

**Supplemental Generic Environmental Impact Statement on the Oil and Gas regulatory Program
Well permit issuance for Horizontal Drilling and High-Volume Hydraulic Fracturing
to Develop the Marcellus Shale and other Low-Permeability Gas Reservoirs.**

NYSDOH Bureau of Environmental Radiation Protection Comments

July 21, 2009

Analysis of three production brine samples provided by DEC¹ shows elevated gross alpha and gross beta results, ranging 14,530 - 123,000 picocuries per liter (pCi/L). Isotopic analysis of these samples found concentrations of radium-226 in the production brine in the range of 2,472 - 16,030 pCi/L. If these measurements are representative of production brine from gas wells in the Marcellus, handling and disposal of this wastewater could be a public health concern. Furthermore, these data suggest that similar radiological sampling and analysis of frac flowback water is needed. Additional production brine sampling results as well as from the water treatment systems should provide information on how to resolve the concerns listed below.

Radium is a naturally occurring radioactive material (NORM). The presence of high levels radium-226 in the production brine brings up several issues that need to be considered for gas drilling of the Marcellus. The issues raised are not trivial but are also not insurmountable, many can be addressed using common engineering controls and industry best practices. The issues are summarized below:

- References^{2,3} to the Marcellus Shale as having a higher radioactive material content than other shale formations, along with results of analysis¹ performed on production brine from Marcellus Shale showing radium-226 levels ranging 2,600 - 16,000 pCi/L, indicate that naturally occurring radioactive materials (NORM) will need to be evaluated for gas wells in this formation. This conclusion is based on data from three wells, so it is suggested that additional production brine samples be collected to determine whether this is a common occurrence and what precautions may need to be taken during operations.
- An assessment of the levels of NORM in production brine is needed to determine if there is a need for additional treatment for their removal. Water filtration or treatment media may concentrate the radioactive materials and require them to be disposed of at a facility prepared to handle this waste. If production brine is to be sent to the POTW for treatment, additional precautions and personnel monitoring for radiation doses (dosimetry) should be considered for the workers.
- Production brine from other formations has been used as spray-down water for dust suppression on unpaved roads or vehicle race tracks. It has also been used to deice roadways. The high levels of NORM in production brine from the Marcellus may prohibit this or other potential beneficial uses unless the radium can be substantially removed.
- NORM may concentrate in piping or other equipment as precipitates or scale and may require their disposal as radioactive waste. Personnel monitoring for exposure to gamma radiation may be required if build up of NORM as pipe scale, sediment in settling ponds or on water treatment media is detected. Also, the facility may need to apply for a radioactive materials license pursuant to 10 NYCRR Part 16.
- Disposal of the NORM waste produced may be problematic due to the potentially high concentrations of radioactive materials in the waste stream. For reference, the effluent water discharge limit for radium-226 is 6E-08 microCi/ml (60 pCi/L) (NYCRR Part 16, Appendices), and the drinking water standard (maximum contaminant level) for radium-226 and radium-228 combined is 5 pCi/L and for gross alpha activity is 15 pCi/L. (NYCRR 10, 5-1.52, Table 7 -

<http://www.nyhealth.gov/environmental/water/drinking/part5/tables.htm#table1>

Until more data are available, gas drilling in the Marcellus should include sampling of drill tailings, frac flowback water and production brine. Analysis of gross alpha activity, gross beta activity and some gamma spectroscopy analysis should be adequate to assess whether further characterization of radioactive material is needed. The counting efficiency for a total gross alpha sample that has high dissolved solids is very low, resulting in considerable uncertainty (error) for estimating possible radiation exposure. However, total gross alpha activity is an inexpensive (but effective) screening tool, and if the value is greater than 15 pCi/L then additional analysis is performed. These data also suggest that baseline sampling of residential or public wells prior to drilling should include analysis of radioactivity (gross alpha and gross beta).

The New York State Department of Environmental Conservation has regulatory authority for releases of radioactive material to the environment and disposal of radioactive waste. This includes the drill tailings and fluids generated from Marcellus shale drilling. We can provide technical support on the issues raised in these comments as necessary.

References

1. Pace Project No. 301059 Report of Laboratory Analysis - Pace Analytical for NYS DEC, 2008
2. Pennsylvania Geology Vol. 38, No. 1, Harper - PA Bureau of Topographic and Geologic Survey, p 9, Spring 2008
3. Fractured Shale Gas Potential in New York, Hill & Lombardi - TICORA Geosciences and Martin - NYSERDA, p 8, 2004