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Wastewater Recycling No Cure-All in Gas Process

By IAN URBINA

As drilling for natural gas started to climb sharply about 10 years ago, energy companies faced mounting criticism over an extraction process that involves pumping millions of gallons of water into the ground for each well and can leave significant amounts of hazardous contaminants in the water that comes back to the surface.

So, in a move hailed by industry as a major turning point, drilling companies started reusing and recycling the wastewater.

“Water recycling is a win-win,” one drilling company, Range Resources, says on its Web site. “It reduces freshwater demand and eliminates the need to dispose of the water.”

But the win-win comes with significant asterisks.

In Pennsylvania, for example, natural-gas companies recycled less than half of the wastewater they produced during the 18 months that ended in December, according to state records.

Nor has recycling eliminated environmental and health risks. Some methods can leave behind salts or sludge highly concentrated with radioactive material and other contaminants that can be dangerous to people and aquatic life if they get into waterways.

Some well operators are also selling their waste rather than paying to dispose of it. Because it is so salty, they have found ready buyers in communities that spread it on roads for de-icing in the winter and for dust suppression in the summer. When ice melts or rain falls, the waste can run off roads and end up in the drinking supply.

Yet in Pennsylvania, where the number of drilling permits for gas wells has jumped markedly in the last several years, in part because the state sits on a large underground gas formation known as the Marcellus Shale, such waste remains exempt from federal and state oversight, even when turned into salts and spread on roads.

When Pennsylvania regulators tried to strengthen state oversight of how drilling wastewater is

tracked, an industry coalition argued vehemently against it. Three of the top state officials at a meeting on the subject have since left the government — for the natural-gas industry.

One executive at a drilling wastewater recycling company said that for all the benefits of recycling, it was not a cure-all.

“No one wants to admit it, but at some point, even with reuse of this water, you have to confront the disposal question,” said Brent Halldorson, chief operating officer of Aqua-Pure/Fountain Quail Water Management, adding that the wastewater contains barium, strontium and radioactive elements that need to be removed.

Mr. Halldorson emphasized that he had not seen high radioactivity readings at the plant he operates in Williamsport, Pa. He said he firmly believed in the benefits of recycling — to reduce the waste produced and water used and to help promote a shift toward natural gas, which burns cleaner than coal for producing electricity. “But there still needs to be a candid discussion, and there needs to be accountability about where even the recycled wastewater is going,” he added.

More than 90 percent of well operators in Pennsylvania use this process, known as hydrofracking, to get wells to produce. It involves injecting water mixed with sand and chemicals at high pressures to break up rock formations and release the gas. Between 10 percent and 40 percent of the water injected into each well resurfaces in the first few weeks of the process.

Many states send their drilling waste to injection wells, for storage deep underground. But because of the geological formations in Pennsylvania, there are few injection wells, and other alternatives are expensive. So natural-gas well operators in the state have turned to recycling.

“The technical breakthroughs that have allowed us to lead the nation in water recycling are complemented by a carefully orchestrated water-management system, involving a combination of on-site and off-site treatment, depending on specific geography and economics,” said Kathryn Klaber, president of the Marcellus Shale Coalition, an industry trade group.

State and company records show that in the year and a half that ended in December 2010, well operators reported recycling at least 320 million gallons. But at least 260 million gallons of wastewater were sent to plants that discharge their treated waste into rivers, out of a total of more than 680 million gallons of wastewater produced, according to state data posted Tuesday. Those 260 million gallons would fill more than 28,800 tanker trucks, a line of which would stretch from about New York City to Richmond, Va.

While the total amount of recycling in the state is nowhere near the 90 percent that the industry has been claiming over the past year, the practice has undoubtedly been on the rise in

recent months. The amount reported recycled in the past six months is roughly 65 percent of the total produced, up from roughly 20 percent during the 12 months before that. At least 50 million additional gallons of wastewater is unaccounted for, according to state records.

The fate of more of the wastewater is unknown because of industry [lobbying](#). In 2009, when regulators tried to strengthen oversight of the industry's methods for disposing of its waste, the Marcellus Shale Coalition staunchly [opposed](#) the effort.

“There is no other industry in Pennsylvania that is required to have a manifest system for residual waste,” industry officials [argued](#), according to notes from a meeting on March 11, 2009, with state regulators and officials from the governor's office. Under the proposed system, a manifest would have been required so that each load of wastewater was tracked from the well to its disposal, to verify that it was not dumped at the side of the road.

After initially [resisting](#), state officials [agreed](#), adding that they would try to persuade the secretary of Pennsylvania's Department of Environmental Protection to agree, according to the notes. In the end, the state's proposed manifest system for tracking was not carried out.

Three of the top state officials in the meeting — K. Scott Roy, Barbara Sexton and J. Scott Roberts — have since left their posts for jobs in the natural-gas industry.

The tracking system that has been put in place requires monthly or yearly reports to the state from well operators indicating where their waste has been taken, but offers no way for the state to guarantee that the waste actually reaches the disposal sites.

The challenges of tracking all of the industry's drilling waste and disposing of it will not go away soon. At least 50,000 new Marcellus wells are supposed to be drilled in Pennsylvania over the next two decades, up from about 6,400 permitted now.

Wells also create waste that is not captured by recycling, because operators typically recycle only for the first several months after a well begins producing gas.

Though the amount of wastewater decreases over time, the wells can continue to ooze for decades after they have been hydrofracked. There are regulations, however, that govern how gas wells are plugged and abandoned.

“This is important because as the well ages, the fluids that come up from it become more toxic, and the state or companies are even less likely to be tracking it,” said Anthony Ingraffea, a drilling expert and professor of civil and environmental engineering at Cornell.

State regulators predict that the heaviest burdens are still to come.

“The waste that flows back slowly and continuously over the 20- to 30-year life of each gas well could produce 27 tons of salt per year,” Pennsylvania officials [wrote](#) in new rules adopted last August about salt levels in drilling wastewater being sent through sewage treatment plants. “Multiply this amount by tens of thousands of Marcellus gas wells,” they said, and the potential pollution effects are “tremendous.”

In an interview on Sunday, John Hanger, who in January stepped down as secretary of Pennsylvania’s Department of Environmental Protection, pointed to these rules as some of the strongest in the country and cited other accomplishments during his term, including increasing inspections of drilling industry trucks, more than doubling his department’s natural-gas staff and improving well design requirements.

The natural-gas industry uses a number of methods to recycle drilling waste.

Some drillers have used recycling equipment at the well site or trucked the water to a dedicated recycling facility. The wastewater is filtered, [evaporated](#) and then distilled, to be used again at the well. Other companies add fresh water to the wastewater, to dilute the salts and other contaminants, before pumping it back in the ground for more hydrofracking.

Any sludge that settles from these various processes is taken to landfills, which in Pennsylvania are equipped with radiation monitors, or is sent to injection disposal wells.

But drilling experts say that virtually all forms of recycling still result in liquid waste that can be [more toxic](#) than it is after the first use.

“The wastewater that comes up from the well will likely increase to some degree in many contaminants such as salts and possibly radium and other radionuclides with each new fracking, but the data is very limited on this issue, so not much is known,” said Radisav Vidic, an environmental engineering professor and drilling expert at the [University of Pittsburgh](#). “There needs to be more data on this.”

Industry officials said there was no reason for concern about radioactivity levels in wastewater.

“All of our reports indicate that this industry operates within the same standards set forth and observed by all water consumers in Pennsylvania,” said Matt Pitzarella, a spokesman for Range Resources-Appalachia, a part of the Range Resources natural-gas company.

Some energy companies have found more profitable options for getting rid of their drilling wastewater.

In West Virginia, for example, environmental regulators and highway officials last year

announced plans for the state to start paying around five cents per gallon for gas drilling wastewater known as brine, which tends to be extremely salty, to melt ice on roads. They planned to buy about 1.2 million gallons at more than 120 sites around the state and to buy more as needed.

West Virginia's water and waste management director, Scott Mandirola, has said that he recognized that the waste might have radioactive contaminants and that some of the waste would find its way to the state's waters.

But he added that it would be highly diluted by rain or snow and that de-icing the roads was important. State officials also said that only wastewater from shallow wells would be used, thereby reducing levels of radioactivity.

Pennsylvania also allows salty brine produced from the wastewater to be spread on roads for dust suppression or de-icing.

More than 155,000 gallons of this wastewater was sent by a drilling company called Ultra Resources to nine towns for dust suppression in 2009, [state records show](#). The water came from two gas wells in Tioga County and contained radium at almost 700 times the levels allowed in drinking water.

"I was told nothing about frack water or any gas-well brines or anything else," said Deborah Kotulka, the secretary of Richmond Township, in Tioga County, whose name appears on the state record. Her township received 101,640 gallons of the water from wells with high radioactivity, [those records show](#).

As gas producers have tried to find new ways to get rid of their waste, they have sought reassurances from state and federal regulators that the industry's exemptions from federal laws on hazardous waste were broad enough to protect them.

In late 2009, for example, officials from an industry trade group, the Pennsylvania Oil and Gas Association, wrote to regulators to confirm that drilling waste, regardless of how it was handled, would remain exempt from the federal law governing hazardous materials. The association said it was asking in case companies sought to distill the waste into salts for de-icing roads.

"The query has monumental significance," Steve Rhoads, then the president of the association, [wrote](#) in a September 2009 e-mail to state regulators explaining his members' concerns about any attempt by federal officials to categorize drilling waste as hazardous material. The correspondence was obtained through open-records requests filed with the state.

If drillers were to lose the exemption from federal law that allowed their waste not to be

considered hazardous, they would probably be forced, at great expense, to start more rigorously testing the waste for toxicity.

They might also have to do what most other industries do: ship any sludge or salts that are high in radioactivity to Idaho or Washington State, where there are some of the only landfills in the country permitted to accept such waste.

Instead, federal regulators informed the industry that their exemption remained intact, a decision that association officials quickly passed on to their members. State regulators declined to comment on the exchange because it concerns a federal, not state, exemption. Federal officials said the salts were regulated by the states.

“In short,” Mr. Rhoads wrote his members, the [Environmental Protection Agency](#) has determined that the exemption “remains in effect once the waste is generated, regardless of how the waste is treated or managed.”