A Foray into Treating Gas Drilling Wastewater

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Cakes produced daily at Advanced Waste Services in New Castle are not the edible kind.

The dense, 16-square-foot, slate-like rectangles are made entirely of sludge, the dry solid residual that results from treating industrial wastewater. It may sound mundane, but the so-called filter cakes and the technology that produces them are a "perfect storm" of recycling, according to facility manager Pat Russell.

And that perfect storm is part of a wave of technology that has surged in response to logistical and environmental challenges created by Marcellus Shale natural gas drilling, an enterprise that has brought both business and controversy to Pennsylvania and other states touched by the boom.

Advanced Waste Services, a division of an environmental services company headquartered in West Allis, Wis., has been treating industrial waste and wastewater created by the hydraulic fracturing or "fracking" process, a drilling technique that creates small fissures in the rock to free the natural gases contained there, since 2007.

The company's business has grown as fracking has taken off in Pennsylvania alongside the region's natural gas boom and frenzied Marcellus Shale drilling of the past three years. In May, the industrial waste treatment facility began trying out a new system created by Cranberry-based Siemens Water Technologies, a division of German corporation Siemens.

The goal is to further streamline the disposal and reuse of waste in the industry.

"It's all about the preservation of water," said Anthony Cialella, vice president and tri-state regional manager of Advanced Waste Services. "Water is our most precious resource, and without it we wouldn't be here. We're taking the containments out of it and returning it cleaner."

Siemens' new wastewater treatment system aims to streamline the way in which fracking water is recycled by reducing the net amount of waste to be disposed of and by making the process more efficient.

Tioga County installed a similar unit last fall, designed to treat nearly 300,000 gallons of water from Marcellus Shale drilling and other local operating wells each day. Siemens also hopes to bring the water treatment units directly to well sites, thereby eliminating costs associated with transporting water to and from a treatment facility.

"It reduces (drillers') operating costs both on delivering fresh water and having to

haul away wastewater to another facility," said Kevin Warheit, product manager for Siemens Water Technologies. "Truck traffic is also reduced in some of these rural areas."

Unlike its Tioga County counterpart, the Siemens' unit in New Castle is not currently handling Marcellus Shale waste.

Though Advanced Waste Services used to treat fracking water, it halted those services this spring after the Pennsylvania Department of Environmental Protection requested that gas drilling operators stop delivering shale wastewater to 15 facilities, including the New Castle Sanitation Authority, where Advanced Waste Services discharges its treated water. The state also asked that those facilities cease discharging water that had been diluted or treated for high concentrations of total dissolved solids.

The request followed up on regulations that Pennsylvania overhauled in August 2010 under then-DEP secretary John Hanger.

Until last summer, groups had applied for permits to discharge drilling wastewater without treating it for dissolved solids. Concentrations as high as 300,000 parts per million would wind up in the state's waterways, though the safe drinking water standard allows for only 500 parts per million.

Hanger said today virtually no wastewater is discharged into rivers and streams without treatment.

That hasn't precluded the New Castle location from putting the new Siemens' technology to use treating wastewater produced from industrial waste and some oil and non-Marcellus Shale natural gas wells. The DEP request would not preclude Advanced Waste Services from contracting with Marcellus Shale drillers, taking the technology directly to well sites, where water could be treated for reuse in fracking, Cialella said.

It's a long journey from dirty wastewater to clear, treated water and freshly pressed filter cakes.

The New Castle plant processes upward of 130,000 gallons of water daily. That liquid is reduced to about 36,000 gallons of sludge, with the remaining solids from that mixture separated into the chalky cakes.

Water enters the facility in large trucks — a typical load measures about 5,000 gallons — and is scanned by radiation detectors for any radioactive or hazardous materials. If the liquid passes the preliminary inspection, most of it heads into loading tanks while a small sample is sent to the lab to evaluate suspended solid concentration, pH level and other chemical properties.

After assessing the water sample in the lab, Advanced Waste Services begins to process the batch using Siemens technology.

The first tank — called the reaction tank — chemically treats the water to separate the mixture into a clear component that sits atop a thick layer of sludge by adjusting the pH and adding reactants that cause the undissolved particles to clump together. As the suspended solids stick together and settle out, the tank periodically pumps out the accumulated sludge.

Eventually, the remaining liquid — now a far thicker mixture — travels to filter presses, which squeeze out nearly all the moisture and produce the lime-coated filter cakes. Each press has a capacity of about 10,000 gallons, and solids are compressed into 80 dense cakes.

Those cakes are placed in landfills; the water is tested again and then discharged to the New Castle Sanitation Authority.

The process recovers about 70 percent of the water initially brought in for treatment, said Cialella.

The final product, according to Warheit, has a high salinity content, around 40 percent — by comparison, seawater is about 3 percent salt — but is otherwise clean enough to drink.

"You could take the water that comes out of our units, run it through an evaporator and you could make drinking water," Warheit said. "It would be purer than what comes out of the tap."

Water usage by the Marcellus Shale drilling industry has become a controversial subject, in part because of fears over how the process will impact water supplies nearby. That debate aside, in terms of actual water used, industry representatives argue that their operations make up just a fraction of a percent of the state's total.

"We are an incredibly small user of water, relatively speaking," said Matt Pitzarella, a spokesman for Range Resources, a leading Marcellus Shale operator headquartered in Fort Worth, Texas. "Recreation, like common swimming pools, uses way more water than we do."

While issues around fracking will continue to be debated, there seems to be little doubt that it has fueled innovation in the treatment of wastewater.

Though Advanced Waste Services has not handled Marcellus Shale wastewater since early August, the company is among a growing number of facilities with technology that can treat water at well sites, something that more drillers are doing. State College-based Rex Energy treats and recycles wastewater at well sites, as does Range Resources.

A number of energy and technology companies are offering services similar to the water treatment done by Siemens' technology.

Aquatech, a Canonsburg-based company that develops water purification technology, is marketing a mobile wastewater treatment unit that distills water to

eliminate dissolved impurities. The unit is mounted on a 53-foot trailer, said Devesh Mittal, vice president of industrial solutions, and will make a technology that has long been used to desalinate seawater available for fracking and drilling.

Wastewater recycling technology that barely existed in 2008 has become widespread as Marcellus Shale drilling has increased and environmental regulations have tightened, said Hanger, the former DEP chief.

The industry as a whole recycles and reuses about 70 percent of drilling wastewater today, he added, with some companies preserving nearly 100 percent.

"This is a huge success story for the environment, it's a huge success story for the industry, and of course it's a huge success story for the companies that have developed the technology," Hanger said.

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