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Marcellus Shale Wastewater: Comments on the *New York Times'* Series

Recently, three *New York Times* articles were published (the week of February 27th) which focused on several environmental issues in connection with the development of Marcellus Shale (most notably in Pennsylvania). The most significant environmental claim raised in the Marcellus Shale series was that elevated radium and other radioactive materials which are naturally present in water coming from oil and gas formations underground pose a danger to the environment and human health[1] when they are discharged with other wastewaters to publicly owned or privately owned treatment plants, and ultimately to surface waters which are used as a drinking water source. Following the publication of the series, several governmental officials called for increased testing and monitoring of surface and drinking water sources that may be affected by discharges of wastewater from oil and gas operations. In fact, EPA Administrator Lisa Jackson stated that she planned to "order" testing at wastewater and drinking water plants and Senator Bob Casey expressed his concern that concentrations of drilling waste contaminants could increase as river levels are affected by drought conditions.

In response to the anxiety induced by the series, the Regional Administrator of EPA/Region III directed the Pennsylvania Department of Environmental Protection ("PADEP") officials in a March 7 letter to "reopen" National Pollutant Discharge Elimination System ("NPDES") Permits within the Region to include monitoring and effluent limitations to ensure the protection of drinking water and aquatic life. EPA/Region III also announced its intent to send Clean Water Act "information requests" to centralized wastewater treatment facilities and community water systems for compliance determinations and the potential need to require sampling for radionuclides. EPA's demands in the March 7 letter to PADEP are indeed surprising given PADEP's recent promulgation of improved water quality regulations (pertaining to Total Dissolved Solids or "TDS") which specifically considered the impact of increased Marcellus Shale production in connection with wastewater discharges. EPA's planned actions will result in an increased scrutiny of wastewater treatment and drinking water plants, and owners and operators should be prepared to respond to concerns with increased monitoring, and potentially, effluent limitations. Moreover, Marcellus Shale operators should be prepared to face increasing pressure from wastewater treatment plants as to the composition of their wastewater and likely litigation regarding levels of radionuclides in wastewaters discharged from the well pad operations.

In response to the *New York Times* series, the Marcellus Shale Coalition (an industry trade group of producers and related companies) noted that the industry in Pennsylvania has made significant progress in recycling and reusing its drilling wastewater (approximately 70 percent) resulting in a reduction in the volume of wastewater that is ultimately discharged to surface waters. The Coalition further observed that the additional testing and monitoring of surface water, wastewater and drinking water for potential impacts from oil and gas production will likely result in increased confidence in the safety of these operations, which will serve to promote continued development and production.

Notwithstanding the claims set forth in the *New York Times* series and the statements from governmental officials, science supports the conclusion that the case for alarm is unfounded. A critical review of the information reported by the *New York Times* reveals that the potential threat to the environment and health from Naturally Occurring Radioactive Materials ("NORM") in wastewater generated from oil and gas production is overstated and misleading.

NORM, including radium, is present in our soil, air, and water, and in the rock formations from which oil and gas are produced. Natural gas drilling and production operations can bring formation, or "produced" water (which becomes wastewater) to the surface along with the gas. Because all natural radium is radioactive, produced water that contains radium also contains NORM. NORM in produced water can contain concentrations of NORM that exceed the natural background concentration for the same radionuclides in surface soils and water.

The *New York Times* series used the relatively high natural concentrations of NORM in water drawn right at the gas well, and the absence of data reflecting the concentration of NORM in water that water treatment plants discharge to surface waters (rivers and streams) and in water supplied by drinking water plants, to raise concerns about these unknown concentrations. However, this comparison ignores the fact that natural gas wastewater is treated after it is conveyed to a treatment facility and prior to its use by public drinking water systems. For example, the *New York Times* series' comparison to drinking water standards assumed that all of the wastewater discharged by a treatment plant contained the levels of NORM, TDS and other constituents measured in produced water from natural gas wells, without accounting for any treatment or mixing with other wastewater sources received by the treatment plant. In fact, NPDES permits issued to these treatment plants limit the amount of wastewater that a plant can receive from sources such as natural gas wells by requiring that discharges from the plant not adversely impact the receiving stream or river. Further, the article's comparison against drinking water standards ignores the fact that drinking water plants which obtain water from rivers and streams into which wastewater plants may discharge natural gas wastewater must treat the water they distribute to meet federal Safe Drinking Water Act standards.

As the industry and federal and state regulators note, the best way to determine whether discharges by wastewater treatment plants result in elevated concentrations of radium in drinking water is to test for it. The Safe Drinking Water Act regulations permit drinking water providers to test for radioactive materials in the drinking water less frequently, provided they can meet the criteria for reducing the frequency of monitoring.[2] Some results for drinking water obtained from the Susquehanna in late 2008 through 2010 are available, even though they were not reported in the *New York Times* article. Tests of the Chester Water Authority (September 2008) and York Water Company's (2009) water supplies, which are both partially drawn from the Susquehanna River, showed that gross alpha, gross beta, radium-226 and radium-228 were well below Safe Drinking Water Act limits for those constituents. Likewise, 2010 testing of the Hampton Township Municipal Authority's drinking water, which is drawn from wells along the Alleghany River, and the Ohio and Alleghany Rivers, showed that concentrations of gross alpha and gross beta were also well below drinking water standards. Even though they are not required to test for radioactive materials until sometime in the future, several distributors of public drinking water have announced their intention to test for radioactive materials in the water that they distribute, and as noted, EPA/Region III has instructed PADEP to perform additional testing at drinking water treatment plants.

As the *New York Times* noted, PADEP has been monitoring rivers and streams for radioactivity near points where drilling wastes are discharged. Unfortunately, the results of that testing were not available before the article went to press. However, this week the PADEP reported the results of analyses performed on samples from these river and stream monitoring points. The analysis of samples from these monitoring points showed radiation levels at or below normal naturally occurring background levels for radium-226 and radium-228.[3] Although the *New York Times* acknowledged that wastewater obtained from natural gas wells was not fit to drink, it persisted in comparing concentrations of NORM in wastewater obtained from natural gas wells to drinking water standards. The justification for repeated reference to drinking water standards when discussing NORM concentrations in produced water from gas wells was that "no comprehensive federal standard for what constitutes safe levels of radioactivity in drilling wastewater," and that after "radium enters a person's body, by eating, drinking or breathing, it can cause cancer and other health problems, many federal studies show." However, the federal Safe Drinking Water Act regulations for radium in public water systems are set well below levels associated with adverse health effects. In fact, every person inhales and ingests small amounts of radium daily from food, water and the air. Thus, we always have little residual amounts of radium in our bodies. The crucial question is, "How much is harmful?"

The health effects of radium have been researched by scientists for nearly a century. These studies show that ingesting radium only at extremely high doses can cause two types of cancer—bone and head cancers.[4] Most importantly, experts have conclusively determined that there are thresholds—levels below which cancer has not been observed—for both types of cancer caused by radium ingestion.[5] This radium threshold research has been approved by the U.S. Environmental Protection Agency Science Advisory Board and the Board's Radiation Advisory Committee, which jointly recommended that the U.S. EPA rely upon this research for establishing the risk of radium intake.[6] In fact, the radium thresholds are so high that it would be physically impossible to consume enough production brine water containing the highest radium levels reported by the *New York Times* to cause bone or head cancer. A person would need to drink a quart of brine containing the highest radium concentration every day for over 45 years to ingest the brain cancer threshold dose of radium. Alternatively, using radium health effects data collected by the United Nations Scientific Committee on the Effects of Atomic Radiation,[7] one would need to drink a quart of brine containing the highest radium concentration reported by the *New York Times* every day for over 80 years to exceed the threshold for radium-induced bone cancer.

Further, the article has distorted one of the primary risk assessment documents upon which it is based. In the February 26, 2011 article, the *New York Times* cited a "confidential" 1990 API study of the effects of produced water discharges as evidence that "using conservative assumptions," radium in drilling wastewater dumped off the Louisiana coast posed "potentially significant risks" of cancer for people who regularly eat fish from those waters.[8] The API study, however, actually states at p. 94 (Section 10.5): "A conservative, screening-level assessment of the risk presented by radium discharged in Louisiana coastal water suggests the potential for significant risk to an individual whose entire seafood diet is harvested near a discharge point."

In the draft API report, the potential risk applied only to an individual "whose entire seafood diet is harvested near" the point where the produced water is disposed.[9] The analysis also assumed that the individual ate the entire organism, including bones, skin and shells, where radium, which is chemically similar to calcium, tends to concentrate.[10] In contrast, the *New York Times* article projects the risk to people "who eat fish (from Louisiana coastal waters where brine disposals have occurred) regularly." It is reasonable to observe that the typical reader would understand the *New York Times* report to mean that people who regularly ate seafood from the Louisiana coast were subject to the potential risk. Instead, the risk pertained only to a hypothetical individual whose total seafood diet was not only very unique, but obtained near the produced water discharge point.

Further, the API report explains that four factors caused the screening-level risk to be overestimated.[11] The *New York Times* article mentions only the first factor—the radium concentrations in the produced water. The *New York Times* emphasizes that the radium concentrations in the Marcellus Shale produced water included in the *New York Times* spreadsheet are greater than the reported concentrations in the Louisiana produced water. But the *New York Times* ignores the other three factors: 1– the use of conservative fish concentration factors (which specifically apply to saltwater, not freshwater fish), 2– the assumption that the hypothetical person obtained his entire seafood diet at the discharge point, and 3– the use of the conservative EPA risk factors. Indeed, if the API draft report had used the radium dial worker cancer risk information recommended by the U.S. EPA Science Advisory Committee, the potential risk would have been zero, because the amount of radium ingested by the hypothetical person would have been far below the threshold.

Conclusion

As is apparent, the development and production of Marcellus Shale gas continues to generate a significant level of public scrutiny by environmental organizations, EPA, state and local agencies, Congress, and now, the media. News stories about the pros and cons of development and production are likely to flourish in the foreseeable future given that shale gas provides a significant opportunity for the U.S. to rely upon less reserves of foreign oil and provides economic benefits to the communities and states where production is/will be occurring. Marcellus Shale producers and operators must continue to monitor the ongoing debate in order to ensure that scientific facts are accurately communicated and understood by the public and to ensure that natural gas production continues to play an important role in our energy policy.

1. Ian Urbina, *Regulation Lax as Gas Wells' Tainted Water Hits Rivers,* N.Y. Times, Feb. 26, 2011, available at http://www.nytimes.com/2011/02/27/us/27gas.html (accessed Mar. 7, 2011) ("[I]nternal documents obtained by the *New York Times* from the Environmental Protection Agency, state regulators and drillers show that the dangers to the environment and health are greater than previously understood."). *See also,* Ian Urbina, *Wastewater Recycling No Cure-All in Gas Process,* N.Y. Times, Mar. 1, 2011, available at http://www.nytimes.com/2011/03/02/us/02gas.html (accessed Mar. 7, 2011).
2. 40 C.F.R. § 141.26(a)(3).
3. Don Hopey, "High radioactivity from Marcellus not found in 7 Pa. rivers," Pittsburgh Post-Gazette, Mar. 7, 2011, *available at* http://www.post-gazette.com/pg/11066/1130343-100.stm (accessed Mar. 7, 2011).
4. Fry, S.A., "Studies of U.S. Radium Dial Workers: An Epidemiological Classic," *Radiation Research,* Vol. 150, No. 5., pp. S21-S29; *Casarett & Doull's Toxicology – The Basic Science of Poisons* (7th ed.), p. 1063.
5. Hoel, D.G, and Carnes, B.A. 2004. "Cancer Dose-Response Analysis of the Radium Dial Painters," *Proceedings of the 9th. International Conference on Health Effects of Incorporated Radionuclides Emphasis on Radium, Thorium, Uranium and their Daughter Products* (2004), pp.
6. "Science Advisory Board Review of Draft 'EPA Radiogenic Cancer Risk Models and Projections for the U.S. Population'," U.S. Environmental Protection Agency Science Advisory Board and Radiation Advisory Committee, January 5, 2010.
7. *2000 Report of the United Nations Scientific Committee on the Effects of Atomic Radiation to the General Assembly,* Vol. II ("Effects"), p. 112-13.
8. Hamilton, L.D., Meinhold, A.F., Nagy, J, "Produced Water Radionuclide Hazard/Risk Assessment – Phase 1" (preliminary draft), Biomedical and Environmental Assessment Group, Brookhaven National Laboratory (December 1990). There is no indication in the document that it is or was "confidential," as purported by the NYT.
9. The risk assessment assumed that in a year, the hypothetical person with the highest seafood consumption ate 50 pounds of saltwater fish, 33 pounds of shellfish, 13 pounds of mollusks, and 25 pounds of crustaceans, which were all harvested from the point where produced water was discharged. *Id.* at 90.
10. *Id.* at 37.
11. *Id.,* at 94-95.

Marcellus Shale Industry Team: www.BlankRome.com/MarcellusShale

Blank Rome has a team of attorneys dedicated to assisting clients who have an interest and/or are involved with Marcellus Shale development and production activities. For further information, please contact:

James M. Andrews • 609.750.2651 • Andrews@BlankRome.com
Michael P. Broadhurst • 215.569.5438 • Broadhurst@BlankRome.com
Kevin J. Bruno • 212.885.5580 • KBruno@BlankRome.com
Ernest W. Chung • 212.885.5447• EChung@BlankRome.com
Kipp B. Cohen • 215.569.5451 • Cohen-KB@BlankRome.com
Pelayo Coll • 215.569.5654 • Coll@BlankRome.com
Heather L. Demirjian • 215.569.5641• Demirjian@BlankRome.com
Thomas P. Dwyer • 215.569.5672 • Dwyer@BlankRome.com
Earl M. Forte • 215.569.5618 • Forte@BlankRome.com
Paul A. Friedman • 212.885.5411 • PFriedman@BlankRome.com
Nicholas A. Giannasca • 212.885.5018 • NGiannasca@BlankRome.com
Mark S. Greenfield • 424.239.3481• Greenfield@BlankRome.com
Margaret A. Hill • 215.569.5331 • MHill@BlankRome.com
Ralph H. Johnson • 202.772.5973 • JohnsonRH@BlankRome.com
Christopher A. Lewis • 215.569.5793 • Lewis@BlankRome.com
Lynn K. McKay • 202.772.5832 • McKay@BlankRome.com
Jeffrey S. Moller • 215.569.5792 • Moller@BlankRome.com
Raymond G. Mullady, Jr. • 202.772.5828 • Mullady@BlankRome.com
Mary Ann Mullaney • 215.569.5598 • Mullaney@BlankRome.com
Grant S. Palmer • 215.569.5578 • Palmer@BlankRome.com
Mark I. Rabinowitz • 215.569.5629 • MRabinowitz@BlankRome.com
Daniel E. Rhynhart • 215.569.5371 • Rhynhart@BlankRome.com
Christopher Sharp • 215.569.5794 • Sharp@BlankRome.com
James T. Smith • 215.569.5643 • Smith-JT@BlankRome.com
Jason A. Snyderman • 215.569.5774 • Snyderman@BlankRome.com
Joseph F. Speelman • 281.298.8230 • Speelman@BlankRome.com