

## Radioactivity Present in Marcellus Waste

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Marcellus Shale contains higher concentrations of naturally occurring radioactive materials (NORM) such as uranium-238 and radium-226 than surrounding rock formations. For years the NY Department of Environmental Conservation (DEC) has held the view that normal disturbances of NORM-bearing rock, such as mining and drilling, do not generally pose a threat to workers or the general public.

But recent tests of brine from Marcellus wells came back with levels much higher than expected. In October 2008 and April 2009 the DEC submitted 13 brine samples from twelve Marcellus wells that were actively producing gas last year. Test results show levels of radium-226 as high as 250 times the allowable level for discharge into the environment and thousands of times higher than the maximum allowed in drinking water.

### **Radioactivity in Shale**

Radioactivity in Marcellus shale is not uniform; it varies from place to place. The radionuclides are present as trace elements uranium-238, thorium-232, and their decay products: radium-222, radium-226, and radium-228. Over time the radioactive particles decay. The half-life (period of time for a substance undergoing decay to decrease by half) of radon is about four days. But some particles take much longer; the half-life of radium-226 is 1600 years.

Even though the radioactivity in Marcellus shale occurs naturally, that doesn't mean it's harmless. Exposure to radionuclides – even at low levels – can cause bone cancer, stomach and lung cancers and other health problems. Radon gas, long known to be associated with Marcellus shale, has been shown to be the primary cause of lung cancer among people who have never smoked.

Because of the health risks associated with exposure to even low levels, the Environmental Protection Agency (EPA) has established guidelines for certain radionuclides: the maximum contaminant level of radium in drinking water as 5 picocuries per liter (pCi/L), for uranium is 30 pCi/L and for the total alpha emitters is 15 pCi/L. The maximum level of radium-226 allowed to be discharged in wastewater is 60 pCi/L and the maximum levels in soil are 5 pCi/g on the surface and 15 pCi/g in subsurface soils.

But the levels of the radionuclides in the Marcellus brines tested by DEC are hundreds of times higher in some cases. Levels of radium-226 ranged up to 16,030 pCi/L – more than 3200 times higher than the allowable levels in groundwater and 267 times higher than what's allowed to be discharged into streams.

### **Radioactive Waste**

This past summer the New York State Department of Health (DOH) raised concerns about the amount of radioactive materials in the wastewater. Handling and disposal of the wastewater could present a public health concern, they said. According to a report by ProPublica, the DOH sent a letter to DEC warning of the difficulties related to disposing of the drilling waste. Wastewater treatment plants will need to do more thorough testing before accepting drilling

fluids, noted DOH, and workers may need to be monitored for radiation in much the same way as workers at nuclear facilities.

Radioactive brine presents a problem for gas companies seeking inexpensive disposal options. Up to this point, industry representatives have planned on sending wastewater and brine to water treatment facilities in NY or Pennsylvania that are able to accept the fluids. However, most discussion up until now has focused on problems with the amount of salts and total dissolved solids in the brine, not the radioactive contaminants.

Four of the twelve or so active Marcellus wells in NY are operated by Fortuna, and all four of those wells are located in the little town of Orange, in Schuyler County. Given the relatively low volume of wastewater of the current vertical wells compared to what's expected from the horizontal Marcellus wells, and given the lack of local industrial wastewater treatment facilities, it is unclear how the gas companies expect to deal with disposal of Marcellus brines.

One thing is certain: the DEC has not set out any rules regulating radionuclides. Instead, they will run another series of tests, says DEC spokesman Yancey Roy. Rick Kessey, an engineer at Fortuna, agrees that more tests are needed.

“Radiation is complex to understand and measure,” Kessey told *Broader View Weekly*. “Even the experts have trouble repeating their findings.” DEC’s test results aren’t wrong, Kessey said, but they did seem “out of whack” with previous tests.

Meanwhile, the Marcellus wastewater has to go somewhere. In the past, DEC has allowed brine to be spread on roads to help melt snow and keep down the dust. Even if there is radiation in the brine, the DEC believes that their models show that road-spreading brine “does not present significant (radiation) doses to the public.”

Still, according to Roy, the DEC is concerned about potential buildup of radioactivity in scale inside casings, pipes and other drilling equipment. That equipment may have to be monitored. DEC is also concerned about the potential for NORM to accumulate in the sludge left from treated wastewater. Since radioactive waste can’t be dumped in any municipal landfill in New York State, that means local drillers might have to ship their waste to Utah, Idaho or other western states that have licensed disposal facilities.

*Brine tests for Marcellus wells are published in Appendix 13 of the DEC’s Supplemental Generic Environmental Impact Statement (<http://www.dec.ny.gov/energy/58440.html>)*