Pennsylvania to regulate salt discharges

The Pennsylvania Department of Environmental Protection (PA DEP) is working to regulate salt discharges that result from natural-gas drilling. The move is a response to a statewide increase in drilling and to water pollution in the fall of 2008 that affected a 70-mile stretch of the Monongahela River, the drinking-water source for more than 300,000 people living near Pittsburgh. High levels of total dissolved solids (TDS), including chloride and sulfate, threaten many other Pennsylvania waterways, according to PA DEP. But many gas and business interests say the proposal is a poorly targeted overreaction.

Pennsylvania is at the heart of the latest natural-gas boom. In 2008, the state issued permits for more than 500 deep natural-gas wells, and drilling companies are leasing mineral rights for hundreds more. The Marcellus Shale, which lies about one mile underneath most of Pennsylvania and parts of New York, West Virginia, and Ohio, is estimated to be the third-largest natural-gas field in the world, according to geologist Terry Engelder of Pennsylvania State University. That gargantuan resource could provide enough natural gas to ease the transition away from fossil fuels and make the U.S. competitive with Russia as a natural-gas supplier.

To reach the gas, a deep production well that branches out horizontally must be drilled, and then over one million gallons of water, plus additives and sand, are injected at high pressure to fracture the rock (*Environ. Sci. Technol.* **2008**, 10.1021/es802190h). The water pumped out of the well carries the additives and brines that were trapped in the formation, along with low levels of metals, sulfides, and radioactivity. As production ramps up, millions of gallons of water will need to be treated each day.

Too much chloride makes water taste bad, damages cooling equipment and water heaters, and impacts aquatic life. But table salt and other salts dissolve so easily and completely into water that they are difficult and expensive to remove. Current methods are limited to reverse osmosis, membrane filtration, and evaporation. In addition, most water treatment facilities are not equipped to treat drilling wastewater, which can contain up to 20% chloride.

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Water impoundment in western Pennsylvania near the Monongahela River, where brine disposal has been linked to elevated levels of DBPs in drinking water.

Pennsylvania's legacy of coal mining exacerbates the situation: drainage from abandoned mines has left many rivers with relatively high levels of sulfate. During last fall's drought, TDS levels—mainly sulfate, but with some chloride—on the Monongahela River reached 900 parts per million, almost twice as high as the U.S. Environmental Protection Agency (EPA) standard, according to Teresa Candori of PA DEP.

At the same time, levels of brominated disinfection byproducts (Br DBPs) increased in some systems. Br DBPs, which pose a greater health risk than chlorinated DBPs, made up more than 90% of the byproducts detected in some finished drinking water during the drought. "The high Br DBPs were associated with the high TDS. The bromide in the water wasn't measured, and we don't know the source," says water engineer Jeanne VanBriesen at Carnegie Mellon University. "It's likely that drilling is the source, because the Marcellus Shale is a marine formation with high chloride and bromide, and bromide is low in abandoned-mine drainage. But we need to do the research."

In April, PA DEP released "Permitting Strategy for High Total Dissolved Solids (TDS) Wastewater Discharges", which proposes standards for pipe-end discharges of 500 milligrams per liter for TDS and 250 milligrams per liter each for chlorides and sulfates. These figures come from EPA's secondary standards for drinking water.

"DEP doesn't realize how many businesses will be affected by these limits," says environmental lawyer Joel Bolstein. "They need to find a way to target Marcellus activities without deterring economic growth." In contrast, the Delaware River has looser TDS standards; even so, those limits impact pharmaceutical manufacturers, power plants, landfill leachate, and some wastewater treatment plants, according to Delaware River Basin Commission engineer Chad Pindar.

Paul Hart, president of Pennsylvania Brine Treatment, Inc., a company that treats drilling wastewater, opposes the proposed strategy, calling it an overreaction. For the Monongahela River, "the majority of the problem was sulfates, which are not significant in oil and gas wastewaters," he says. "Industry recognizes that salt will have to be removed from some of the water that is disposed, but figuring out how to do it will take several years."

—REBECCA RENNER

10.1021/es901934m

Published on Web 07/08/2009