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DRILLING

REGULATION

This article addresses various issues surrounding hydraulic fracturing for natural gas, or “fracking.” While the practice is not new, new technologies have made fracking economically feasible in previously inaccessible deposits of natural gas, including deposits near relatively densely populated areas. This, in turn, has given rise to a host of environmental and health-related considerations, the authors of this article say. The article discusses fracking activities in the Marcellus Shale area in Pennsylvania, New York, Ohio, and West Virginia; environmental issues raised by fracking in the Marcellus Shale; federal fracking legislation and regulations; state and local requirements; regional water allocation issues; and associated litigation and due diligence avenues of inquiry.

What’s the Deal With Fracking? Regulation, Litigation, and Due Diligence

ABBI L. COHEN AND JOHN M. IX

It is an unusual day where the news does not have a leading story about natural gas, shale formations, or hydraulic fracturing. However, neither natural gas exploration and production (E&P) nor the drilling technique known as hydraulic fracturing is new. In fact, the first well installed for the purpose of extracting natural gas was dug in 1821 in Fredonia, N.Y.¹ In Pennsylvania, hydraulic fracturing has been occurring since about the

1950s.² Only recently, though, have enhanced drilling techniques made it economically feasible to drill in certain shale formations, like the Marcellus Shale, and tap

² *Hydraulic Fracturing of Shale Beds: Ensuring Regulatory Approaches That Will Help Protect Jobs and Domestic Energy Production, Hearing Before the Subcomm. on Water Resources of the H. Comm. on Transp. and Infrastructure, 112th Cong. 1 (2011)* (statement of Michael L. Krancer, Secretary, Pennsylvania Department of Environmental Protection) (Krancer), available at <http://transportation.house.gov/hearings/Testimony.aspx?TID=6901>.

¹ See <http://www.naturalgas.org/overview/history.asp>.

into the estimated trillions of cubic feet of natural gas trapped within those formations.

The ability to tap into previously inaccessible yet potentially enormous natural gas reserves has resulted in numerous M&A transactions involving companies in the shale gas E&P business as well as those related businesses that support or benefit from shale gas E&P. According to a report by PricewaterhouseCoopers, “merger and acquisition activity in the shale arena has been booming since 2008, and much of it consists of foreign investors, international oil companies and even some national oil companies partnering with U.S. independents in joint ventures.”³ In the third quarter of 2011, M&A activity related to shale plays accounted for \$22.6 billion, representing 46 percent of the total oil and gas deal value for the quarter.⁴ Despite lower natural gas prices in the United States, a recent report by Deloitte opined that “the biggest driver of investment continues to be enabling technology events that have unlocked the potential of shale.”⁵ Given the importance of natural gas development to the U.S. economy and environment, as highlighted in President Obama’s recent State of the Union Address, it is reasonable to expect that the level of transaction activity in this sector will continue to grow at a brisk pace.

M&A transactions in the shale gas E&P sector have been, and will continue to be, completed against a backdrop of litigation and changing regulatory requirements for some time to come. Some shale plays, such as the Barnett, are located in jurisdictions with well-established petroleum E&P regulatory programs. However, the recent and rapid expansion of Marcellus Shale gas E&P activities has left many state, regional, and local regulators struggling to catch up. Several regulatory changes have been enacted, and yet other changes have been proposed, that will affect many aspects of natural gas well installation and operations, including water, wastewater, chemical disclosure, and air emissions. Moreover, regulatory changes are being adopted at all levels of government, not just by the federal government. A quickly changing regulatory regime can affect the timing and size of the expected rate of return on an investment and/or increase the environmental risks in an investment or financing. The jurisdiction in which a target’s natural gas assets are located as well as the stage of the target’s natural gas E&P also could have an effect on deal risk. Consequently, environmental due diligence of proposed M&A transactions in the “upstream” shale gas E&P sector should include not only the environmental profile and compliance status of the target but also an evaluation of the environmental regulatory regime in the relevant jurisdictions—both in effect and proposed. The purpose of this article is to outline some of the more significant aspects of the current and changing environmental regulatory regime and offer suggestions for specific environmental due diligence inquiries.

³ PricewaterhouseCoopers LLP, *Maximizing Value of Shale Joint Ventures* (2011), available at <http://www.pwc.com>.

⁴ See <http://www.pwc.com/us/en/press-releases/2011/us-oil-and-gas-deal-value-jumps.jhtml>, <http://www.pwc.com/gx/en/oil-gas-energy/publications/maximizing-value-of-shale-joint-ventures.jhtml>.

⁵ Deloitte Center for Energy Solutions, *Oil and Gas Mergers and Acquisitions Report—Yearend 2011 (2012)*, available at <http://www.deloitte.com>.

The Marcellus Shale & “Fracking”

The Marcellus Shale is a fine-grained sedimentary rock located principally beneath parts of New York, Ohio, Pennsylvania, and West Virginia. Progressive burial of sediments and organic material deposited more than 300 million years ago generated heat and pressure, forming the sedimentary rock and transforming the organic matter into liquid and gaseous petroleum. The liquid and natural gas remain stored in isolated pore spaces and fractures within the shale. The Marcellus Shale ranges in depth from 4,000 feet to 8,500 feet below the ground surface (bgs)⁶ and in certain regions the shale itself is 250 feet thick.⁷

The advent of enhanced drilling techniques, such as horizontal drilling, when coupled with hydraulic fracturing (fracking or fracing), not only has made it possible but economically feasible to extract natural gas from the Marcellus Shale.⁸ Horizontal drilling involves drilling vertically down to the gas-bearing rock formation targeted for extraction, then curving the well so the remainder is drilled horizontally through the gas-bearing rock formation. Horizontal drilling facilitates production of more gas from each well, and multiple horizontal wells can be drilled from the same surface location. Fracking is a process for stimulating extraction that consists of pumping a fluid and a “proppant”—such as sand—down a well under high pressure to fracture the gas-bearing rock formation. The proppant keeps the fractures open so more gas can be extracted. A Marcellus Shale well uses between 3.0 million and 5.0 million gallons of water.⁹ Fracking fluid typically consists of more than 98% water and sand,¹⁰ with less than 2% chemical additives that may include friction reducers, biocides, gels to carry the proppant

⁶ Pennsylvania Independent Oil & Gas Association, *Learn About the Marcellus Shale (2011)*, available at <http://www.pioga.org/marcellus-shale/>. See also Penn State College of Agricultural Sciences, Cooperative Extension, *Marcellus Education Fact Sheet—Water Withdrawals for Development of Marcellus Shale Gas in Pennsylvania (2010)*, available at <http://pubs.cas.psu.edu/FreePubs/pdfs/ua460.pdf>.

⁷ See http://www.dcnr.state.pa.us/topogeo/econresource/oilandgas/marcellus/marcellus_faq/marcellus_shale/index.htm. There have been varying estimates of the total quantity of recoverable natural gas in the Marcellus Shale. In January 2012, the federal government lowered its estimate from 410 trillion cubic feet (tcf) to 141 tcf. See U.S. Energy Information Administration, *Annual Energy Outlook 2012 Early Release Overview*, 9, available at <http://www.eia.gov/forecasts/aeo/er/>. However, the Pennsylvania Department of Conservation and Natural Resources reports industrial and academic assessments of recoverable natural gas in the Marcellus Shale “vary from 50 to 500 trillion cubic feet (Tcf).” See http://www.dcnr.state.pa.us/topogeo/econresource/oilandgas/marcellus/marcellus_faq/marcellus_shale/index.htm.

⁸ See American Petroleum Institute, *Freeing Up Energy, Hydraulic Fracturing: Unlocking America’s Natural Gas Resources* (July 19, 2010) (API).

⁹ See <http://marcelluscoalition.org/marcellus-shale/production-processes/fracture-stimulation/>. It is projected that 35 billion gallons of water are used in U.S. shale gas wells each year, the same amount of water consumed by a million U.S. homes. While that volume of water may seem large, it is a long way from the largest volume of water consumed. For example, fracking is only the ninth largest user of water in Pennsylvania. Krancer, *supra* note 2, at 8.

¹⁰ See <http://marcelluscoalition.org/marcellus-shale/production-processes/fracture-stimulation/>.

into the fractures, solvents, surfactants and other additives.¹¹

Approximately 15 percent of the fracking fluid injected into shale gas wells returns to the surface as so-called “flowback” water.¹² The first phase of flowback typically occurs during the first 30 days following fracturing, when some of the injected fracking fluid returns to the surface.¹³ According to the U.S. Environmental Protection Agency (EPA), after this first phase, some flowback can continue to come to the surface for the life of the well.¹⁴ Marcellus drillers recycle nearly 60 percent of the flowback water.¹⁵ When not recycled, the primary options for disposal of waste flowback water are injection into a permitted deep waste disposal well or treatment and discharge to surface water.¹⁶ Waste flowback water can contain relatively high concentrations of total dissolved solids (e.g., chloride and bromide) (TDS); naturally occurring radioactive material; and volatile organic compounds (VOCs), including methane, benzene, ethylbenzene, and xylenes.¹⁷ During the return of flowback water to the surface, methane, other VOCs, and toxics in the flowback also can be released to the atmosphere unless controlled.¹⁸

The Environmental Issues Raised in the Fracking Discussion

Much of the environmental debate surrounding fracking relates to water, both the water used to frack the well and water resources potentially affected by well drilling and fracking activities. Primarily, the issues being discussed are: (1) whether the released natural gas itself may migrate out of the wells, thereby impacting nearby groundwater and/or soil; (2) whether the fracking fluid poses a risk of release to the environment during injection for well development; (3) whether there is a risk that improperly designed or installed wells will result in releases of natural gas or fracking fluid to ground and surface water; and (4) whether the fracking fluid can be stored and disposed of in an environmentally sound manner.

There is a divergence of views over whether the process of creating fractures in the Marcellus Shale itself presents an unreasonable risk of impacting water resources. Because the Marcellus Shale is located 4,000 to 8,500 feet bgs¹⁹ and groundwater is located approxi-

mately 600 feet or less bgs,²⁰ however, it seems unlikely the hydraulic fracturing process could result in contamination of drinking water resources. A May 2011 study in the area of Dimock Township, Pa., by Duke University affiliates found no evidence of drinking water contamination by deep brines or fracking fluids.²¹ Nevertheless, the study concluded shale gas extraction had resulted in methane contamination of drinking water.²² The Pennsylvania Department of Environmental Protection (DEP) disputed the results of the study regarding methane, alleging it was “statistically and technically biased” and that the detected methane gas originated in shallower rock formations, not the Marcellus Shale.²³ In January 2012, EPA announced its intent to sample drinking water from approximately 60 homes in Dimock.²⁴ In March 2012, EPA announced that results for the first 11 homes “did not show levels of contamination that could present a health concern.”²⁵ Apart from its Dimock investigation, EPA in November 2011 issued a plan to study the potential impact of hydraulic fracturing on drinking water supplies.²⁶ Initial study results are expected in 2012 and the remaining results are expected in 2014.²⁷ Regardless of the results of the EPA study, the imposition of more stringent regulations aimed at protecting aquifers is likely. Improperly designed or installed well casings and surficial releases of waste flowback water prior to injection or treatment have been alleged to result in impacts to surface and groundwater. As with conventional gas wells, there also have been allegations that defectively designed or installed fracking wells can result in blow-outs. The debate was heightened due to recent blow-outs of fracking wells. On April 19, 2011, there was a blow-out at a Bradford County, Pa., fracking well. Thousands of gallons of fluid flowed over farm land and into a creek.²⁸ DEP fined Chesapeake Energy \$900,000 for this spill.²⁹

of Marcellus Shale Gas in Pennsylvania (2010), available at <http://pubs.cas.psu.edu/FreePubs/pdfs/ua460.pdf>.

²⁰ Kramer, *supra* note 2, at 17.

²¹ Osborn S.G., Vengosh, A., Warner, N.R., and Jackson, R.B., *Methane Contamination of Drinking Water Accompanying Gas Well Drilling and Hydraulic Fracturing*, 108 Proceedings of the National Academy of Sciences No. 20, at 8, 172-76 (May 17, 2011).

²² *Id.*

²³ Krancer, *supra* note 2, at 2.

²⁴ U.S. Environmental Protection Agency, Action Memorandum—Request for Funding for a Remedial Action at the Dimock Residential Groundwater Site, Intersection of PA Routes 29 & 204, Dimock Township, Susquehanna County, Pennsylvania (Jan. 19, 2002).

²⁵ Associated Press, “EPA Water Quality OK in PA Gas Drilling Town” (March 15, 2012). See also 52 DEN A-9, 3/19/12.

²⁶ See U.S. Environmental Protection Agency, *Plan to Study the Potential Impacts of Hydraulic Fracturing on Drinking Water Resources*, EPA/600/R-11/122 (November 2011), available at http://water.epa.gov/type/groundwater/uic/class2/hydraulicfracturing/upload/hf_study_plan_110211_final_508.pdf. See also 214 DEN A-5, 11/4/11.

²⁷ *Id.* at x.

²⁸ Jim Hamill and Sarah Buynovsky, *Gas Drilling Emergency in Bradford County* (April 20, 2011), available at <http://www.fox43.com/news/wnep-brad-leroy-gas-drillingemergency20110420,0,1614437.story>.

²⁹ Pennsylvania Department of Environmental Protection, Press Release (May 17, 2011), available at <http://www.newsroom.dep.state.pa.us/newsroompublic/Print.aspx?id=17405&typeid=1>.

¹¹ API, *supra* note 8.

¹² Krancer, *supra* note 2, at 9.

¹³ 76 Fed. Reg. 66,286, 66,295-96 (Oct. 26, 2011).

¹⁴ *Id.*

¹⁵ See <http://marcelluscoalition.org/marcellus-shale/production-processes/fracture-stimulation/>.

¹⁶ See Krancer, *supra* note 2, at 10.

¹⁷ See 76 Fed. Reg. 66,286, 66,296 (Oct. 26, 2011). Radium 226 has been detected at concentrations up to 16,030 pCi/l in Marcellus Shale flowback water. *Id.* See also Environmental Protection Agency, *Fact Sheet: Proposed Amendments to Air Regulations for the Oil and Natural Gas Industry*, 2, available at <http://www.epa.gov/airquality/oilandgas/pdfs/20110728factsheet.pdf>.

¹⁸ *Id.*

¹⁹ Pennsylvania Independent Oil & Gas Association, *Learn About the Marcellus Shale (2011)*, available at <http://www.pioga.org/marcellus-shale/>. See also Penn State College of Agricultural Sciences, Cooperative Extension, *Marcellus Education Fact Sheet—Water Withdrawals for Development*

On June 3, 2011, there also was a blow-out in Clearfield County, Pa. Natural gas and wastewater was released into the air for 16 hours. Well operators were fined \$400,000 and ordered to suspend all well operations in the state for 40 days.³⁰

The disposal of flowback water after use also has been the subject of much environmental scrutiny and debate. As noted above, the primary means of disposal of waste flowback water that is not recycled are: (i) injection back into the ground, under an allegedly impermeable layer of rock and beneath the groundwater supply; and (ii) transporting the fracking fluid to potentially remote storage and treatment locations by pipeline or truck, after which it is discharged to surface water. Deep injection of waste flowback water has been alleged to be a potential cause of earthquakes.³¹ The theory is that fracturing or deep injection of fluids destabilizes the earth's underground plates and may lead to more earthquakes in the future. As a result of seismic activity near Youngstown, Ohio, a nearby fracking wastewater deep injection well recently was shut down, and the initial operation of four others was delayed.³² The second disposal option also raises environmental questions. The typical publicly owned treatment works (POTW) can only treat TDS and radioactivity through dilution,³³ and inadequate treatment of waste flowback water has been identified by EPA as a potential cause of surface water contamination.³⁴

Hydraulic fracturing also has prompted evaluation of potential air quality issues. Fracking wells emit methane gas and other VOCs into the atmosphere.³⁵ More generally, shale gas E&P can result in increased industrial activity, trucking, and general construction activities, prompting discussion of potential community impacts.³⁶ The President's FY 2013 budget includes \$14 million for research on the effect of hydraulic fracturing on air quality, water quality, and ecosystems.³⁷

³⁰ Pennsylvania Department of Environmental Protection, Press Release (July 13, 2010), available at <http://www.portal.state.pa.us/portal/server.pt/community/newsroom/14287?id=12818&typeid=1>.

³¹ A class action complaint was filed in the Faulkner County, Ark., Circuit Court alleging nearby fracking operations have caused an unprecedented increase in seismic activity. *Lane v. BHP Billiton Petroleum Inc.*, Ark. Cir. Ct., No. 23cv-11-482, filed 5/20/11. See also Steve Connor, *Small Earthquake in Blackpool, Major Shock for UK's Energy Policy*, THE INDEPENDENT (June 1, 2011), available at <http://www.independent.co.uk/news/science/small-earthquake-in-blackpool-major-shock-for-uks-energy-policy-2291597.html>.

³² See *State Natural Resources Director Reaches Agreement to Halt Operation of Youngstown Area Injection Well* (Jan. 3, 2012), available at http://www.ohiodnr.com/home_page/NewsReleases/tabid/18276/EntryId/2644/State-Natural-Resources-Director-Reaches-Agreement-to-Halt-Operation-of-Youngstown-Area-Injection-Well.aspx.

³³ See 76 Fed. Reg. 66,286, 66,296 (Oct. 26, 2011).

³⁴ See *id.* at 66,297.

³⁵ See 76 Fed. Reg. 52,738, 52,756-58 (Aug. 23, 2011).

³⁶ Bipartisan Policy Center, *Shale Gas: New Opportunities, New Challenges*, 15 (January 2012).

³⁷ Susan Phillips, *Obama Proposes \$14 Million for Fracking Research* (Feb. 13, 2012), available at <http://stateimpact.npr.org/pennsylvania/2012/02/13/obama-proposes-14-million-for-fracking-research/>. See also 39 DEN A-10, 2/29/12.

Federal Fracking Legislation, Regulation, and Investigation

Currently, there is limited federal legislation or regulation of hydraulic fracturing. However, laws and regulations designed to minimize the environmental issues identified above are being enacted and/or applied to fracking with increasing frequency. The regulation of fracking also is the subject of continuing legislative and executive branch efforts. The seemingly inevitable increase in federal legislation and/or regulation certainly will affect both the timing and cost of natural gas E&P in the Marcellus Shale gas play, thereby affecting transactions in the sector.

Fracking Fluid Disclosure and Well Permitting

As part of the environmental debate on fracking and the underground injection of chemical additives during the fracking process, a great deal of attention has been focused on the public disclosure of the chemical additives in fracking fluid. Since July 2005, when Congress adopted the Energy Policy Act, fracking fluids have been exempt from the Safe Drinking Water Act's general regulation of fluids injected into the ground, including the obligation to obtain an Underground Injection Control (UIC) permit.³⁸ Under this so-called "Halliburton loophole," companies have not been required by the Safe Drinking Water Act to disclose the chemical composition of their fracking fluids or otherwise provide any information about the fluids' potential effects on human health or the environment. The exemption applies to "the underground injection of fluids or propping agents (other than diesel fuels) pursuant to hydraulic fracturing operations related to oil, gas, or geothermal production activities."³⁹ In 2012, EPA is expected to issue a guidance document clarifying what is meant by the "diesel fuel" carve-out to the exemption. Needless to say, the continued applicability of the Halliburton loophole also is the focus of significant legislative and public scrutiny.

Specifically, in several sessions since 2009, Congress has considered legislation entitled the "Fracturing Responsibility and Awareness of Chemicals Act," dubbed the "FRAC Act," that would repeal the exemption for non-diesel hydraulic fracturing fluids in the Safe Drinking Water Act, require disclosure of fracking chemicals, and require UIC permits for fracking wells.⁴⁰ Although Congress has yet to take action on the FRAC Act, in his 2012 State of the Union Address, President Obama stated that he is "requiring all companies that drill for gas on public lands to disclose the chemicals they use."⁴¹

Regardless of whether the Safe Drinking Water Act requires disclosure of fracking chemicals, such disclosure also could be required by other federal regulation. In particular, EPA announced in November 2011 that it will solicit public comment on a possible federal reporting requirement for fracking fluids pursuant to the

³⁸ See Energy Policy Act of 2005, Pub. L. No. 109-58.

³⁹ 42 U.S.C. § 300h(d)(B)(ii).

⁴⁰ H.R. 2766, 111th Cong.; S. 1215, 111th Cong.; H.R. 1084, 112th Cong.; S. 587, 112th Cong.

⁴¹ See <http://www.whitehouse.gov/the-press-office/2012/01/24/remarks-president-state-union-address>.

Toxic Substances Control Act.⁴² The announcement responded to a petition by Earthjustice and 120 other groups⁴³ for fracking fluid disclosure and other requests. EPA indicated it would convene a stakeholder process and publish an advance notice of proposed rulemaking.⁴⁴ It also expressed its expectation that the TSCA proposal “would focus on providing aggregate pictures of the chemical substances and mixtures used in hydraulic fracturing” but “would not duplicate . . . the well-by-well disclosure programs of states.”⁴⁵ Indeed, several states already require some level of fracking fluid disclosure, including Pennsylvania and West Virginia.⁴⁶ In addition, many companies voluntarily have disclosed their fracking fluid contents on a new industry database.⁴⁷

The expansion of the Safe Drinking Water Act UIC permit program to gas wells beyond those used for the injection of diesel could increase significantly the amount of time and cost necessary to obtain well installation approvals. This is especially true where, as in Pennsylvania, EPA is the permitting authority. EPA’s evaluation of a UIC permit application must include consideration of public comments and the potential applicability of the Wild and Scenic Rivers Act, the National Historic Preservation Act of 1966, the Endangered Species Act, the Coastal Zone Management Act, and the Fish and Wildlife Coordination Act.⁴⁸ The length of time for EPA to address these environmental considerations will have to be factored into any estimates of the time it will take to get a well into the ground and producing gas.

Flowback Water

EPA recently announced an intent to develop regulations governing pre-treatment of the flowback water before the water is discharged to wastewater treatment plants.⁴⁹ The federal regulations will require technological controls based, in part, on what is economically achievable in the industry.⁵⁰ The TDS concentrations in flowback water likely would require some form of evaporation/distillation⁵¹ to meet the current federal drinking water standard of 500 mg/l,⁵² which is estimated to cost \$0.25 per gallon.⁵³ In areas where deep

injection of flowback water is geologically impracticable, such as much of Pennsylvania,⁵⁴ the cost to treat flowback water could be a significant economic factor in natural gas E&P viability. Presumably, drillers without ready access to deep disposal wells or authorized treatment facilities in the vicinity of their wells may have to transport the flowback water to appropriate facilities at further distances or consider developing their own pre-treatment facilities at significant time and cost. Needless to say, ready access to permitted injection wells or wastewater treatment facilities could be a significant competitive advantage.

Air Emissions

New Source Performance Standards. Although most of the environmental activity in conjunction with fracking has focused upon water-related environmental issues, there also have been new developments on the federal level regarding the regulation of air pollutants. On July 28, 2011, EPA proposed new rules to address air pollution for the oil and natural gas industry.⁵⁵ EPA issued the final rule April 17.⁵⁶ These rules were promulgated pursuant to the Clean Air Act and are part of EPA’s obligation to establish new source performance standards (NSPS) for industrial categories that cause or significantly contribute to air pollution that may endanger public health or welfare.⁵⁷ The new rules require reductions in VOCs from completions of new gas wells and recompletions of existing natural gas wells that are fractured or refractured. EPA would minimize the VOC emissions by requiring the use of “green completions.”⁵⁸ Such completions require the use of special equipment to separate gas and liquid hydrocarbons from the flowback.⁵⁹ The separated gas and hydrocarbons then are treated and sold. Although EPA estimates the cost of the green completions will be recovered at the average well within one year, the incremental cost is estimated to be approximately \$34,000 per well per completion.⁶⁰

With new source performance standards, the duty to comply with the rules is triggered from the date the proposal was published; in this case, Aug. 23, 2011, rather than the date EPA’s final rule is published, but green completions will not be required until Jan. 1, 2015.⁶¹ The NSPS rules requiring green completions also impose a two-day advance notice requirement.⁶² That notice would have to have been filed even in advance of the final publication date of the rule.

⁴² See http://www.epa.gov/oppt/chemtest/pubs/EPA_Letter_to_Earthjustice_on_TSCA_Petition.pdf. See also 227 DEN A-7, 11/25/11.

⁴³ See <http://www.epa.gov/oppt/chemtest/pubs/petitions.html>.

⁴⁴ *Id.*

⁴⁵ *Id.*

⁴⁶ 41 Pa. Bull. 805, 815 (Feb. 5, 2011); W.Va. Code R. § 35-8-1.1 et seq.

⁴⁷ See, e.g., <http://fracfocus.org>.

⁴⁸ U.S. Environmental Protection Agency, Introduction to UIC Permitting, 1-9, 1-14 (April 2002) (“If any of these acts are applicable to the project, additional interagency coordination will be necessary, and the time frame for permit review and issuance should be expected to be significantly long [sic] than usual.”).

⁴⁹ 76 Fed. Reg. 66,286 (Oct. 26, 2011). See also 204 DEN A-1, 10/21/11.

⁵⁰ *Id.* at 66,288.

⁵¹ 40 Pa. Bull. 4835 at 7 (Aug. 21, 2010), available at <http://www.pabulletin.com/secure/data/vol40/40-34/1572.html>.

⁵² 76 Fed. Reg. 66,286, 66,297 (Oct. 26, 2011).

⁵³ 40 Pa. Bull. 4835, at 12 (Aug. 21, 2010), available at <http://www.pabulletin.com/secure/data/vol40/40-34/1572.html>.

⁵⁴ See Krancer, *supra* note 2, at 10 (“The best solution for disposing of high TDS wastewater is deep well injection. Unfortunately, the best geology in Pennsylvania for this method of waste disposal is being used for gas storage. Exploration for new injection sites is ongoing but not commercially available yet.”)

⁵⁵ 76 Fed. Reg. 52,738, 52,743 (Aug. 23, 2011).

⁵⁶ See <http://www.epa.gov/airquality/oilandgas/actions.html>. See also 75 DEN A-1, 4/19/12.

⁵⁷ 76 Fed. Reg. 52,738, 52,740 (Aug. 23, 2011).

⁵⁸ *Id.* at 52,745.

⁵⁹ *Id.* at 52,757.

⁶⁰ *Id.* at 52,758.

⁶¹ 40 C.F.R. § 60.1; Summary of Requirements for Processes and Equipment at Natural Gas Well Sites (NSPS Summary), available at <http://www.epa.gov/airquality/oilandgas/actions.html>.

⁶² NSPS Summary, *supra* note 61.

To reduce the compliance burden on industry, EPA's rule would exempt certain oil and gas sources from Title V operating permit requirements that otherwise would have been triggered by the rule.⁶³ (If Title V permitting were to apply, the permittee may need to demonstrate that the lowest achievable emissions rate is achieved; all of its facilities in the same state are in compliance with applicable emissions limitations; and it has offset with emission reduction credits in accordance with the new source performance rules the applicable VOC emissions. From a timing perspective, in many states, it can take up to 18 months to obtain a Title V permit.) The exemption for Title V permitting would apply only to sources covered by the NSPS that are not major sources and do not have to obtain Title V operating permits for another reason.⁶⁴

Aggregation. The exception for Title V permitting associated with the NSPS rules may not be that relevant if changes are made in the way air sources are aggregated by EPA or states that implement the Clean Air Act. The issue of air aggregation relates to which operations should be taken into account to determine whether the emissions from these sources are sufficient to constitute a major stationary source or major facility for purposes of certain Clean Air Act permitting programs, including new source review and Title V permitting programs. For example, if emissions can be aggregated from two or more air contamination sources so the sources reach major source applicability thresholds, then they would be subject to additional air quality permitting requirements under these programs.⁶⁵

In 2009, EPA issued a guidance document, commonly known as the "McCarthy Memorandum," that identified three criteria for aggregating emission activities:

- whether the activities are located in one or more contiguous or adjacent properties,
- whether the activities are under the control of the same person or persons under common control, and
- whether the activities belong to the same industrial grouping.

According to the McCarthy Memorandum, all three factors must be met to aggregate separate activities.⁶⁶

Not all states agree with EPA's view of aggregation. For example, Pennsylvania recently issued a guidance document that would consider sources contiguous or adjacent if they were located within a quarter mile of each other or are otherwise nearby.⁶⁷ Properties located outside a quarter mile would be considered contiguous or adjacent on a case-by-case basis.⁶⁸ Accord-

ing to Pennsylvania DEP's guidance document, "the application of the quarter mile or less rule of thumb" takes a "common sense approach" to determining if sources are located on contiguous or adjacent properties and does not aggregate pollutant emitting activities that as a group would not fit within the ordinary meaning of "building," "structure," "facility," or "installation."⁶⁹ EPA has criticized Pennsylvania's policy and quarter-mile test.⁷⁰

The application of the aggregation theory to various equipment and installations that play a role in fracking can have significant implications on the timing and cost of the installation of gas wells. For example, if an entity's wells, compressor stations, and related equipment are considered to be a single air contamination source under the Clean Air Act, then Title V permitting could apply. As noted above, this could result in a significant increase in the time and cost it could take to start operating the affected equipment and wells.

SEC Reporting

Estimates of recoverable natural gas resources vary widely. Such variety presents more than an academic exercise for those corporations subject to Securities and Exchange Commission (SEC) reporting. Recently, the SEC has been investigating the accuracy and supportability of corporate natural gas well productivity estimates, issuing subpoenas to at least two companies.⁷¹ The New York Attorney General's Office also issued subpoenas related to productivity estimates.⁷² Given this scrutiny, it is not a stretch to think the SEC and/or state attorneys general in applicable states may start to focus on other disclosures made by public companies in the Marcellus Shale E&P sector. As with SEC disclosures of environmental risks in other environmentally sensitive industries, the public disclosure of the potential environmental liabilities and risks associated with fracking can give rise to potential litigation or conflict.

State Requirements

The relative absence of federal regulatory oversight gives the states room to regulate with an eye towards the particulars of their local environment and the nature of their local fracking operations. As a result, state regulation of fracking varies significantly. Accordingly, in the natural gas E&P industry, location plays a large role in defining deal risk. In Pennsylvania, shale gas extraction is governed by the Oil and Gas Act of 1984.⁷³ The Oil and Gas Act requires the issuance of a permit before a well may be drilled. As a part of the permit application process, companies must disclose the names of all chemicals to be stored and used at a drilling site.⁷⁴ The Oil and Gas Act requires the posting of a bond. As

⁶³ *Id.* at 52,749.

⁶⁴ VOC sources generally are not major if they emit less than a hundred tons of VOCs per year, although the emissions threshold can be lower in certain areas of the country. *Id.* at 52,751.

⁶⁵ *See id.*

⁶⁶ *See* <http://www.epa.gov/region7/air/nsr/nsrmemos/oilgaswithdrawal.pdf>.

⁶⁷ Pennsylvania Department of Environmental Protection, Guidance for Performing Single Stationary Source Determinations for Oil and Gas Industries, Document Number: 270-0810-006 (Oct. 21, 2011), available at http://files.dep.state.pa.us/Air/AirAggregation/AirAggregationPortalFiles/TechnicalGuidance_SingleSourceAirAggregation_101211.pdf.

⁶⁸ *Id.* at 4.

⁶⁹ *Id.*

⁷⁰ *See* Don Hopey, *EPA Criticizes State for Shale Air Pollution Rules*, PITTSBURGH POST-GAZETTE (Dec. 6, 2011).

⁷¹ *See* Deborah Solomon, *SEC Bears Down on Fracking*, THE WALL STREET JOURNAL (Aug. 25, 2011).

⁷² *Id.*

⁷³ 58 Pa. Cons. Stat. § 601.101 *et seq.*

⁷⁴ Pennsylvania Department of Environmental Protection, Drilling for Natural Gas in the Marcellus Shale Formation, Frequently Asked Questions, available at <http://files.dep.state.pa.us/OilGas/BOGM/BOGMPortalFiles/MarcellusShale/MarcellusFAQ.pdf>.

amended in 2012, it also creates a presumption that gas well operators are responsible for pollution of water supplies within 2,500 feet of their gas well for one year after drilling is completed if no pre-drilling water samples were collected from the private water supply.⁷⁵ Thus, Pennsylvania's liability scheme provides a significant incentive for E&P companies to establish a baseline of local drinking water quality. The February 2012 amendment also established a per well impact fee and significantly restricted local drilling regulation.⁷⁶

In February 2011, the Pennsylvania environmental rulemaking authority, the Environmental Quality Board, also amended regulations to improve drilling, casing, cementing, testing, monitoring, and plugging requirements for oil and gas wells to minimize gas migration and protect water supplies.⁷⁷ The amendments imposed well construction and operation requirements, gas migration response requirements, and fracking fluid reporting requirements.⁷⁸

While Pennsylvania has amended regulations and passed amendatory legislation to address hydraulic fracturing in the Marcellus Shale, New York has been more cautious, imposing a moratorium on issuing required permits until it completes an environmental impact statement. New York issued a draft revised version of the impact statement in September 2011 and accepted public comments until Jan. 11, 2012.⁷⁹ The draft revised impact statement recommends prohibiting any surface drilling: (a) within 2,000 feet of public drinking water supplies; (b) on the state's 18 "primary" aquifers and within 500 feet of their boundaries; (c) within 500 feet of private wells, unless waived by landowner; (d) in floodplains; (e) on "principal" aquifers without site-specific reviews; and (f) within the Syracuse and New York City watersheds.⁸⁰ According to the state, 80 percent of the Marcellus Shale "where gas extraction is viable" would remain available for drilling.⁸¹ West Virginia recently enacted legislation known as the "Horizontal Well Act" which, among other things, establishes well siting criteria, creates a rebuttable presumption of causation for drinking water contamination or loss within 1,500 feet of a well pad, and requires the submission with permit applications of erosion and sediment control plans, water management plans, and other safety-related plans.⁸²

⁷⁵ Amy Worden, *Pennsylvania Lawmakers Agree on Bill to Impose a Fee for Gas Drilling*, THE PHILADELPHIA INQUIRER (Feb. 7, 2012); Jim T. Ryan, *Corbett Signs Shale Impact Fee*, CPB-JNow.com (Feb. 14, 2012), available at <http://www.centralpennbusiness.com/article/20120214/CPBJ01/120219905/Corbett-signs-shale-impact-fee-bill>.

⁷⁶ *Id.*

⁷⁷ 41 Pa.Bull. 805 (Feb. 5, 2011), available at <http://www.pabulletin.com/secure/data/vol41/41-6/239.html>.

⁷⁸ *Id.*

⁷⁹ See High-Volume Hydraulic Fracturing SGEIS Time Line, available at <http://www.dec.ny.gov/energy/75370.html>.

⁸⁰ New York State Department of Environmental Conservation, Revised Draft Supplemental Generic Environmental Impact Statement on the Oil, Gas and Solution Mining Regulatory Program, 19-22 (Sept. 7, 2011), available at <http://www.dec.ny.gov/energy/75370.html> See also 189 DEN A-2, 9/29/11.

⁸¹ See <http://www.dec.ny.gov/energy/75664.html>.

⁸² West Virginia House Bill 401, available at http://www.legis.state.wv.us/Bill_Text_HTML/2011_SESSIONS/4X/Bills/hb401%20enr.htm See also 241 DEN A-13, 12/15/11.

Increased state regulation of the fracking process likely will increase the time and cost required to obtain permits and construct new fracking wells as well as operate existing ones. The relative differences in state approaches to fracking also could have a significant effect on the value of, or the time to recover on, an investment in a given geographic area.

Regional Water Allocation Requirements

In addition to federal and state oversight, natural gas drilling in the northeast can be subject to oversight (and significant limitations) by the Delaware River Basin Commission (DRBC) or the Susquehanna River Basin Commission (SRBC), two interstate commissions charged with water resource allocation and protection authority. The DRBC was created in 1961 by a compact between the federal government, Delaware, New Jersey, New York, and Pennsylvania.⁸³ The SRBC was created in 1970 by a compact between the federal government, Maryland, New York, and Pennsylvania.⁸⁴ The DRBC currently has an effective moratorium on natural gas E&P from shale within the basin.⁸⁵ In December 2010, the DRBC published draft regulations (subsequently revised) that would allow natural gas drilling within the basin but limit the total number of natural gas wells in the basin to 300, establish siting and setback requirements, require financial assurance of up to \$25 million, and limit the storage and discharge of fracking fluid.⁸⁶

The SRBC amended its Project Review regulations in September 2010 and again in December 2011 to address natural gas development within the basin. The SRBC's usual 100,000 gallon per day threshold for regulating withdrawals does not apply; SRBC oversees all withdrawals of surface water and groundwater and consumptive water uses in the basin related to unconventional natural gas development.⁸⁷ (However, unlike the DRBC, the SRBC does not regulate gas well permitting, well construction, fracking standards, erosion and sedimentation control, or wastewater disposal and treatment.)⁸⁸ The SRBC employs an Approval-by-Rule application process for consumptive use of water in hydrocarbon development projects,⁸⁹ which requires the

⁸³ See <http://www.nj.gov/drbc/>.

⁸⁴ See <http://www.srbc.net/about/geninfo.htm>.

⁸⁵ See <http://www.state.nj.us/drbc/programs/natural/> and http://www.state.nj.us/drbc/home/newsroom/news/approved/20100506_newsrel_naturalgas050610.html.

⁸⁶ See <http://www.state.nj.us/drbc/programs/natural/draft-regulations.html> The DRBC was scheduled to vote on the proposed regulations Nov. 21, 2011, but cancelled the vote Nov. 18, 2011. http://www.state.nj.us/drbc/home/newsroom/news/approved/20111118_newsrel_naturalgas.html. Reportedly, the vote was cancelled after the governor of Delaware announced his intent to vote against the regulations, which could have led to the federal government having to cast the deciding vote. <http://www.platts.com/RSSFeedDetailedNews/RSSFeed/NaturalGas/6692639>. See also 224 DEN A-11, 11/21/11.

⁸⁷ 18 C.F.R. § 806.4(a)(8).

⁸⁸ *Shale Gas Production and Water Resources in the Eastern United States, Hearing Before the Subcomm. on Water and Power of the S. Comm. on Energy and Natural Resources*, 112th Cong. (statement of Thomas W. Beauduy, Deputy Executive Director & Counsel, Susquehanna River Basin Commission) (Beauduy).

⁸⁹ 18 C.F.R. § 806.22(f)(1).

submission of a Notice of Intent to the SRBC.⁹⁰ The SRBC's executive director may grant, deny, suspend, rescind, modify, or condition an approval to operate under the Approval-by-Rule.⁹¹ The SRBC's current concern for water allocation within the basin focuses on the location, timing, and impact of withdrawals on smaller surface water bodies rather than the total allocation for Marcellus Shale E&P activities within the basin.⁹² Therefore, to protect surface water flow from the impact of large water withdrawals, SRBC approvals can require a decrease or complete cessation of withdrawals during low flow periods.⁹³

Given the current and potential restrictions on hydraulic fracturing in these regions, the technically available natural gas resources might not be practically available for extraction for some time to come. In the Susquehanna River Basin, the characteristics of the fracking water source could be a significant factor in whether and when fracking may take place. In the Delaware River Basin, even if the current moratorium is lifted, the proposed regulations would significantly restrict the number and location of extraction sites and, thereby, the ability of the industry to capitalize on the available natural gas.

Local Requirements

A number of municipalities have responded to the significant proposed and actual increase in fracking by seeking to ban or restrict the process in their communities. However, there may be little municipalities can do to prevent Marcellus Shale E&P from taking place within their jurisdictions. In West Virginia, a court ruled in August 2011 that a local fracking ban was preempted by the state's comprehensive oil and gas regulatory program.⁹⁴ Specifically, the court concluded that "the State's interest in oil and gas development and production throughout the State . . . provides for the exclusive control of this area of law to be within the hands of the WVDEP. These regulations do not provide any exception or latitude to permit the City of Morgantown to impose a complete ban on fracking or to regulate oil and gas development and production."⁹⁵ As noted above, recent Pennsylvania legislation would limit the ability of municipalities to enact zoning restrictions on hydraulic fracturing well siting.⁹⁶ The legislation requires municipalities to allow wells and pipelines in every zoning district, including residential.⁹⁷ In addition, the legislation would prevent Pennsylvania municipalities from classifying drilling as a "conditional use" in most circumstances.⁹⁸ In New York, 54 communities have pro-

hibited drilling of hydraulic fracturing wells.⁹⁹ Although existing New York law prohibits "local law or ordinances relating to the regulation of the oil, gas and solution mining industries" except those relating to local roads and property taxes,¹⁰⁰ two New York trial courts recently upheld municipal bans on petroleum exploration, reasoning that municipalities may not regulate *how* such exploration takes place but may regulate *where* it does.¹⁰¹ In addition, there are bills pending before the New York Legislature that would allow municipalities some control over zoning for drilling.¹⁰² While municipalities may be prevented from outright banning Marcellus Shale E&P, some local requirements still may be applicable and will need to be considered in siting and installing wells.

Litigation

As in any other environmentally sensitive industry, natural gas E&P companies will be exposed to investment risk due to the threat of environmental litigation. As noted above, there have been environmental litigation and/or claims brought by state environmental agencies related to alleged contamination associated with fracking.¹⁰³ Given the nature and extent of public discussion about environmental issues raised by fracking, it should be no surprise private citizens have filed tort actions against oil and gas companies for fracking operations. Such claims usually fall into two categories: land use and rights and personal injury claims. Although the land-use suits mostly are contract claims seeking to modify or invalidate leases,¹⁰⁴ there also are land use and rights suits brought in state and federal courts asserting claims for trespass, nuisance, negligence, strict liability, fraud for contaminated well water, and air and noise pollution.¹⁰⁵ Individual as well as class action lawsuits have been filed in state and federal courts for personal injury claims. In addition, plaintiffs' firms have begun advertising seeking clients with potential personal injury lawsuits.¹⁰⁶ To our knowledge, all of the personal injury suits are in their infancy and none have made it to trial. Some fracking cases already have been settled. In December 2010, Pennsylvania DEP announced it had negotiated a \$4.1 million settle-

⁹⁹ Eric Waeckerlin, *Local Fracking Bans: A Growing and Serious Challenge for Industry*, (Jan. 4, 2012), available at <http://www.frackinginsider.com>. See also <http://www.r-cause.net/bans-moratoria-local-global.html>.

¹⁰⁰ N.Y. Env'tl Conserv. Law § 23-0303(2).

¹⁰¹ See *Anschutz Exploration Corp. v. Town of Dryden*, Index No. 2011-0902 (Sup. Ct. Tompkins Co.) and *Holstein Corp. v. Town of Middlefield*, Index No. 011-0930 (Sup. Ct. Otsego Co.). See also 38 DEN A-2, 2/28/12.

¹⁰² See, e.g., N.Y. Senate Bill S5830-2011, available at <http://open.nysenate.gov/legislation/bill/S5830-2011>.

¹⁰³ See, e.g., text accompanying notes 28 - 30, *supra*.

¹⁰⁴ See, e.g., *Lauchle v. Keeton Group LLC*, 768 F. Supp.2d 757 (M.D. Pa. 2011).

¹⁰⁵ See *Harris v. Devon Energy Production Co.* (N.D. Texas, No. 3:10CV02554, filed Dec. 15, 2010); *Smith v. Devon Energy Production Co.* (N.D. Texas, No. 3:11CV00196, filed Jan. 31, 2011); *Mitchell v. Encana Oil & Gas, Inc.* (N.D. Texas, No. 3:10CV02555, filed Dec. 15, 2010); *Lester v. Frontier Gas Services, LLC* (E.D. Ark., No. 4-11-cv-0420, filed May 17, 2011).

¹⁰⁶ See, e.g., http://www.yourlawyer.com/topics/overview/hydraulic_fracturing_fracking; http://www.cellinoandbarnes.com/Personal_Injury_Practice_Areas/Hydraulic_Fracturing.aspx.

⁹⁰ 18 C.F.R. § 806.22(f)(2).

⁹¹ 18 C.F.R. § 806.22(f)(9).

⁹² Beauduy, *supra* note 88, at 8.

⁹³ Susquehanna River Basin Commission, Information Sheet: Natural Gas Well Development in the Susquehanna River Basin, 2 (January 2010).

⁹⁴ *Northeast Natural Energy, LLC v. City of Morgantown*, Monongahela Cnty Cir. Court, No. 11-C-411, 8/12/11. The court's order is available at http://www.frackinginsider.com/Tucker_Marcellus_Order.pdf. See also 159 DEN A-8, 8/17/11.

⁹⁵ *Id.*

⁹⁶ See note 76 *supra*.

⁹⁷ *PA Impact Fees for Drillers Come With a Zoning Catch*, THE PHILADELPHIA INQUIRER (Feb. 12, 2012).

⁹⁸ *Id.*

ment between 19 Dimock Township families and Cabot Oil & Gas.¹⁰⁷ Each family would receive twice the value of their home, with a minimum payment of \$50,000, and Cabot would be required to install whole-house gas mitigation devices in each of the affected homes.¹⁰⁸ Cabot also will pay the DEP \$500,000 to offset the state's investigation expenses.¹⁰⁹

Environmental Due Diligence for Transactions Focusing on Marcellus Shale Fracking

As outlined, above, the rapid expansion of natural gas E&P from the Marcellus Shale has created a rapidly changing regulatory environment as well as litigation. With temporary fracking moratoria throughout New York and the Delaware River Basin (e.g., eastern Pennsylvania), the jurisdictional location of E&P assets within the Marcellus Shale region will be a key factor in evaluating how quickly a target will be able to exploit natural gas reserves. The location of E&P assets also will matter practically and economically in connection with the availability of water for fracking and waste flowback water disposal options along with the application of federal or state air emission permitting and aggregation policies. Given the number of proposed and recently enacted regulations governing fracking, well installation timing also will be important. Companies producing natural gas from existing wells may have an economic advantage over those subject to recent and proposed regulations that are or will be applicable to new or refractured wells. Alternatively, those companies relying on fracking wells and related infrastructure installed before the recent regulatory onslaught might be more susceptible to environmental contamination and litigation risks.

In evaluating environmental regulatory risks associated with transactions involving upstream Marcellus Shale gas E&P companies, consider including some or all of the following questions in your environmental due diligence review:¹¹⁰

1. What is the environmental risk profile of the target:
 - (a) Is the target the subject of any pending environmental regulatory compliance investigation or other administrative proceeding?
 - (b) Is the target the subject of any pending or threatened environmental claims or litigation?

¹⁰⁷ Pa. DEP press release, December 16, 2010, available at http://www.portal.state.pa.us/portal/server.pt/community/search_article/14292. See also 241 DEN A-10, 12/17/10.

¹⁰⁸ *Id.*

¹⁰⁹ *Id.*

¹¹⁰ These questions primarily focus on identifying the potential impacts of recent and upcoming legislative and administrative changes and trends affecting fracking in the Marcellus Shale. Of course, the specific questions one would ask in a given transaction will depend upon the identity of the parties as well as the structure and size of the deal. We have not included basic environmental regulatory questions that might be relevant to any construction-based project or investment, including questions relating to erosion and sediment control plans, stormwater permits, or the like. We also have not included environmental due diligence questions relating to the transportation and distribution of the shale gas. For a given project, issues associated with the transportation and distribution of the gas may be significant impediments to entry.

- (c) Does the target have a history of well blow-outs or issues associated with alleged poor well construction or operating practices?
 - (d) Has the target shifted any of its environmental compliance, contamination, or litigation risks to third parties, including insurance companies, sellers/buyers of assets or businesses, or joint venture partners, if any?
 - (e) Is the target subject to SEC reporting? Are the target's estimates of natural gas reserves, if applicable, supportable? Is the target's estimation of environmental risks associated with its fracking operations supportable?
2. For targets who have existing wells, consider the following:
 - (a) In what regions, states and municipalities are the target's wells located?
 - (i) Has impact fee legislation been proposed or enacted in the relevant jurisdictions? Has the target accounted for such fees?
 - (b) Are the wells still generating flow-back? How is it managed? If they rely on a wastewater treatment plant, can the plant continue to treat the wastewater in compliance with the Clean Water Act and/or state law?
 - (c) If they are using injection wells, does the target use fracking fluid that includes diesel fuel? Does the target have an underground injection permit?
 - (d) Does the target monitor groundwater and/or drinking water? If so, are there any impacts noted? If there are identified impacts, are there other potential sources of contamination in the area, including abandoned wells? Has the target undertaken or is it proposing to undertake any investigation, remediation, or other response action with respect to the impacted groundwater, including providing drinking water to potentially affected residences?
 - (e) Does the target disclose the chemical constituents (and relative amounts of such constituents) of its fracking fluid?
 - (f) Does the target have a Title V permit? Does the gas well utilize green completion technology?
 3. For targets who propose installing new wells, consider the following:
 - (a) In what regions, states, and municipalities are the target's proposed well sites located?
 - (i) Is there a ban, moratorium, or limit on new well installations or the number of wells installed by a single legal entity? (For example, does the company have holdings in New York State or within the jurisdiction of the DRBC?)
 - (ii) Are there proposed or enacted well set-back requirements that effectively could limit the target's ability to install new wells?
 - (b) What will be the source of the fracking water supply?
 - (i) Will the target need a DRBC or SRBC water withdrawal permit? Has the target taken into account the timing and cost of permitting?

- (ii) Is any source water authorization subject to any low-flow (i.e., drought) restrictions that could impact the timing of fracking?
- (c) How will the flowback water be managed?
 - (i) Are the proposed wells in an area where injection is feasible/permitted? How long will injection permitting take?
 - (ii) Does the target plan on using fracking fluid that could contain diesel fuel as defined by EPA for purposes of the Safe Drinking Water Act?
 - (1) If so, has the target taken into account the timing and cost of obtaining an injection permit?
 - (iii) Does the target have access to a wastewater treatment facility that can accept the flowback water? Is it in proximity to planned wells? Has the target accounted for wastewater transportation and treatment costs?
 - (iv) Is the target considering constructing a dedicated wastewater treatment plant? Has the target budgeted the cost? Has the target taken into account the timing and cost of permitting?
- (d) Will the well installation require a construction permit under state air pollution laws and/or a Title V permit (i.e., due to aggregation rule)?
 - (i) Has the target taken into account the timing and cost of obtaining such permits? Has the target accounted for the cost of green completions and/or other air control technology that reasonably would be expected to be required?
- (e) Has the target performed baseline groundwater sampling of drinking water supplies?
 - (i) Are there any known impacts to groundwater in the vicinity of the proposed gas

well(s)? Has the target evaluated whether there are any constituents in its fracking fluid present in the existing drinking water supply? Can the target make substitutions to its proppants to avoid problems of proof?

Conclusion

Investments in and acquisitions of businesses engaged in Marcellus Shale E&P are being conducted against a backdrop of evolving laws and regulations. Although it appears it will be some time before the full extent of environmental regulatory and litigation challenges associated with fracking in the Marcellus Shale can be well defined, by following the regulatory debate and by asking appropriate due diligence questions, investors can take the first steps in managing these challenges.

About the Authors:

Abbi L. Cohen and John M. Ix are with the Philadelphia office of Dechert LLP. Cohen is a Partner with the firm whose practice is focused on evaluating environmental liabilities associated with corporate, real estate, and financing transactions—including renewable energy projects—and providing both state and federal permitting and regulatory compliance advice. She has assisted clients in siting and permitting industrial facilities, including resource recovery and cogeneration facilities as well as power plants.

Ix is Counsel at the firm, advising clients on environmental regulatory compliance issues, supporting litigated environmental disputes, and negotiating environmental terms in business transactions.

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