STATE OF NEW YORK
DEPARTMENT OF HEALTH
Flanigan Square 547 River Street Troy, New York 12180-2216

Richard F. Daines, M.D.
Commissioner

Wendy E. Saunders
Executive Deputy Commissioner

July 21, 2009

Bradley Field, Director
Division of Mineral Resources
New York State Department of Environmental Conservation
625 Broadway 3rd Floor
Albany, NY 12233

Re: Marcellus shale potential public health concerns

Dear Mr. Field:

On March 10, 2009 you requested that the New York State Department of Health Center for Environmental Health (CEH) review information related to the potential for public health impacts from natural gas drilling in the Marcellus shale formation in NYS. The assistance was sought as part of the development of a supplement to DEC's 1992 Generic Environmental Impact Statement on the Oil, Gas and Solution Mining Regulatory Program (GEIS).

CEH staff from three Bureaus - Toxic Substances Assessment (BTSA), Water Supply Protection (BWSP) and Environmental Radiation Protection (BERP) - have helped develop the information that you requested. CEH and Division of Mineral Resources (DMR) staff met in person and via telephone conference several times to define the scope of the review and to share relevant information. CEH was provided with confidential business information identifying the chemical composition of products used or proposed for hydraulic fracturing of gas wells in NYS and examples of fracturing fluid component mixtures for several NYS wells and wells in PA and WV. DMR also provided chemical analysis data for samples of flowback and production fluids collected from hydraulic fractured gas wells in NYS, Pennsylvania and West Virginia.

BTSA reviewed existing toxicological data on chemicals in hydraulic fracturing products that could be used in Marcellus gas drilling operations in NYS. On April 29, 2009, Jan Storm provided Kathy Sanford with a draft write-up of the toxicology comments. In early July, Kathy provided Jan with some additional information about some of the frac fluid additives. The additional information included some new ingredients, but none that raise any more concern from a health perspective than those already noted in the table. BTSA has not had a chance to modify the summary table to include the new ingredients but will do so when Jan and other staff return from vacation the end of July. They also are preparing the list of references and a conclusions section. We plan to provide that information the end of the first week in August.

BWSP and BERP have also prepared comments (see attached). These are new documents, but I think you have been made aware of all of these concerns previously.

We appreciate the opportunity to review this information and help you identify possible public health concerns. Please let me know if you have any questions or reactions to our

comments. As noted above, we would like to finalize our contributions to this important DGEIS during the first week in August. I can be reached at 518.402.7511 or by e-mail to egh01@health.state.ny.us.

Sincerely,

Edward G. Horn, Ph.D., Director
Division of Environmental Health
Assessment

Enclosure

cc: H. Freed, M.D.
R. Chinery
J. Storm
L. Wilson
A. Salame-Alfie

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 DEC[1] 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 analysis[1] 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 that 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

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 Water Supply Comments
20 July 2009

Before responding to the specific questions that DEC posed in early March 2009, we would like to provide a few general comments. The 1992 Generic Environmental Impact Statement (GEIS) on oil and gas exploration described that any proposed oil and gas well within 1000' feet of a municipal water well requires a supplemental site-specific environmental impact statement and any proposed oil and gas wells within 2000' of a municipal supply well must be treated as SEQR Type 1 action likely to require an EIS. The GEIS does not define " municipal water well" and this is a term not used and defined in the Sub-part 5-1 of the State Sanitary Code for Public Water Supplies. Many public water systems do not service municipalities. We recommend that the SGEIS clarify the terminology by making it consistent with DOH definitions of public water systems. Public water systems are defined in subpart 5-1.1.ay as any system with 5 service connections and or serving at least 25 people per day for at least 60 days. http://www.nyhealth.gov/environmental/water/drinking/part5/subpart5.htm#511

We are comfortable with continuing the 1000- and 2000-foot SEQR conditions as described in the GEIS. Neither the horizontal nor vertical component of a borehole should come closer than a 1000 feet to a public water supply well without a careful site-specific SEQR assessment.

The New York City water supply is a surface water resource of special concern. The majority of the City's West-of-Hudson (WOH) watershed overlies the Marcellus Shale formation. The WOH watersheds include the Catskill and Delaware water supply systems which provide approximately 90% of the drinking water to the 8 million City residents and 1 million people in counties north of the City. These watersheds are unique not only because they provide almost half of New York State's population with drinking water, but because the drinking water supply is unfiltered. New York City's Catskill/Delaware water supply is the largest drinking water supply in the country receiving a Filtration Avoidance Determination. The unique nature of this watershed was recognized by the signing of the historic 1997 New York City Watershed Memorandum of Agreement. This Agreement, signed by the Governor of New York, the Department of Health, Department of Environmental Conservation, local communities and environmental groups, recognized "...that an adequate supply of clean and healthful drinking water is vital to the health and social and economic well being of the people of the State of New York." The Agreement provides many of the surface waters feeding the Catskill and Delaware water supply systems with enhanced protections relative to other watersheds in the State. We are willing to discuss ways to provide more careful oversight for drilling in this area. For example, DEC should consider setbacks from certain surface waters for drilling; storm water control; erosion; drill cutting disposal; and storage, handling and mixing of frac fluid ingredients. A possible alternative could be to treat Marcellus gas drilling in the New York City watershed as a Type I SEQR action.

For surface waters that provide drinking water, we have concerns related to the potential release of waste-water as a result of leakage, catastrophic pit wall failure, and improper waste-water disposal. Sediment and storm water generation from construction activities, the daily use of access roads and the drilling pad itself are also of potential concern. Perhaps the same concepts as discussed above for the New York City water supply should be applied to other surface waters providing drinking water.

We note that Pennsylvania requires a variance for drilling within 100 feet of a stream, spring, water-body, or wetland. They also limit the storage volume on-site to 250,000 gallons per pit and no more than 500,000 gallons in pits at any site. If these are not already in DEC regulation, perhaps they can be considered.

Question

1. *Identify additives and their constituents of concern with respect to the following:*
    a) *well site setbacks from private water wells and springs used for domestic supply*
    b) *on-site storage specifications for fracturing flowback fluid*
        1. *Lined pits*
        2. *Tanks*
    c) *tracking and manifesting requirements for transport of fracturing flowback fluid*

Response

1) Responses related to setbacks and on-site storage are described below in response to Question 3.
2) Tracking and manifest requirements are regulated by DEC and DOT. We assume that manifest requirements for the concentrated additives are already adequately addressed. We also assume the DEC and DOT programs are evaluating the hazardous materials and their concentrations in flowback and production waters and classifying them appropriately. If a spill occurs near a potable water supply, the manifest needs to provide adequate information for spill responders to properly notify affected parties and take appropriate remedial action(s).

Question

3. *Describe, based on review of the spreadsheet and the Department's well construction requirements, comparability of well sites where high-volume hydraulic fracturing additives will be used to the "contaminant sources" listed in Table 1 of DOH's water well standards (http://www.health.state.ny.us/environmental/water/drinking/part5/appendix 5b.htm#table1). The objective is to assist this Department in its determination of an appropriate setback from private water wells and springs used for domestic supply.*

Response

Setbacks of contamination sources from potable water wells are specificed in the Sanitary Code (NYCRR Part 5) and NYCRR Part 75. The relevant standards can be found at

http://www.nyhealth.gov/environmental/water/drinking/part5/subpart5.htm

1) Separation distances to protect private water wells from contamination are provided in Sub-part 5-1 Appendix 5-B (Section 5-B.7), Table 1, Required Minimum Separation Distances to Protect Water Wells From Contamination (on page 126 in the pdf version). Separation distances to protect public supply wells are provided in Appendix 5-D, Special Requirements for Wells Serving Public Water Systems , Table 1, Required Minimum Separation Distances to Protect Public Water Supply wells from Contamination (see page 168).

We interpret that open storage pits for drilling operations (e.g. frac fluid, flow-back water) are considered "Chemical storage site not protected from the elements". Thus, a minimum of a 300 foot setback is required for both residential and public water supplies. Tanks (e.g. production water) would be considered "Contained chemical storage sites protected from the elements " with a minimum setback

of 100 feet for a residential supply and 200 feet for public systems.

If concentrated additives or petroleum products are being stored, handled or mixed on-site, the storage, handling and mixing areas are considered "Fertilizer and/or pesticide mixing and/or clean up areas". Thus these areas must be at least 150 feet from a residential water supply and at least 200 feet from a public system.

2) The quality of the installation and operation of the gas wells is extremely important in terms of protecting groundwater. The concern of cross-contamination of aquifers by drilling through them to get to Marcellus shale makes it imperative that gas well construction (casing) and operation be done to isolate it from any aquifers that are traversed. As wells are drilled, any information gained regarding lack of confining layers and the presence of fractures should be recorded and used to reevaluate the drilling plan, and if one was completed, the site-specific supplemental EIS.

Drilling may take place in areas of the State with designated Primary and Principle Aquifers. When drilling is proposed through these aquifers, especially Primary Aquifers,DEC should consider requiring a supplemental EIS or treating the drilling as a Type I SEQR action, regardless of whether a potable supply is within 1000 or 2000 feet.

3) We think a notification requirement similar to that imposed by the Pennsylvania DEP and other states is worth further consideration. We suggest that the owners of all potable supply wells within a 1000 feet of the proposed gas drilling should be notified at least two weeks prior to the start of gas drilling. If an operator wishes to preserve its defense that pollution of a water supply existed prior to drilling, it must perform a pre-drilling survey which includes the collection of a water sample. Otherwise, the operator is presumed liable when water supply pollution occurs within 1,000 feet and within 6 months of drilling or altering (e.g. refracing) a gas well.

Question

4. *Describe, based on review of spreadsheet, any recommended additions to the recommended well testing parameters stated on fact Sheet # 3. (http://www.health.state.ny.us/environmental/water/drinking/part5/appendix 5b/fs3 waterquality.htm) for private water wells in the vicinity of high volume hydraulic fracturing operations.*

Response

1) A review of why the sampling is being done needs to be completed each time sampling is occurring to be sure the appropriate parameters are being tested. If the purpose is to establish a baseline, we recommend that testing include the following parameters: chloride, iron, manganese, sulfate, methane, hydrogen sulfide, arsenic, pH, total dissolved solids, static water level (depth to water), VOCs and bacteriology (total coliform). If the testing is being done in reaction to a spill or leakage, then the 2-4 most concentrated constituents of the material spilled (e.g. fracing fluid, flow-back water) should be targeted, particularly those that are highly soluble and expected to disperse rapidly in groundwater. Collecting just one sample to establish a baseline prior to drilling has limited use because wells are dynamic. Wells change according to precipitation, seasons, amount of use, competing wells etc. However, results from one sampling event are better than no data, and sampling the wells nearest to the drilling activity should help address complaints that drilling activities have affected other more distant wells. Guidance on naturally occurring radioactive materials (NORM) is being provided by our Bureau of Environmental Radiation Protection.

Question

5. *Provide based on review of the Department's well construction requirements any additional criteria and monitoring requirements necessary for the reuse of treated, disinfected waste-water treatment plant effluent as a source of hydraulic fracturing water. The objective is to assist this Department in defining SPDES permit conditions and any other applicable requirements regarding this potential new off-site use of treatment plant effluent.*

Response

In 2005, legislation required DEC to promote waste-water reuse. The legislation requires DEC to publish a report and then within 1 year develop regulations. However, the report has not been published yet. At this time, the potential effects of injecting WWTP effluent that contains viable microbes and nutrients into subsurface wells are poorly understood. We think it is prudent to defer the question of the WWTP effluent use until after the reuse regulations are completed.

Background Material Used to Develop Recommendations: Review of Other State Programs

Setbacks

The State of Ohio has no set-back distances in its code, but does require neighbor notification if 15 residences or more are located within 500 feet of the drilling unit (parcel). The State of Ohio relies on the Clean Drinking Water Act standards for enforcement. If a water quality standard is violated by the gas drilling operation, the Division of Mineral Resources can impose a stop work order and impose fines.

West Virginia has no set-back distances in its code, but requires notification of all neighboring properties within 1,000 feet of the proposed gas well, that may be reliant on springs or groundwater for human or domesticated animal consumption. The well driller must sample at least one drinking water source located within 1,000 feet of the proposed gas well, that in the opinion of the operator, is considered most vulnerable to contamination. The required sampling parameters include pH, iron, chloride, total dissolved solids, detergents, though other parameters may be included as the well driller sees fit. If gas well drilling/operations lead to an exceedance of a state water quality standard in a water supply, the operator must provide potable water to the affected residents and submit a remediation plan within 30 days.

The State of Pennsylvania requires contractors to apply for a variance if the proposed gas well will be located within 100 feet of a stream, spring, water-body, or wetland. The variance application must be accompanied by an erosion and storm-water control plan. If the proposed gas well will be located within 200 feet of an existing building, the landowner's permission is required. All land owners and water purveyors whose water supplies are within 1,000 feet of the proposed gas well must be notified by certified mail and given a 15-day objection period. An operator that wishes to preserve its defense that pollution of a water supply existed prior to drilling must perform a pre-drilling survey which includes the collection of a water sample. Otherwise, Pennsylvania's Oil and Gas Act presumes operator liability when water supply pollution occurs within 1,000 feet and within 6 months of drilling or altering a gas well.

Onsite storage of drilling fluids

In Ohio the regulations state that storage plans must be pre-approved by the Division of Mineral Resources but sets no technical standards for compliance other than the pit must not leak. Stored drilling fluids must be disposed of within 6 months after well completion. The disposal plan must be approved by the Division of Mineral Resources but the law is not proscriptive, i.e. fluids may be injected into deep wells, land spread, brought to a treatment plant, etc.

In West Virginia, the regulations state that all waste-water pits shall be constructed and maintained to prevent seepage, leakage, overflows, and the pit must maintain its integrity. Site reclamation plans must be submitted at time of application for a gas drilling permit. Waste-water that is unfit for domestic livestock or other general use can not be discharged to any surface water without a state permit. West Virginia does not specify how waste-water should be treated or disposed.

The State of Pennsylvania mandates that all pits be lined with a synthetic, flexible liner and lie 20 inches from seasonally high groundwater. No pit may hold more than 250,000 gallons of waste and no more than 500,000 gallons may be stored on the property at any time. Within 9 months of the completion of the gas well, the operator must remove or fill the pit.