.

been caused by exposure to pollutants.

According to Thomas Murphy, co-director of Pennsylvania State University's [Marcellus Center for Outreach and Research](#), the "technology is improving" for wastewater storage and treatment. In addition, state regulations are changing and becoming more effective, Murphy said.

New industry technology includes mobile filtration plants designed to filter the flowback of fracking fluids. That's becoming an industry "best practice," said Joe Massaro, a field director with [Energy In Depth](#), a group sponsored by the [Independent Petroleum Association of America](#). For instance, a mobile wastewater treatment facility that Cabot Oil & Gas uses in Susquehanna County, Pennsylvania, treats wastewater in the field so it can be reused in nearby wells.

Massaro acknowledged some initial problems during the fracking rush, but says most companies drilling natural gas are focused on operating cleanly. "Dumping stuff down the [storm] drain, those guys should get the book thrown at them," Massaro said, referring to an Ohio company [charged with improper dumping last February](#). "That is not the case for the whole industry."

A new wastewater treatment facility run by [Eureka Resources](#) in Williamsport, Pennsylvania, holds perhaps the most promise for cleaning tainted wastewater. The plant uses a more effective filtering process of distillation to burn off wastewater contaminants, according to Duke University biologist Robert B. Jackson. The newer distillation plants, however, have proven more energy intensive, and thus more expensive, and the Williamsport plant remains the only one of its kind operating in Pennsylvania. The EPA has cited the Eureka facility for air quality violations.

Industry officials say that as much as 90 percent of Pennsylvania's fracking wastewater is either reused or treated before it is released back into streams or other water sources.

But while there have been

**Levels of radium 200
times higher than normal**

improvements in storage and treatment technology, there hasn't been "an overall industry solution for flowback in Pennsylvania and Ohio," said Anthony Ingraffea, an engineering professor at Cornell University. "In Pennsylvania, disposal of wastewater has been and will remain a chronic problem because they produce it in very large quantities," Ingraffea said.

were found in sediment downstream.

Violations issued in Washington County, show the scale of the problem. In the last 12 months, Pennsylvania DEP's Office of Oil and Gas Management found 27 violations in the county, of which 10 involved improper treatment or storage of fracking wastewater.

During testing from 2010 to 2012, Jackson and fellow Duke scientists made an alarming discovery at the Josephine Brine Treatment Facility, a disposal site on Blacklick Creek, which feeds into water sources for Pittsburgh and other cities. The researchers found that the facility did a poor job of filtering chloride and that levels of radium 200 times higher than normal were present in the sediment downstream, Jackson said. The plant had contributed about four-fifths of the downstream chloride content, and bromide was also found downstream, posing a possible health risk for drinking water, Jackson said.

The dangerous releases at the Josephine plant have ended. In May, 2013, [Fluid Recovery Services](#), the facility's operator, signed an agreement to stop accepting or discharging wastewater from Marcellus Shale wells until it installs technology to remove toxic and radioactive compounds.

But Freyman predicts that municipalities will begin legislating to keep fracking a safe distance from population centers and their water supplies, as [Dallas, Texas has done](#). "There needs to be more discussion and more transparency before we as a society decide what the tradeoffs are and how to mitigate the risks," she said.



COMMENTS

Nice summary. Add to this the question of using acid mine drainage water in fracking, as Pennsylvania now proposes to do, and it's quite a problem.

Readers interested in fracking wastewater and water-related issues can visit [ShaleReporter.com](#), which covers the Marcellus Shale and beyond. Reporter Rachel Morgan, the "From the Ground Up" bloggers (including — full disclosure — myself), and others take a look from many angles.

Thanks,
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Posted by Miranda Spencer on 18 Feb 2014

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