DELAWARE AND THE STATUS OF FRACKING FOR GAS IN THE MARCELLUS SHALE

HIGHLIGHTS of June 2013 Fun Lunch program

Hydraulic fracturing, or "fracking", involves pumping a liquid at high pressure into a drilled hole in order to shatter tightly packed layers of shale or sandstone and thus release material -- gas, water or oil -- trapped inside. Fracking to increase the yield from oil wells was introduced just after the Civil War and fracking for natural gas was underway by 1949.

Despite this long history, there are currently many questions about the effects of fracking on the environment and our water supply. The approach to fracking changed markedly in 1997-98, due to the development of a technique called horizontal drilling. Current methods involve drilling vertical holes, often 5000 to 8000 feet deep and then drilling horizontal holes as much as a mile long in various directions and at various depths. Fracturing the rock surrounding these wells requires massive amounts of aqueous solutions (typically 2-6 million gallons) pumped in at very high pressure.

In order to deliver the water to the end of the pipe at appropriate pressures, it needs to be made "slick" by adding chemicals (most often a polyacrylamide) that reduce the friction between water and pipe. Other chemicals are added to prevent corrosion, help break the shale and keep all the ingredients in solution. Commercial fracking solutions may contain dozens of different chemicals and their compositions are not disclosed. Among the commonly used chemicals are hydrochloric acid, methanol, ethylene glycol, aromatic hydrocarbons related to benzene and the surfactant 2-BE (2-butoxyethanol).

Flowback water comprises the estimated 20-80 percent of the fracking mixture that comes back up the well after the injection. Along with the chemicals used in fracking, the flowback may contain dissolved or suspended materials including arsenic, selenium, strontium, radium and uranium. In addition to the flowback, the fluids coming out of the well may contain produced water, the extremely salty brine (chlorides, bromides, and salts of toxic metals and radioactive elements) often present with the shale. The liquid wastes from fracking are often stored on site in open, plastic-lined ponds.

Animals living in close proximity to the ponds have been reported to exhibit a variety of symptoms such as loss of hair or fur, loss of tails, wide-spread infertility, spontaneous abortions, and births of seriously deformed offspring. Families living near the ponds have reported high levels of headaches, nausea, rashes and have been diagnosed with central nervous system damage, anemia and unusual cancers.

Disposal of fracking wastes is problematic. Some areas have allowed them to be used to settle the dust on gravel roads, while in other areas there are reports that haulers are illegally releasing them into streams. Treatment of the wastes at sewage plants does not remove materials dissolved in the waste water and even plants designed to treat chemical wastes generally do not remove the radioactive elements. The wastes have been injected into deep wells (approximately 10,000 feet), but a growing body of evidence has linked this practice with increased earthquake activity. There are also concerns that the layers of rock separating the disposal layer and the aquifers lying thousands of feet above them are not as impermeable as once believed.

Fracking fluids not returned to the surface could contaminate aquifers used for drinking and farming. Studies in peer-reviewed technical journals showed that fossil methane, solvents used in fracking (ethanol and methanol), and toxic chemicals including arsenic are found at high levels close to gas wells (within 1-3 km), but the levels drop with distance from the wells.

The problems with water contamination and the destruction of habitat accompanying fracking have the greatest effect within a few miles of fracking sites, but Delaware could suffer some deleterious effects. Currently, there is no fracking in the Brandywine Creek watershed, which supplies Wilmington's water. There is some concern that installation of a larger pipeline crossing the East Brandywine will cause increased sediment to enter the supply. Current and proposed fracking sites could affect White Clay Creek, which contributes to Newark's water supply.

Radioactive elements in the Marcellus shale present challenges of potential importance to Delaware. The uranium and radium compounds dissolved in the water present no dangers from exposure through swimming or other water-related activities. Their concentrations may also be low enough that they don't exceed limits for drinking water. The concern is that they will be taken up by microorganisms and enter the food chain, leading to high concentrations in fish at the top of the feeding chain such as those caught in sport fishing in the Delaware Bay.

There is also concern that high levels of radium in Marcellus wells could mean unacceptably high levels of radon in its gas. One consultant calculated that radon levels in the gas could be hundreds of times higher than in that of previous supplies. A number of different groups have vigorously disputed his results. Radon measurements are planned for the major gas lines entering New York City to determine actual levels.

Since the national EPA dropped its examination of polluted water in Dimock, Pennsylvania, and Pavillion, Wyoming, there is almost no oversight of fracking on the federal level. This will likely remain the case until the "Halliburton Loophole" (exempting fracking from certain clauses in the Clean Air and Clean

Water Acts) is reversed. A moratorium on new wells in the Delaware watershed has been in effect since 2010. Draft regulations were sent out in late 2010 by the Delaware River Basin Commission (DRBC). After they were revised in November 2011, Gov. Markell sent a letter to other members saying that he could not support them. Since then, the DRBC has been waiting for New York State to issue regulations. These have been delayed many times, but are expected in 2013.

It is clear that appropriate regulations, if they are strongly enforced, could do a great deal to lessen water contamination. A 2011 study in Pennsylvania indicated that some companies received as many as 100 times more violations (on a per well basis) than others did. A large percentage of serious violations could be attributed to failure to follow recommended practices on issues including handling wastes and sealing wells. In many cases, problems do not result in violations and violations do not lead to fines.

Although proper enforcement should lead to far fewer problems with active well sites, there remain strong concerns about abandoned wells. By current estimates, approximately 8 percent of wells begin leaking methane as soon as they begin operation. Repairing the cement sealant can improve the immediate problem, but tests show that the sealant is bound to fail within one century, sometimes within just a few years. Leaks in abandoned wells represent possibilities for future water contamination. They are also a cause for concern on global warming. Over a twenty-year period, methane is calculated to be about 75 times more powerful than carbon-dioxide as a global warming agent. Methane leaks in the range 5-9 percent (consistent with measurements to date) could mean that global warming would be speeded up even as we convert to a more efficient, lower-carbon

talk and write-up by Coralie Pryde, June 2013