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The Fracking Debate Expands:

Water-Related Regulations, Disposal and Treatment of Flowback and Wastewater, and Water Contamination Litigation Spawned by Hydraulic Fracturing for Shale Gas

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I. Introduction: The Intersection of Water Law and Energy Law

Water law and energy law are becoming increasingly integrated and interdependent. The relationship between water resources and energy development has become increasingly intertwined during the past decade as the shale gas boom has dramatically altered future energy supply projections. Its impact on the economic, environmental, political, hydrological and legal landscape of many states and now many nations is extraordinary. Huge financial stakes surround hydraulic fracturing, or fracking, a rapidly expanding method of extracting natural gas from vast shale formations. The worldwide flow of gas has already halved gas prices in the United States domestic market, and reliable estimates show that shale gas can comprise up to 50% of our nation's total production over the next 30 years.[1] There are massive demands on water supplies near fracking sites, however, with each well site calling for one to eight million gallons of freshwater resources. Gone are the days of a relatively light-handed regulatory regime that prevailed in earlier years. Extraordinary pressures are now being exerted on state and federal agencies with overlapping regulatory and oversight responsibilities linked to sustainable water resource management, energy development and security, and pollution prevention mandates.

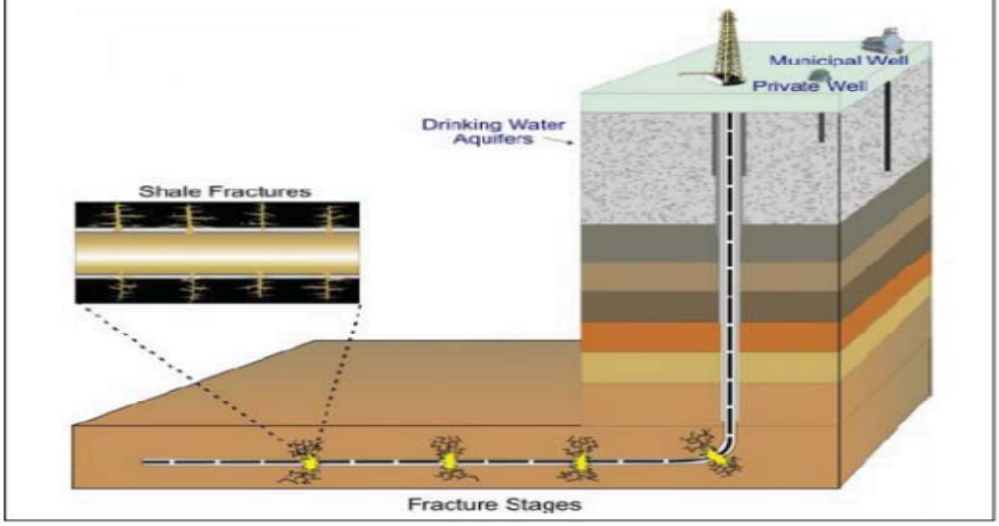
There is a complex interplay between our nation's overarching need to achieve energy independence in an unstable global market for oil and gas[2] and the public's need for a reliably adequate, uncontaminated water supply. The fracking debate is being played out at the intersection of these two needs. As President Obama put it in March 2011, "We've got to make sure we're extracting natural gas safely, without polluting our water supply."[3]

At the core of this presentation on the expanding fracking debate are water resource management concerns, challenges facing different water allocation regimes, and the future of water rights as they have developed under vastly different Eastern and Western water law regimes. In order to appreciate the complexity and depth of the water-related issues associated with the fracking process, it will be helpful to understand the fundamental characteristics of this controversial process perceived by some as environmentally unfriendly and by others as the key to energy security.

II. The Hydraulic Fracturing Process: Fracking 101

A detailed description of the phases of wellbore drilling and measures to protect groundwater during fracking operations has been provided in *American Law and Jurisprudence on Fracking – 2011*[4], including placement of steel tube surface casing, cementing of boreholes, setting up production zones with several layers of steel augmented by cement that isolate groundwater zones and freshwater aquifers from the drilling fluids, and monitored drilling of intermediate and production holes in the strata between groundwater zones and the area from which production will take place. Each step of the process leading to a completed borehole is described, and if the process is "followed with care and thoroughness," freshwater aquifers are separated from communication with fluids in the well bore by layers of steel tubing and cement, with producing formations near the bottom of the hole typically thousands of feet from uphole aquifers, separated by cement and packers.

Figure 2.1: Schematic diagram of hydraulically fractured horizontal well – not to scale (US EPA Hydraulic Fracturing Research Study – Scoping Backgrounder, 2010)



The natural gas industry has harnessed a rapidly developed technology that enables natural gas trapped in shale formations to be recovered in a cost-effective manner. The dramatic escalation in the use of the fracking process is due in part to the spike in the price of oil and gas worldwide that rendered such efforts economically viable.

As drilling sites for fracking operations have increased, so have the intensity and specificity of environmental concerns over groundwater pollution, surface water contamination, and depletion of water resources that in some areas are under stress related to extended drought conditions and overuse.

These concerns have been magnified by media hype, hysterical public confrontations, and an increasingly potent environmental community. One CEO of a leading natural gas producer in a speech at an industry conference in Philadelphia recently castigated fear-mongering, anti-drilling extremists who want Americans to live in a world where "it's cold, it's dark, and we're all hungry."[5] Such reactions from industry leaders may be understandable to an extent but cannot obscure the fact that the credibility of the natural gas industry is at an all time low at time when it needs all the friends it can get, particularly when the fracking process is being scrutinized and dissected by multiple layers of state and federal legislative factfinding efforts, and agency

investigations and studies at the local, state and federal level. Moreover, the fracking debate has only been made more contentious by the unfortunate lack of transparency and stonewalling tendency on the part of gas industry in response to public demands for information about the composition of chemical cocktails that are being injected thousands of feet beneath the surface. Concerns over the potential release of fracking wastewater into the environment have only escalated in the face of the industry's refusal to disclose the chemical composition of hydraulic fracturing fluids used.[6] The origins of this divisive debate can be traced back to a little over a half-century ago.

A. A Modern Day Gold Rush

The basic technology behind this modern day gold rush has been around for over sixty years. It was not economically feasible to employ this technology for domestic energy production until the global oil and gas market skyrocketed around 2005. At that point, the development of shale gas extraction through fracking received a major boost in the United States when the oil and gas industry began investing billions of dollars in what promised to be a means of bringing relatively cheap energy to consumers.[7] Incidentally, 2005 was the year fracking was exempted from the Safe Drinking Water Act in energy legislation that included the Halliburton Loophole.

In a nutshell, fracking is a technologically feasible and relatively economical method of extracting natural gas from shale deposits located sometimes thousands of feet beneath the surface. It involves pumping millions of gallons of water into a well under high pressure, with a mixture of "proppants" consisting of sand, chemical additives, and lubricants that "prop" or hold open the fissures or fractures in shale formations from which trapped natural gas can escape and travel to the surface through a gas well constructed in compliance with strict well casing and cementing requirements. The fracking process was described vividly[8] in *Coastal Oil and Gas Corp. v. Garza Energy Trust*, 268 S.W. 3d 1, 6-7 (Tex. 2008), where the court described a 'tight' shale formation as:

> relatively imporous and impermeable, from which natural gas cannot be commercially produced without hydraulic fracturing stimulation, or [fracking], as the process is known in the industry. This is done by pumping fluid down a well at high pressure so that it is forced out into the formation. The pressure creates cracks in the rock that propagate along the azimuth of natural fault lines in an elongated elliptical pattern in opposite directions from the well. Behind the fluid comes a slurry containing small granules called proppants – sand, ceramic beads, or bauxite are used – that lodge themselves in the cracks propping them open against the enormous subsurface pressure that would force them shut as soon as the fluid is gone. The fluid is then drained, leaving the cracks open for gas or oil to flow to the wellbore. [Fracking] in effect increases the well's exposure to the formation, allowing greater production.

B. Environmental concerns

Both water allocation and water pollution control issues arise in the fracking process. With over one million gas wells in this country, and an average of two to eight million gallons of water injected during the fracking process per well,[9] the modern day gold rush may be coming

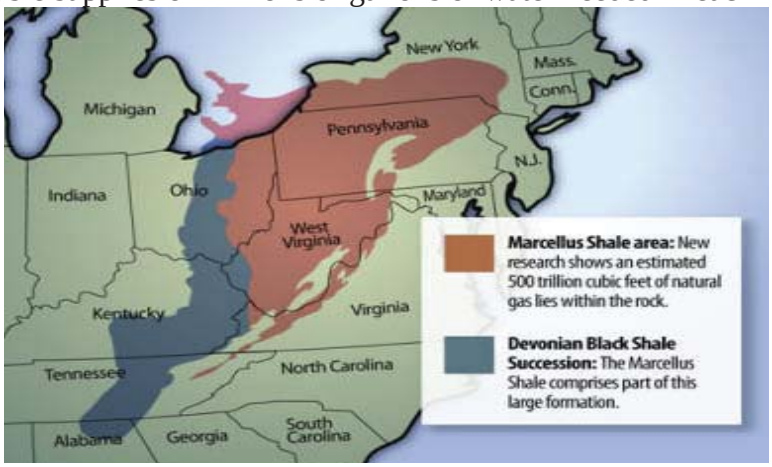
with a high price. The enormous water use requirements for the fracking process can reduce groundwater levels and affect communities dependent on aquifers as a source of potable water.[10]

Groundwater contamination can result from failed casing and cementing of gas wells, or from a failed frack pit. The casing and cementing are supposed to prevent migration of drilling fluids and gas from the well into the groundwater that surrounds the well, but "[o]nce in a while, the cement does not hold up or the pipe fails at the top of the well. That allows the groundwater from down in the lower parts of the well to come up to the top and migrate throughout the drinking water aquifer, causing contamination. It can be contaminated with salt or methane gas from down below."[11] In the event of a failed frack pit, when pressurized water comes back up to the surface and placed into an impoundment, usually a pit lined with a thick plastic liner and sealed, but "[o]nce in a while, however, the lining can rip. When that happens, if there is a drinking water source downstream from the pit, contaminants from the pit will move into the drinking water source and contaminate the well."[12] The driller is usually required to establish a replacement water supply, and mother nature takes over from there, with the aquifer eventually flushing itself clean in six months to a year.

Further, aside from leakage from failed frack pits, there are concerns with flowback left underground when the fracking operation is over. Once the pressure within a well is released, a substantial portion of the fracking fluids – up to forty percent – rise to the surface with the captured gas in the form of high salinity wastewater known as flowback, which can contain heavy metals, chemical additives, and naturally occurring radioactive material. As noted above, some of the flowback is stored in lined open pits or tanks, but some remains underground.[13] The water supply issues surrounding potential depletion of water resources are compounded by environmental concerns over migration of fracking fluids and disposal of flowback and wastewater, particularly in states like New York that have no plants capable of properly treating the flowback through dilution or other means.[14]

C. The Marcellus Shale Play

The Marcellus Shale play is one of the largest shale regions in the United States. It spans over six states and is now the focal point for much of the controversy over hydraulic fracturing and its potential impact on groundwater resources, surface water affected by waste disposal, and sustainable supplies of millions of gallons of water needed in each fracking operation.



The estimate of recoverable gas from the Marcellus Shale was projected to be over 363 trillion cubic feet (TCF) (10.2790 trillion cubic meters or TCM) as of November 2008. Compare this to the estimate of recoverable shale gas for the entire United States in 2011, placed at 860 TCF (24.3524 trillion cubic meters or TCM) according to Advanced Resources International. The U.S. alone uses about 23 TCF (0.651287 trillion cubic meters or TCM) of natural gas annually.[15]

This means the Marcellus Shale gas resource alone could be large enough to supply the needs of the entire nation for at least 15 years at current rates of consumption. As a transitional energy source, such a dependable supply of natural gas extracted from shale could provide the time and economic impetus for the United States to achieve an unprecedented level of energy resource sustainability within the foreseeable future.

As one of the largest shale deposits in the United States, this sedimentary rock formation known as the Marcellus Shale Play was deposited over 350 million years ago in a shallow inland sea located in what would become the eastern United States. It stretches from the Catskill Mountains of New York across Pennsylvania, eastern Ohio, western Maryland and West Virginia.

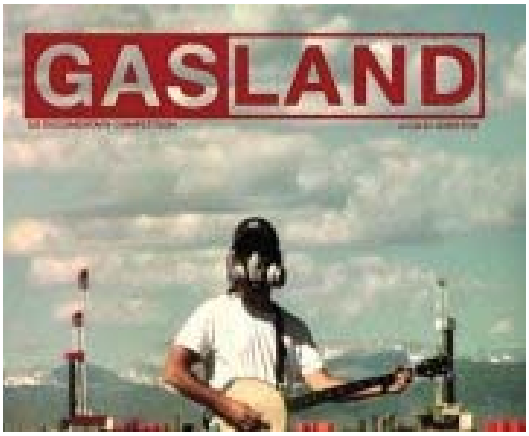
Estimates of the size of the Marcellus Shale Play have increased geometrically over the past decade as more accurate measurement methods have become available. Translating a trillion cubic feet into something most of us can understand is not that difficult. The number of tcf – trillion cubic feet - of shale gas reserves in the Marcellus Shale Play is enough to satisfy a large part of the nation's need for fossil fuel-based energy for several generations. That is more than good news for a nation that has felt the energy noose tightening since the 1973 Arab Oil embargo. That is hope for the future for a nation with lingering memories of long lines at the gas pumps and dramatic increases in the world market price of oil that effectuated a massive transfer of wealth from this nation to the OPEC-member nations.

On the negative side is the fact that the Marcellus shale reserves overlie a major part of the watershed that provides drinking water for New York City and surrounding areas. Drilling of natural gas wells and fracking for shale gas in this watershed entail significant environmental risks that have captured the attention of many people, elected officials at the state and local level, the media and an increasingly well-organized environmental community opposed to fracking.

Major stakeholders have assured the public that in most areas of the Marcellus Shale formation, the induced fractures from the fracking process "should not create a geological pathway to usable quality aquifers," since thousands of feet of rock are often between the usable quality aquifers and the shale. Such assurances come with the caveat that "[i]f development with hydraulic fracture treatments occurs where the Marcellus is shallow and in close proximity to usable quality water zones, the potential effects on aquifers must be addressed." With respect to geological pathways, moreover, let us not ignore the elephant in the living room: the well itself is a "geological pathway" to the overlying aquifers, and wells can and do fail.

D. *Gasland*: Heightened Public Awareness and a Game-Changer

In February 2011, the New York Times launched an investigative series on fracking that highlighted possible radioactivity from fracking affecting streams and waterways in Pennsylvania. About the same time, an Academy-Award nominated documentary entitled *Gasland* was produced by independent filmmaker Josh Fox and aired as an HBO documentary film. *Gasland* went viral as television networks, blogs, and environmental organizations picked up on the story. Clips of it are accessible at http://www.gaslandthemovie.com/.



In the documentary's opening moments, Fox shows startling shots of folks lighting their faucet water on fire, purportedly due to hydraulic fracturing. *Gasland*'s infamous scene of the flaming faucet (likely due to methane migration, but not necessarily related to fracking, according to natural gas industry sources) was attacked by the industry as misleading, fundamentally dishonest and a deliberately false presentation for dramatic effect.[16]

Through interviews with ordinary people who had been living ordinary lives in ordinary communities from the Northeast to the Midwest and Western states, Fox provided a graphic portrayal of the damage that this gas drilling practice had caused across the nation, focusing public attention on hydraulic fracturing, horizontal drilling, and flaming faucets, and also focused attention on the FRAC Act, proposed legislation that would make drilling companies disclose the chemicals injected during the fracking process. Fracking was rapidly becoming a household conversation topic.[17] The Independent Petroleum Association of America launched an "Energy in Depth" compaign to expose the errors, misleading claims and misunderstandings of *Gasland* and issued a seven-page rebuttal to the film, called "Debunking Gasland".[18] America's

Natural Gas Alliance published "The Truth About Gasland,"[19] and other industry groups like the Barnett Shale Energy Education Council challenged the accuracy of *Gasland*'s "myths" that natural gas drilling contaminates water, state regulators are unable to monitor new drilling, no one knows what goes into fracking fluid, hydraulic fracturing is not well regulated, fish kills have been caused by natural gas drilling, residents of a Texas community suffered from illnesses due to pollution from nearby drilling, the 2005 energy bill exempts the oil and natural gas industries from the Safe Drinking Water Act (actually, only a "half truth" according to industry spokesmen).

As Tisha Conoly-Schuller, President and CEO of the Colorado Oil & Gas Association, conceded in public comments on September 13, 2011, the shale gas industry has had its collective ass kicked, and kicked hard, by *Gasland* and others opposed to hydraulic fracturing and needs to redefine its core messages to defuse a burgeoning negative public perception of the controversial drilling technique. According to Conoly-Schuller, "What we've seen in the last few years, and I hope it's peaking, is a completely heightened public awareness around hydraulic fracturing and an increase in active opposition. I hate to credit the movie *Gasland*, but it's really changed the conversation."[20]

The Natural Gas Industry may hate to credit *Gasland*, but it is hard to ignore the fact that this indy movie was not only nominated for an Academy Award for the Best Documentary in 2011, but was also nominated for Best Documentary by Environmental Media Awards; Best Animation by Graphics Cinema Eye Awards; Best Documentary Screenplay by the Writer's Guild of America (WGA); and so far has received the Ono/Lennon Grant for Peace, 2010 Sundance Special Jury Prize, Sarasota International Film Festival Special Jury Prize, Yale Environmental Film Festival Grand Jury Prize, Big Sky Film Festival Artistic Vision Award, Thin Line Film Festival Audience Award, and Traverse City Film Festival, Best Environmental Documentary.

E. Public awareness, media hysteria, and industry retrenchment

The early stages of the fracking debate have been marked by hearings, factfinding and legislative action at the state and national level. Contributing to the public's increasing awareness of the potential environmental risks associated with the fracking process was a new-found

eagerness on the part of the Obama Administration, primarily through the EPA and the Department of Energy, to initiate agency-level studies aimed at protecting public safety while not impeding the necessary development of a vital bridge fuel that could carry our country to an unimagined level of energy independence and energy security. The stage was set for action at every level of government, including municipal, county and other forms of local government.

As if matters needed to be more shaken up, reports began to surface about fracking not only contributing to drinking water contamination but also to the frequency of earthquakes in the region overlying the New Madrid Fault in Arkansas. Indeed, the fact that fluid injection can trigger earthquakes is well-established.[21]

III. Existing and Proposed Water Laws Regulating Fracking

A. Safe Drinking Water Act (SDWA)

The SDWA is the primary law that ensures the quality of Americans' drinking water. 42 U.S.C. § 300f et seq.). Under the Energy Policy Act of 2005, Congress quietly amended the Safe Drinking Water Act to exempt gas drilling and fracking from regulations under the SDWA, creating what has become known as the Halliburton Loophole, §1421(d), under which federal regulators "have no authority to limit the types of their substances. Indeed, natural gas companies do not need to report to federal regulators what their fracturing fluids contain or where they are used."[22] In the 1996 amendments to the Act, Congress recognized that "safe drinking water is essential to human health."[23] The proposed legislation known as the FRAC Act, now pending before the U.S. Senate after passage in the House of Representatives, would amend the SDWA and remove the Halliburton Loophole.

B. Underground Injection Control Program (UIC)

When Congress enacted the SDWA in 1974, Part C of the Act established the Underground Injection Control ("UIC") program that prohibited any "underground injection" (defined as the "subsurface emplacement of fluids by well injection") that endangers underground drinking water sources.[24] Under the UIC, EPA has issued regulations establishing minimum requirements for states to follow, and, if requested, reviews proposed state UIC programs to evaluate compliance with these minimum requirements. If a state chooses not to regulate, EPA runs the program.[25] Underground injection "endangers drinking water sources if

such injection may result in the presence in underground water which supplies or can reasonably be expected to supply any public water system of any contaminant, and if the presence of such contaminant may result in such system's not complying with any national primary drinking water regulation or may otherwise adversely affect the health of persons."

EPA policy into the 1990s was that the UIC program did not apply to hydraulic fracturing because it applied only to operations where the "principal function" of an injection was the placement of fluids, and the principal function of fracking is resource recovery.[26] Given this Orwellian turn of a phrase that allowed injection to continue to take place regardless of the "principal function," states were thus left to regulate fracking under their own laws as they saw fit.

This interpretation stood unchallenged until 1995, when Alabama citizens living near a coalbed methane operation that used hydraulic fracturing reported contaminants in their drinking water wells, and petitioned EPA to require Alabama to regulate fracking under the UIC.[27] Over objections from these landowners, EPA approved Alabama's UIC regulations, which did not govern fracking. The residents appealed EPA's decision and, in 1997, the Eleventh Circuit overruled EPA's interpretation, instructing the agency to begin requiring states to regulate fracking under the SDWA.[28] Although the Eleventh Circuit limited its ruling in 2001,[29] the seeds of regulatory uncertainty had been sown. According to one commentator, different political pressures were quickly brought to bear: "on the one hand, by those concerned with potential environmental impacts of a widespread and largely unregulated industrial practice; on the other, by those concerned that unnecessary government oversight would cripple energy development. The former wanted fracking's environmental impacts studied, the latter wanted the practice exempted from environmental regulation."[30]

In late 2010, EPA posted an announcement in the form of a fracking permit notice on its website that "[a]ny service company that performs hydraulic fracturing" using diesel fuel in the fracking fluid must obtain Underground Injection Control (UIC) program permits as Class II wells. Before this announcement, the UIC program had been operated almost exclusively by individual states, and EPA had not required a federal class II UIC permit prior to drilling despite the fact that fracking operations that used diesel were subject to Safe Drinking Water Act (SDWA) regulation.

On August 21, 2010, the International Petroleum Association of America (IPAA) and the U.S. Natural gas Association filed a petition in the D.C. Circuit alleging that the EPA surreptitiously created new federal regulatory requirements related to fracking in contravention of federal administrative law. Asserting that the EPA's actions "have serious and economic consequences and constitute reviewable final agency action," the IPAA alleged that EPA should have adhered to the Administrative Procedure Act's notice and comment rulemaking requirements when issuing its fracking permitting notice.[31]

At the heart of the dispute was EPA's fracking permit notice, a website statement which, if ruled legal, could mean a wholesale change in how the natural gas industry is regulated in the United States. The legal issue at the core of IPAA's challenge is whether the website posting of the UIC permitting requirements constitutes a "final agency action" under the APA. EPA's

agency determination requiring that any service company that performed hydraulic fracturing using diesel fuel must receive prior authorization from the Underground Injection Control ("UIC") is thus being challenged as a change in legal obligations under the UIC, for which EPA did not undertake notice and commend rulemaking procedures required by the APA.

C. Clean Water Act (CWA)

In 1972, Congress enacted the Clean Water Act,[32]which established a new permit program, the National Pollutant Discharge Elimination System, prohibiting the discharge of pollutants into waters of the United States from any point source, unless with a permit issued under the Act's rigorous regulatory and permitting provisions. The CWA also advanced the goals of prohibiting discharge of toxins in toxic amounts and preserving and protecting state responsibilities and state rights to "prevent, reduce, and eliminate pollution, to plan the development and use … of land and water resources."[33]

The CWA does not require an NPDES permit for discharges to isolated or tributary groundwater or confined wells.[34] Based on the CWA's legislative history, some courts have held that the CWA does not assert authority over groundwater even if hydrologically connected to surface waters, reasoning that Congress could include groundwater as a category of navigable waters (or "waters of the United States") if it intended to do so, and that Congress evidently intended groundwater to be a category of water distinct from the CWA jurisdictional term "navigable waters".[35] The EPA has noted the potential connection between groundwater and surface water, but has left the regulatory definition alone.[36] When discharges to groundwater have resulted in the migration of pollutants to hydrologically connected surface waters, however, some courts have found that a NPDES permit may be required.[37]

Opponents of shale gas fracking generally take the position that the EPA has the right to regulate water when it is combined with sand and chemicals to make the fracking fluid that is injected into underground shale formations to stimulate production of natural gas, while proponents of shale gas fracking take the position that the CWA does not cover fracking fluid since it enters the earth far beneath the water table has no chance to pollute groundwater.[38] As the above case law indicates, the EPA has the authority to regulate water after it comes out of the ground as wastewater, but not while it is below the surface in the form of groundwater. Water that resurfaces from a fracking well is considered industrial wastewater, but while the "fracking water" is underground, it may be subject to applicable state regulations even if beyond the reach of the CWA, under which state regulations may require permits for discharges to groundwater.[39] One may conclude that regulation of fracking during the various stages of the fracking process comes about through a veritable patchwork of state and federal agencies.[40]

IV. Federal and State Monitoring and Regulations on the Horizon

A. New York

Following its July 2011 release of a Supplemental Generic Environmental Impact Statement that addressed permit conditions required for natural gas drilling in the Marcellus Shale, the New

York Department of Environmental Conservation (DEC) completed its revised SGEIS on September 7, 2011 and posted it online for comments which are due by December 12, 2011.[41]

The final SGEIS will apply statewide, except in areas that DEC proposes should be off-limits to surface drilling for natural gas using high-volume hydraulic fracturing technology, which include the watersheds associated with unfiltered water supplied to the New York City and Syracuse areas, reforestation areas, wildlife management areas, and "primary" aquifers as defined by State regulations, and additional setback and buffer areas. Forest Preserve land in the Adirondacks and Catskills is already off-limits to natural gas development pursuant to the New York State Constitution. The revised SGEIS calls for tighter monitoring of wastewater disposal and other process streams, disclosure of chemicals used to the DEC, and other environmental controls, and is expected to tighten environmental protection while allowing the state to maximize the benefits of shale gas development. In an overview of the potential impacts on water resources, the revised SGEIS did not pull any punches:

> significant adverse impacts on water resources exist with regard to water withdrawals for hydraulic fracturing; stormwater runoff; surface spills, leaks and pit or surface impoundment failures; groundwater impacts associated with well drilling and construction; waste disposal and New York City's subsurface water supply infrastructure. During the public scoping process, additional concerns were raised relating to the potential degradation of New York City's surface drinking water supply and potential groundwater contamination from the hydraulic fracturing procedure itself. Water for hydraulic fracturing may be obtained by withdrawing it from surface water bodies away from the well site or through new or existing water-supply wells drilled into aquifers. [W]ithout proper controls on the rate, timing and location of such water withdrawals, the cumulative impacts of such withdrawals could cause modifications to groundwater levels, surface water levels, and stream flow that could result in significant adverse impacts, including but not limited to impacts to the aquatic ecosystem, downstream river channel and riparian resources, wetlands, and aquifer supplies.[42]

B. New Jersey

Even though the Garden State possesses no known natural gas deposits that would require the use of fracking, New Jersey's Legislature earlier this year passed S. 2576, legislation that affirmed the state's involvement in the Regional Greenhouse Gas Initiative (RGGI), by a vote of 32 to 1 in the Senate and 56 to 11 in the House, banning the natural gas drilling technique known as hydraulic fracturing, or fracking.[43] If the New Jersey anti-fracking bill has been signed by Governor Chris Christie, it would have been the first statewide ban on fracking in the United States. On August 25, 2011, however, Governor Christie conditionally vetoed the legislation and proposed a middle-ground solution in lieu of a permanent ban on fracking within the state of New Jersey. He proposed instead a one-year moratorium on all natural gas fracking operations in the state, a decision that was attacked by fracking opponents as "mostly symbolic and highly politically-motivated." Governor Christie explained his proposal as necessary to give the state environmental protection agency the opportunity to "further evaluate the potential environmental impacts of this practice in New Jersey as well as evaluate the findings of still outstanding and ongoing federal studies."[44]

C. Texas

On June 17, 2011, Texas Governor Rick Perry signed into law the United States' first bill which will require natural gas operators to publicly disclose the chemicals they use in all hydraulic fracturing projects in the state.[45] The Disclosure of Composition of Hydraulic Fracturing Fluids Act, H.B. 3328, took effect on September 1, 2011, and has been heralded as the first in the nation to require public disclosure of the chemical composition of fracking fluids and requires disclosure of the type and rate of concentration of base fluids, additives, and chemical constituents used in fracking. Companies subject to the disclosure requirements can protect proprietary chemical formulas by seeking formal approval from the Texas Railroad Commission, and upon receiving such approval, proprietary chemical formulas will be protected from disclosure unless disclosure becomes necessary for medical treatment. The legislation also calls for disclosed chemical composition information to be posted on fracfocus.org, a public website. The law takes effect on September 1, 2011.[46] Fracking opponents nonetheless complained that the legislation was filled with loopholes, particularly the one protecting trade secrets, with one critic remarking "Want to inject millions of gallons of benzene directly into the ground? As long as it's garnished with your secret blend of herbs and spices, you can go right ahead!"[47]

D. Pennsylvania

The secretary of the Pennsylvania Department of Environmental Protection remarked in a June 2010 NPR interview that "gas drilling wastewater is exceptionally polluted. It's nasty, nasty stuff." The Pennsylvania DEP now devotes a web page to news on the Marcellus Shale formation, with answers to frequently asked questions about the area, descriptions of the regulations governing its development, information for landowners considering leasing their mineral rights to natural gas companies, and a list of the hazardous components in various hydraulic fracturing solutions. The state's regulatory enforcement mechanism is fully engaged, as is evident from an August 2010 fine of $97,350 on a Marcellus Shale operator for an incident in which used hydraulic fracturing fluids escaped from a wastewater pit and contaminated a watershed. In an official statement about the pollution incident, the state DEP regional director stated that "[i]t is unacceptable for drilling companies in Pennsylvania to threaten public safety or harm the environment through careless acts, such as this. … The Marcellus Shale offers significant economic opportunities for Pennsylvania, but these companies must adopt operating standards that prevent these sorts of accidents and they must make protecting our water resources a top priority."[48]

Pennsylvania's Environmental Quality Board proposed a series of new rules in May 2010 that "updates existing requirements regarding the drilling, casing, cementing, testing, monitoring and plugging of natural gas wells, and the protection of water supplies." Sierra Club and Earthjustice, a public interest law firm, believe that proposed rules do not go far enough and have commissioned a review of the rule changes by a petroleum and environmental engineer who recommended 47 ways to strengthen the regulations, including setting stronger standards for the surface casing used to protect freshwater aquifers, and a 24-hour deadline to respond to contamination complaints. The Pennsylvania Governor's Marcellus Shale Advisory Commission (MSAC) recently submitted its report and recommendations concerning the development of

natural gas in the Marcellus Shale. Among the Commission's 93 recommendations is to oblige well operators to track and report the treatment and disposal of waste water.[49]

E. Wyoming

In the western states, with their a longer history with the combination of hydraulic fracturing and horizontal drilling, the industry-friendly state of Wyoming introduced what was heralded as "some of the nation's toughest rules governing fracturing" in June 2010, including requirements that companies disclose the ingredients in their fracking fluids to state regulators. The disclosure requirement was the first in the nation, although the new rules to not require that those ingredients be disclosed to the public.[50]

F. Colorado

In 2007 the state of Colorado revamped its natural gas laws to require that companies maintain an inventory of the chemicals used in the fracking process at each well. The inventory is required to be maintained for the life of the well plus an additional five years. While the companies do not have to file the list with state regulators, they are required to provide it to the Colorado Oil & Gas Commission on request, and while the inventory list is not available to the general public, the Commission can then share the information with health officials or a treating physician under a confidentiality agreement.[51]

G. Delaware River Basin Commission

In addition to state regulators weighing in on fracking, multistate entities like the Delaware River Basin Commission are stepping up their regulatory oversight. The Commission oversees the 330-mile Delaware River flowing through New York, Pennsylvania, New Jersey and Delaware, with over 15 million people depending on the basin for their drinking water, farming and industrial needs. In May 2009, it took a tough stance in requiring commission approval of any natural gas drilling in the Delaware River Basin, citing concerns that the massive amounts of water required for hydraulic fracturing would deplete the aquifers, that drilling operations could pollute groundwater or surface water, and that the recovered fracking fluids would not be treated and disposed of properly. The Delaware River Basin's actions were challenged by oil companies as well as environmental groups. Avoiding a federal district court hearing at the last minute, the parties may still challenge the Basin's Natural Gas Development Regulations issued in December 2010, which apply to "all natural gas development projects ... in the Basin regardless of the target geologic formation, and to water withdrawals, well pad and related activities and wastewater disposal activities comprising part of, associated with or serving such projects." The regulations as drafted impose requirements on operators who plan to drill and operate natural gas wells in the Delaware River Basin, including requirements for bonds and other financial assurance that the state may require for a permitted well, a requirement that operators maintain an additional $ 125,000 in financial assurance per natural gas well, and contribute to a separate excess financial assurance account of up to $ 25 million. The regulations if allowed to become effective would also impose broad reporting requirements on operators who receive Basin approval of natural gas well projects, including reporting any "circumstances that may reasonably lead to a finding of a violation [of the Basin's rules]," and any complaints that an

operator receives regarding a project. The regulations will also require operators to repair, replace, or otherwise mitigate impacts to "any ground or surface water user which is substantially adversely affected, rendered dry or otherwise diminished as a result of the project sponsor's withdrawal."[52]

H. The FRAC Act

A report several years ago from the House Committee on Energy and Commerce disclosed that that natural gas service companies conducting fracking operations had used over 2500 fracturing products containing 750 chemicals, toxic and carcinogenic. The House Committee report lists every chemical disclosed by the natural gas industry, revealing that some of the chemicals are proprietary and cannot be identified. As the report notes:

> Up until 2005, much of the discussion and debate over fracking took place outside the mainstream public's perception. Concerns grew over the environmental and public health impacts of hydraulic fracturing fluids used to fracture rock formations, fluids that contained numerous chemicals that could harm human health and the environment, especially if they enter drinking water supplies. The opposition of many natural gas companies to public disclosure of the chemicals they use in the fracking process only compounded this concern. As the volume and intensity of demands continued to escalate for the natural gas industry to provide detailed disclosure of the chemicals used in fracking, the industry was nearing the end of a time when it could simply assure regulators that fracking fluids were basically benign and in any event could be contained underground or handled carefully on the surface. While resisting disclosure of
> the precise chemical makeup of these chemicals based on claims that their formulas are proprietary intellectual property, opposing environmental concerns increasingly emphasized that some chemicals used in fracking operations were known to be toxic, that increased use led to increased risk of spills, and that regulators would not know what to test for and medical professionals would not know what to look for if the chemicals remained secret.[53]

Disclosure bills began to surface at the local, state and federal level, and disclosure language was attached to the Senate's legislative response to the Gulf Oil Spill.[54] The Fracturing Responsibility and Awareness of Chemicals Act, H.R. 2766 and S. 1215, known as the FRAC Act, was introduced to both houses of the 111th United States Congress on June 9, 2009. Its aim was to close the Halliburton Loophole and repeal the exemption for hydraulic fracturing in the Safe Drinking Water Act. The FRAC Act would require the energy industry to disclose the chemicals it mixes with the water and sand it pumps underground in the fracking process, information that has largely been protected as trade secrets. The energy and gas industry opposed the legislation, and it did not become law.

On March 24, 2011, however, the FRAC Act was re-introduced in the 112th United States Congress, was passed by the House of Representatives, and is now before the U.S. Senate, where it was initially referred to the Senate Committee on Environment and Public Works, and the last bill status report of April 12, 2011 reflects that hearings will be held by that committee jointly with the Subcommittee on Water and Wildlife.[55] Sponsors of the 2011 bill noted that

there was a "growing discrepancy between the natural gas industry's claim that nothing ever goes wrong and the drumbeat of investigations and personal tragedies which demonstrate a very different reality."[56] They characterized the FRAC Act as "a simple, common sense way to answer the serious concerns that accompany the rapid growth of drilling across the country," restoring "a basic, national safety-net that will ensure transparency within the industry and safeguard our communities. If there is truly nothing to worry about, then this bill will lay the public's concern to rest through science and sunlight."[57]

V. Framing of the Public Debate: Sound Science, Facts and Reason

The fracking process has raised several distinct concerns relating to water quality and quantity:

(1) Groundwater contamination;[58]

(2) Wastewater and flowback disposal potentially affecting surface water;[59] and

(3) Water supply overuse and the potential impact on other important uses of large amounts of water used in the fracking process.[60]

One of these environmental issues was the subject of an October 10, 2008 report that brine from gas well drilling in Pennsylvania led to excessive dissolved salts being discharged from a wastewater treatment plant into the Monongahela River. It is very common for brine to contaminate groundwater when brine injection wells fail. The fracking process has apparently led to impairment of water quality in that river and prompted the Pennsylvania Department of Environmental Protection to order nine wastewater treatment plants on the river to curtail treatment of gas well drilling brine until further notice.

In discussing the Monongahela River incident, one commentator noted in "Marcellus Shale: Material Drinking Water Risks?" that "[t]he extent to which opponents of drilling projects will obtain 'traction' will likely be a function of the frequency and severity of the occasions when adverse environmental impact is tied to some aspect of a drilling operation," and that a damper could be put on the Marcellus "gas rush" with the occurrence of a few more issues like this one.[61]

In addition to assurances from the American Petroleum Institute, practitioners in this field suggested that the concerns and public opposition to fracking were being overstated. One noted that "while guarantees cannot be provided, [fracking] in the Marcellus deposit occurs well below the depths at which drinking water aquifers are located" and that the regulatory focus on drinking water protection is "ahead of the fact, not after the fact." Unfortunately, such assurances do not take into account the fact that wells must still be drilled through and pass through these water-bearing units.[62]

VI. The Scientific Debate: Academic, Federal and State Studies

Up until recently, most of the debate over environmental risks associated with fracking was not driven by good science, but by anecdotal evidence.[63] Calls have been made for hydraulic fracturing to receive the highest regulatory priority through instigation of a federal, scientifically rigorous report prepared by the National Academy of Sciences or a similar "neutral" body and a simultaneous regulatory risk-limiting mechanism.

Scientific and government-sponsored studies have been cited in recent years as reassurance that some of these groundwater contamination concerns were "being actively addressed in those states and water basins subject to the jurisdiction of regulatory bodies governing water withdrawal" and that "concern about groundwater contamination has received little substantive support from either regulators or the scientific community."[64]

These studies are already outdated and are neither scientifically conclusive nor reassuring. Sources for these reassurances included two public statements, one from the New York Department of Environmental Conservation and the other from the Natural Gas Compact Commission:

First, the Commissioner of the New York State Department of Environmental Conservation's testimony that "no realistic risk of groundwater contamination from the fracking process exists," and that "[t]he same geology that has sealed natural gas in the rock for millions of years - together with our strict well casing and cementing requirements - prevents any risk of groundwater contamination from the drilling and fracking operation. As a result, the only likely vector for possible threats to groundwater comes from the surface management of the water used in the drilling and fracking operations."[65] Granted that this latter observation is a bold, categorical statement that discounts the likelihood of well failure, if these requirements were as effective as the New York DEC indicated, they could be the starting point for an accurate and reliable means of reducing the chances of failure. If enforced by external governmental regulatory controls, as opposed to the kind of industry self-policing evident when the Deep Horizon blowout in the Gulf of Mexico took place in 2010, such regulatory oversight could go a long way toward restoring public confidence in the ability of energy exploration and development to coexist with and not threaten environmental safety.

Second, a statement by the Interstate Natural Gas Compact Commission on its website that "In 2004, the U.S. Environmental Protection Agency completed a study of the environmental risks associated with the hydraulic fracturing of coal bed methane wells. The EPA concluded that the injection of hydraulic fracturing fluids poses little or no threat to underground sources of drinking water. Although thousands of wells are fractured annually, the EPA did not find a single incident of the contamination of drinking water wells by hydraulic fracturing fluid injection. Effective state regulation has made hydraulic fracturing a safe and environmentally-sound way to maximize and conserve our nation's natural resources."[66]

The same authors also noted that The Catskill Riverkeeper organization and others in the environmentalist community have charged that hydraulic fracturing may result in groundwater contamination, but the cases cited by these organizations where hydraulic fracturing is the

suspected source of impaired or polluted drinking water do not involve fracking at the depths involved with the Marcellus region.[67] It should be noted that such "geology will keep us safe" arguments may often be true, but not always. The environmental risks incident to the fracking process are indeed site specific, but concerns accurate site characterization still remain, that is, over whether the natural gas industry can and will adequately and accurately characterize exploratory holes, core samples and geophysical exploration to determine lithology and any potential fast paths prior to commencing fracking operations. More substantial and encompassing regulation may be the only reasonable and appropriate alternative.

A. Duke University Study

One of the first scientific reports connecting methane contamination of groundwater to fracking was published by a team of scientists at Duke University. Their study came under sharp criticism from the moment it was released in April 2011.[68] It did not note that researchers sampled 68 wells across Pennsylvania and New York, where more than 20,000 water wells are drilled annually, nor did it reflect any baseline data and provide any valid basis for determining if methane concentrations were high prior to drilling.[69] The study did acknowledge that methane was detected in 85% of the wells tested, regardless of drilling operations, and no trace of fracking fluids were found in any wells. The Duke study also noted the possibility of leaky well casings at the top of a drilling site, from which methane could migrate to water supplies. Risks incident to proper well construction and maintenance are not unique to fracking, are encountered in any type of drilling, and along with adequate site characterization prior to beginning operations should be the focus of industry standards and attention.[70]

B. Cornell University Study

In February 2011, just as the Senate Environment and Public Works Committee was about to convene a subcommittee hearing on the safeness of hydraulic fracturing in the United States, a Cornell University study was released, explaining how methane gas that escapes during natural gas and fracking production may make natural gas as dirty as coal in terms of carbon emissions. The Cornell University researchers concluded that natural gas pried from shale formations is dirtier than coal in the short term, rather than cleaner, and "comparable" in the long term. Their findings were fiercely disputed by the natural gas industry and severely undermined the widely stated belief that gas is twice as "clean" as coal in terms of greenhouse gas emissions.[71]

C. EPA Science Advisory Board's Proposed Fracking Study

In the Appropriations Committee Conference Report for Fiscal Year 2010, Congress directed the EPA to study the relationship between fracking and drinking water. EPA began the process of preparing a plan for a study to of the potential impacts of hydraulic fracturing on drinking water resources, and vowed to use the best available science and independent sources of information using a transparent, peer-reviewed process and engaging in consultation with stakeholders throughout the study. The EPA Science Advisory Board was appointed, consisting of representatives from 21 states, the Association of State Drinking Water Administrators, the Association of State and Interstate Water Pollution Control Administrators, the Ground Water

Protection Council, the Interstate Natural gas Compact Commission, and representatives from industry and from non-governmental organizations.[72]

On February 7, 2011, the EPA presented its draft plan for the study, the purpose of which was to "understand the relationship between hydraulic fracturing and drinking water resources."[73] The study would "examine the conditions that may be associated with the potential contamination of drinking water resources, and … identify the factors that may lead to human exposure and risks." The EPA's proposed research included "the full lifespan of water in hydraulic fracturing, from acquisition of the water, through the mixing of chemicals and actual fracturing, to the post-fracturing stage, including the management of flowback and produced water and its ultimate treatment and disposal."[74]

EPA in its preliminary remarks about the plan said that many public concerns about hydraulic fracturing centered on potential risks to drinking water resources and impacts of the fracking process used during natural gas production from shale and coalbed methane formations. It also expressed awareness of the "potential risks to surface and underground sources of drinking water [that] might occur at various points in the hydraulic fracturing process" as well as "[t]he likelihood of those risks causing drinking water contamination. …"[75]

Once the draft study plan was submitted to EPA's Science Advisory Board (SAB) for review, stakeholders and the public were asked to provide comments. Concerns were expressed with increasing frequency and volume over whether EPA's study would ultimately raise more questions than it answered. According to one commentator, policymakers are looking to the EPA's study of the potential impacts of fracking on drinking water resources for guidance that will enable them to balance the potential environmental risks against the benefits of this form of increased domestic production of natural gas, and "the agency has to get it right."[76] As one commentator put it:

> [T]hose with a stake in a credible, authoritative analysis of the potential environmental impacts of hydraulic fracturing on drinking water are concerned about EPA's effort. Given the lack of any threshold for degree or probability, EPA's study seems likely to identify potential risks to drinking water. However, industry, environmental groups, and regulatory agencies will be left to debate how those risks should be characterized and whether they are adequately addressed by existing law.[77]

The timetable for the initial and final reports made clear that this was not to be a study in brevity. Initial study results were expected by the end of 2012, but additional reports based on study findings from long-term projects would not be published until 2014.

Some have questioned whether the EPA study is duplicative of other federal efforts to study the fracking issue and whether the study will indeed provide meaningful guidance insofar as it is not a risk assessment, nor does it purport to assess the degree or probability of any potential risk to drinking water posed by fracking.[78] On March 30, 2011, President Obama unveiled a "Blueprint for a Secure Energy Future"[79] setting forth his energy "blueprint" to make sure the nation is "extracting natural gas safely, without polluting our water supply."[80]

D. DOE SEAB Shale Gas Subcommittee Study and 90-Day Report

More than one federal agency has been involved in the 2010-2011 public hearings, studies and research into the fracking process and its potential environmental risks and impact on the future of shale gas production. While EPA initially took the lead, the Department of Energy was not far behind and has now leaped out front.

The week after the President's Blueprint was released, Energy Secretary Steven Chu announced that The Secretary of Energy Advisory Board (SEAB), an independent advisory committee, had been given the responsibility of forming a subcommittee to study the issue. The subcommittee was to be supported by the Department of Energy, EPA and the Interior Department, with its members extending beyond SEAB membership to include industry, environmental experts and states. On August 11, 2011, the Shale Gas Subcommittee of the Secretary of Energy Advisory Board, charged with identifying measures that could be taken to reduce the environmental impact and improve the safety of shale gas production, issued its 90-day report with "recommendations that if implemented will reduce the environmental impacts from shale gas production."

While the EPA fracking study was underway, and well before the 2014 publication of its final study, the SEAB Shale Gas Production Subcommittee in the Department of Energy generated its own interim report on August 11, 2011.[81] The report included recommendations calling for disclosure of all chemicals used for fracking at each well, use of a life-cycle approach to managing and tracking water and wastewater, extensive testing, monitoring, and disclosure of air pollution associated with gas development, reduction in use of diesel fuel, improving communication among state and federal regulators, and further study of the climate change impacts posed by natural gas development. It also identified significant gaps in how state and federal regulators manage shale gas development and pointed out the need for major improvements in the natural gas industry's drilling practices in a manner that protects public health and the environment.[82]

Unlike the EPA study, the SEAB Subcommittee looked beyond the fracking process and took note of the need for make changes in the management of water use and disposal, well design, drilling, cementing and well integrity practices. While these same concerns have been raised with EPA, the SEAB Subcommittee has taken the lead in focusing attention on much needed improvements in these areas.

As with the EPA study committee, the composition of the SEAB Subcommittee panel was severely criticized by the right and left, with the natural gas industry and congressional Republicans complaining the panel was "stacked with former Democratic appointees hostile to drilling," while environmentalists and congressional Democrats complained up to seven panel members had financial ties to the natural gas industry. Panels so balanced are hard to come by, and this one takes the prize as an equal opportunity offender. The panel has provided a series of recommendations for amassing more information on the effects of drilling and sharing that

information with the public. It makes no policy recommendations, suggests no changes in specific laws, regulations or enforcement, and makes the following recommendations:

(1) Improve public information about shale gas operations[83]
(2) Improve communication among state and federal regulators[84]
(3) Improve air quality[85]
(4) Protect water quality[86]
(5) Disclose fracturing fluid composition[87]
(6) Reduce the use of diesel fuel[88]
(7) Manage short-term & cumulative impacts on communities, land use, and wildlife[89]
(8) Organize for best practices[90]
(9) Identify research and development needs[91]

VII. The Dawn of Fracking Litigation

The development of Marcellus Shale has spawned a number of civil actions by plaintiffs asserting claims that the drilling, storage, or containment process and procedure causes contamination of groundwater or the water supply. Four lawsuits filed in Pennsylvania provide examples of the types of claims one can anticipate.[92]

Fiorentino v. Cabot Oil & Gas Corp., 750 F. Supp. 2d 506, 2010 WL 4595524 (M.D. Pa. 2010) is the first reported ruling to arise from a tort claim for personal injuries and property damage from Marcellus Shale Gas drilling. In November 2009, multiple plaintiffs filed suit claiming that Houston-based Cabot Oil & Gas Corporation's drilling activities surrounding 62 gas wells within Dimock Township had caused the release and discharge of hazardous chemicals and pollutants into the plaintiffs' water supply. Specifically, the plaintiffs alleged that fracking fluid used by Cabot included carcinogenic and toxic chemicals that are discharged into the ground, and that diesel fuel, lubricating agents, and related materials used during the drilling process and well operation contributed to the contamination and increased levels of 1, 2, 4-trimethylbenzen, aluminum, iron, N-propylbenzene, and P-isopropyl toluene. The plaintiffs asserted claims based on the Hazardous Sites Cleanup Act, negligence, private nuisance, strict liability, breach of contract, fraudulent misrepresentation, medical monitoring trust funds, and gross negligence, and sought to recover damages for harms suffered, including contaminated water supplies, diminished property value, personal injuries, and emotional distress. Cabot's motion to dismiss was granted with respect to the HSCA claim and gross negligence claim, but denied as to the remaining claims, including the claim for punitive damages, thus allowing the case to go forward through the discovery phase, with Cabot given the right to reassert its defenses by motion for summary judgment after the record was more fully developed.

In Armstrong v. Chesapeake Energy Corp., No. 10-cv-000681 (M.D. Pa. Nov. 29, 2010) and Berish v. Sw. Energy Prod. Co., No. 3:10-cv-01981-ARC (M.D. Pa. Sept. 14, 2010), the plaintiffs have alleged that the affected groundwater contains elevated levels of methane, ethane, barium and other unidentified harmful substances.

In Zimmerman v. Atlas America, LLC, No. 7564 (Washington Cnty. Ct. of C.P. Nov. 9, 2010), the Zimmermans, Pennsylvania tomato farmers, have alleged that chemicals used in or released by hydraulic fracturing contaminated their land and that although baseline water tests

results were "perfect," tests performed after drilling commenced revealed the presence of elevated levels of arsenic, benzene, and naphthalene. The Zimmermans claim focuses on alleged groundwater contamination and seeks monetary compensation for diminution of property value, exposure to allegedly hazardous pollutants, loss of enjoyment of their property, and physical injuries, as well as damages for the loss of a water well on their property that was allegedly compromised as a result of Atlas America's activities and for lost profits associated with tomato farming. They allege that their property became polluted with acetone, benzene, toluene, trimethylbenzene, isopropyl toluene, and other unidentified compounds as a direct result of drilling and related activities.

In Texas, civil litigation over fracking-related claims has been commenced in four different cases. Each involves contamination of water wells allegedly caused by exploration and production activities, and each complaint specifically mentioning hydraulic fracturing, each seeks to impose liability for nuisance, trespass, and negligence, and each requests punitive damages.[93]

In Scoma v. Chesapeake Energy Corp**.,** Civil Action No. 3:10-CV-1385-N (N.D. Texas), the plaintiffs alleged that Chesapeake's drilling activities (including hydraulic fracturing) contaminated their water well and that the effects of the contamination consisted of an intermittent orange/yellow coloring of the water, bad taste, and foul odor. The plaintiffs tested their wells in 2008 and 2009 and alleged that the results showed an increase in the concentration of "harmful petroleum byproducts, such as benzene (a well-known cancer-causing agent), toluene, ethylbenzene, xylene, barium, and iron." They sought to impose liability on the basis of nuisance, trespass, and negligence, and claimed that the continuing tort doctrine tolled the statute of limitations for these causes of action.

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In Mitchell v. Encana Oil & Gas (USA), Inc. Civil Action No. 3:10-CV-02555-L(N.D. Texas), the plaintiff alleged that his well water began to feel slick to the touch and give off an oily, gasoline-like odor in May 2010, and that testing results indicated that the well water contained "various chemicals, including C-12-C28 hydrocarbons, similar to diesel fuel." In addition to claims for nuisance, trespass, and negligence, the plaintiff asserted a claim for fraud and fraudulent concealment alleging that the "[d]efendants failed to warn [the plaintiff] of and have concealed the dangers of the diesel range organic discharges into ground water," and also assert a claim for strict liability due to ultra-hazardous and abnormally hazardous activities identified as "[p]etroleum drilling and hydraulic fracking bore holes." The plaintiff also sought medical monitoring damages.

In Harris v. Devon Energy Production Company, L.P**.,** Civil Action No. 4:10-CV-00708-MHS-ALM (E.D. Texas), the plaintiffs similarly asserted claims for nuisance, trespass, strict liability and negligence arising from contamination of two wells on their property with a gray sediment, rendering them unusable. The plaintiffs also asserted a fraud and fraudulent concealment claim based on a failure to warn the plaintiffs of the dangers of fracking and the chemicals used in the process, and included in their damage claim a request for medical monitoring damages.

In Parr v. Aruba Petroleum, Inc., No. 11-01650-E (County Court at Law No. 5 of Dallas County, filed March 8, 2011), the Parr family, including a minor child, brought this action against nine companies, alleging that the oil and gas exploration and service companies caused releases of various materials resulting in personal injury to the Parr family, injury to their animals and livestock, property damage, and emotional distress, among other damages. They asserted claims for assault, intentional infliction of emotional distress, negligence, gross negligence, negligence per se, private nuisance, trespass (including subsurface trespass), and strict liability for abnormally dangerous activity. As in the previous cases, the Parr family also claimed that the continuing tort doctrine tolled the statute of limitations for their causes of action. In addition to monetary damages, the Parr family requested exemplary damages, remediation, injunctive relief "precluding current and future drilling and fracking activities near Plaintiffs' land," and medical monitoring damages.

VII. Water Resource & Supply Challenges in Eastern and Western Water Law Regimes

A thorough analysis of water rights and the challenges for effective and responsible water resource management in the over 34 states in which hydraulic fracturing operations are underway is beyond the scope of this presentation. Suffice it to say that the fracking process is filled to the brim with water resource challenges. In states through which the Marcellus Shale play is located, for example, unprecedented scrutiny will likely be given to common law and statutory regimes governing the allocation, withdrawal and demands that are being placed on freshwater supplies, whether surface water or groundwater.

Environmental concerns centering on water supply and water quality have fueled the debate over this natural gas extraction technique at a time when the United States is poised to break free from the stranglehold of dependence on energy supplies from halfway around the globe. The role of state and local governments and regulatory agencies in addressing those concerns is significant and will remain so as we move forward.

The fracking debate has unearthed critical issues relating to the adequacy and viability of water resources, the need for effective and sustainable water management, the feasibility of

water conservation practices, and the ability of state and local government to continue their role as the primary source for enforcement and oversight with respect to of water quality protection and water pollution control, prevention and remediation.

Broadly speaking, water law is a matter of state law as to which the United States has wisely opted not to preempt. There is no federal common law governing water quantity, quality, use, allocation and management. There are clearly federal statutes with regulatory programs that carve deeply into state-level prerogatives in the water law arena, including the Clean Water Act, the Safe Drinking Water Act and the UIC Program, the Clean Water Act, and CERCLA, to name a few. But the water-related issues that we have identified as arising from the fracking process center on the acquisition and use of water in fracking operations and the disposal of flowback and fracking wastewater once those operations have been completed. These are areas traditionally within state control and oversight.

Likewise, the current water allocation systems in the United States are the prior appropriation system in the arid western states and the regulated riparian and common law riparian system in the eastern states, with certain exceptions and qualifications for permitting systems that in at least three states consist of elements of both prior appropriation and regulated riparianism. Federal preemption of water allocation systems is not on the horizon. When addressing issues involving the source of water for increased demands and needs arising from the fracking process, the legal regimes governing use of groundwater fall into the categories of regulated riparian doctrine, common law riparian doctrine, conjunctive use, absolute ownership and dominion, and rule of capture. All of these are state law regimes that have developed with a specific linkage to state resources, geography, geology, geohydrology, climate, history and politics. The concomitant standards for decisionmaking in each of these regimes are beneficial use and reasonable use, no harm to existing users, and the public interest, all informed by specific statutory and common law developments in each state.

Given these significant variations in water regimes, water allocation systems and sources of legally cognizable rights among competing users of water resources, one might readily conclude that water law was complicated enough *before* the energy development opportunities and challenges presented by fracking came along. Perhaps the most appropriate observation one can make is that these water resource and energy development challenges will call for a significant degree of strategic planning and legal and regulatory finesse.

A good example of how one court resolved the clash between separate legal doctrines applicable to groundwater and surface water is Michigan Citizens for Water Conservation v. Nestle Waters North America, Inc.[94] In that case the Michigan Court of Appeals held that a bottled water company would be permitted to pump 200 gallons per minute until the trial court could work out how much pumping should be allowed under the reasonable use doctrine to reasonably protect the plaintiff's riparian rights in enjoying a stream. In resolving this issue, the Court addressed claims that groundwater withdrawals for a new bottled water facility would have a negative impact on water levels in certain wetlands and the flow of a stream, to the detriment of the recreational and aesthetic interests of an environmental organization. In doing so it dealt with the cross-resource impacts and applied a reasonable use balancing test. First, the Court noted that "in our increasingly complex and crowded society, people of necessity interfere

with each other to a greater or lesser extent," and that one's right to the enjoyment of water and one's water use as it may affect the availability of a common resource cannot be expressed in terms of an absolute right. Second, it reasoned that the reasonable use balancing test must be employed to assist the court in making a case-specific inquiry:

> [I]t is not merely whether one suffers harm by a neighbor's water use, nor whether the quantity of water available is diminished, but whether under all the circumstances of the case the use of the water by one is reasonable and consistent with a correspondent enjoyment of right by the other.[95]

Under this reasonable use balancing test, the court must balance all uses of surface water and groundwater against each other, considering the factors similar to those enumerated in Restatement (Second) of Torts §850, namely,

(1) the purpose of the use,
(2) the suitability of the use to the location,
(3) the extent and amount of the harm,
(4) the benefits of the use,
(5) the necessity of the amount and manner of the water use, and
(6) any other factor that may bear on the reasonableness of the use."[96]

The Court of Appeals also determined that in applying this balancing test, natural uses are preferred over artificial uses, and uses on the land are preferred over uses that "ship the water away."[97] This balancing approach to determining water use conflicts could be employed in the context of water supply and allocation disputes arising from the seemingly large withdrawals of freshwater resources needed for fracking operations.

When addressing the issue of liability for harmful impacts caused by water supply withdrawals and water supply development incident to fracking operations, one must evaluate applicable state law governing water rights and water allocation, focusing on the particular water withdrawal and allocation regulatory regime and the extent to which it provides for different or even conflicting treatment of surface water and groundwater. Liability may turn not only on the location and nature of the water withdrawal at issue, but also on whether the water use or withdrawal is (1) in the form of installing and using water from surface water sources or wells that has an impact on downstream flows or causes depletion of an aquifer, or (2) in the form of fracking for shale gas in a way that has an impact on the quantity of groundwater or that contributes to groundwater pollution. An excellent analysis of some of the water resource challenges that are just now beginning to find their way into our judicial system in the context of shale gas development has been provided in two articles by Timothy Weston, "Development of the Marcellus Shale – Water Resource Challenges,"[98] and "Harmonizing Management of Ground and Surface Water Use Under Eastern Water Law Regimes."[99]

VIII. Conclusion: Federal Floor and State Regulatory Oversight

Establishing and coordinating standards at the federal level, coupled with meaningful and proactive state regulatory oversight, requires a mature understanding of cooperative federalism, particularly in a time of federal government shrinkage and retrenchment. It may be one of the

best approaches to resolving or at least bringing some degree of détente to the fracking debate. Federal involvement by defining a floor and uniform standards for environmental safety and protection of water resources that involve multistate users would provide the framework for an increased, coordinated and narrowly tailored state regulatory presence on a site-specific basis. The federal role would exist in recognition of the fact that waterways, aquifers, and water supplies do cross state boundaries. The federal role also bespeaks recognition of the need for national uniformity in our energy policy and energy security, both uniquely impacted by the fracking debate.

The need for such a solution is great. At the moment, political gridlock and acrimonious debate over natural gas development can preclude states and communities from realizing the economic benefits of natural gas as a reliable, transitional energy source. Ignoring the need for ramped-up regulatory oversight would be a moronic choice for even these most disingenuous of extremists on either side of the fracking debate. Shale gas is indeed a critical bridge fuel on a path to energy independence for our nation and for the world, but environmental safety and a reliably adequate water supply cannot be assured with the same lax regulatory control that characterized the past decade. Without a good faith, comprehensive, and coordinated effort to achieve a solution to the fracking debate, it can and will spill over to Congress and state legislatures, as we have seen in New Jersey and local government bodies tired of waiting for federal or state intervention, and that will come with uncertain consequences.

A reporting and disclosure mechanism similar to the FRAC Act of 2011 may provide the communication and information network that is an essential element of ensuring that our nation's water resources are protected, public health, water supplies and water quality are not compromised, and states and communities are not exposed to unknown environmental risks. In conjunction with such a reporting and disclosure mechanism, consideration could be given to creating a federal-state cooperative authority focused on monitoring and risk management, capable of addressing the following concerns over water resource supply and quality for surface water and groundwater in the vicinity of hydraulic fracturing operations:

(1) Best practices for treatment: protocols and best practices for the treatment, disposal or recycling of fracking waste fluid, which cannot be treated like oil field brines and reinjected into the ground, since the water did not come from that source to begin with;
(2) Disclosure of chemicals: implementation of a transparent and effective process for disclosing the identity of all chemical ingredients, components and additives using in fracking fluids and propping material;
(3) Public participation in permitting: expansion of public input and participation in the permitting process when dealing with transboundary aquifers and water resources;
(4) Monitoring of contaminants: coordination of efforts to monitor contaminants such as radium, barium, strontium and other heavy metals, radioactivity, and other environmental risks associated with hydrofracking fluid waste; and
(5) Shared technology: increasing the level of public-private collaboration and sharing of technology to increase level of understanding of the impacts of drilling and extraction processes on the management and protection of water resources and water supplies.
(6) Remediation for injuries and losses: remediation protocols by the industry – provisions to authorize and facilitate payment of monetary damages to landowners and others determined to have suffered injuries or losses as a result of failures during the fracking process, accidental

spills or contamination attributable to spillage, leakage or other contamination above or below the surface at or near hydraulic fracturing sites.

Under the current regulatory regime, the greater weight of competent, peer-reviewed, scientifically validated and reliable evidence indicates that hydraulic fracturing as a technologically available method for extraction of shale gas likely cannot be performed in an environmentally safe manner, particularly with respect to the water-related issues discussed above. But the winds of change are already being felt at all levels of the public and private sector. With appropriate strengthening of regulatory oversight and coordinated risk management efforts at the national, state and local levels, coupled with meaningful public participation, a balance can be struck between the safety and environmental security of the public and the continuing development of shale gas as a growing energy resource and a key to the future energy security of our nation.

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[1] Juliette Kayyem, *Rethinking the Fracking Debate*, The Boston Globe, August 22, 2011, http://www.statesman.com/opinion/rethink-the-fracking-debate-1775276.html?printArticle=y; Kenneth B. Madlock III, Ph. D., Amy Myers Jaffe, and Peter R. Hartley, Ph. D., *Shale Gas and U.S. National Security* at 23 n.14, James A. Baker III Institute for Public Policy and U.S. Department of Energy, July 2011, http://www.bakerinstitute.org/publications/EF-pub-DOEShaleGas-07192011.pdf

[2] Kenneth B. Madlock III, Ph. D., Amy Myers Jaffe, and Peter R. Hartley, Ph. D., *Shale Gas and U.S. National Security* at 13, James A. Baker III Institute for Public Policy and U.S. Department of Energy, July 2011, http://www.bakerinstitute.org/publications/EF-pub-DOEShaleGas-07192011.pdf

[3] *Obama Discovers the Virtues of Natural Gas,* NGI Reports, BusinessWire, April 1, 2011, http://www.cngnow.com/EN-US/NewsAndEvents/Pages/Obama-Discovers-the-Virtues-of-Natural-Gas-NGI-Reports.aspx

[4]Thomas E. Kurth, Michael J. Mazzone, Mary S. Mendoza and Chris S. Kulander, *American Law and Jurisprudence on Fracing—2011*, accessible online at http://www.haynesboone.com/files/News/bc104daf-7461-4aec-8243-65f4d698ac70/Presentation/NewsAttachment/87417183-0c8c-46f2-b5c1-e9271a8b7669/Fracking%20Study%202011%20Updated%20Version%2008%2022%202011.pdf

[5] Michael Rubinkam, *Chesapeake CEO takes on anti-drilling 'extremists'*, Associated Press, September 11, 2011, at http://www.bellinghamherald.com/2011/09/07/v-print/2173336/ridge-shale-drilling-worries-phony.html

[6] Matt Armstrong, *The process and policy implications of EPA's hydraulic fracturing study*, 42 TRENDS, No. 6, at 1 (July/August 2011, ABA Section of Environment, Energy and Resources Newsletter); Fred Krupp, *The Smart Path for the Shale Gas Revolution*, Wall Street Journal, Thursday, August 18, 2011, at A15.

[7] Shale Gas: Cheap, Readily Available, Made In USA, Eurasia Review- News and Analysis, April 20, 2011, http://www.eurasiareview.com/shale-gas-cheap-readily-available-made-in-usa-20042011/
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[8] An equally graphic description of fracking is provided by Hannah Wiseman in *Regulatory Adaptation in Fractured Appalachia*, 21 Vill. Envtl. L.J. 229, 238-39 (2010) ("To begin this fracture and fracture "propping" process, a fracking operator punches holes in ("perforates") the well casing. After conducting several fracking-related tests, the operator then cleans the shale around the wellbore by injecting acid down the well and forcing it out of the perforated areas; cleaning is required because the well drilling process can plug the shale pores. Following the acid treatment, the well is ready to be fractured. To prepare the fracking fluid, the operator brings millions of gallons of water to the well pad; the operator either hauls in the water by tanker truck or carries the water to the site through a pipeline, and the operator sometimes stores the water on site in large tanks or impoundments. The operator then mixes what can amount to several thousand gallons of chemicals with the several million of gallons of water to create a fracking "fluid." About a dozen or fewer chemicals, selected from a pool of more than 250 available fracking chemicals, are used. These chemicals, among other functions, allow the fracturing fluid to better carry the proppants, ensure that bacteria do not grow and contaminate the natural gas, and reduce the friction generated when millions of gallons of fluid are pumped through the well bore. The company injects the water mixed with chemicals, which forms the "fracking fluid," at high pressure into the perforated wellbore; this pressurized fluid that is forced down and out of the wellbore causes the shale to fracture or enhances existing fractures, and injected proppants move into these fractures; natural gas then begins to flow through the fractures toward the well. This gas eventually travels back up through the wellbore, through a natural gas processor, and into a gas flow-line. Following the fracturing process, some of the fracturing fluid also flows back up through the well; this "flowback water" is stored in an impoundment at the surface and eventually disposed of. ")

[9] According to the New York State Departments of Environmental Conservation, "It is estimated that 2.4 million to 7.8 million gallons of water may be used for a multi-stage hydraulic fracturing procedure in a typical 4,000-foot lateral wellbore." Revised Draft SGEIS 2011, Executive Summary, Page 8, September 7, 2011; Robert E. Beck, Current Water Issues in Oil and Gas Development and Production: Will Water Control What Energy We Have?, 49 Washburn L. J. 423, 425 (2010).

[10] "The amount of groundwater and/or surface water needed to perform hydraulic fracturing is, by all accounts, substantial. But will it lower aquifers and surface water bodies to levels that pose risks? The answers that are offered in response to these questions differ, of course, based on the source. … Ultimately, whether, and to what extent, water resource impairment is a significant concern will likely depend on the specific location of the proposed water withdrawal and the levels of available groundwater or surface water at the time of withdrawal. Areas not clearly subject to water withdrawal regulation and oversight are by definition more likely to see disputes and, perhaps, impacts." Alerts and Updates, *Marcellus Shale: Material Drinking Water Risks*? November 25, 2008, http://www.duanemorris.com/alerts/alert3054.html

[11] Symposium: *Shall We Drill? The Legal and Environmental Impacts of Extracting Natural Gas From Marcellus Shale*, 2 Vill. Envtl. L.J. 189, 196 (2011).

[12] *Id.*

[13] While risk exists for contamination at the ground surface resulting from spills, overflows from storage basins, "most of the risks appear to be in line with those associated with the collection, storage, transportation and overall management of wastewater streams generated by numerous other industrial processes. Permitting and regulatory programs already exist to address these risks, which are identifiable and quantifiable." Alerts and Updates, *Marcellus Shale: Material Drinking Water Risks*? November 25, 2008, http://www.duanemorris.com/alerts/alert3054.html

[14] Michelle L. Kennedy, *The Exercise of Local Control Over Gas Extraction*, 22 Fordham Envtl. L. Rev. 375, 376-77 (2011).

[15] Id. at 12.

[16] *The Truth About Gasland*, America's Natural Gas Alliance, http://anga.us/truthaboutgasland.

[17] http://gaslandthemovie.com/; http://www.cantonrep.com/newsnow/x2106600386/Palace-screens-documentary-critical-of-fracking; http://www.pbs.org/now/shows/613/index.html; http://abcnews.go.com/Entertainment/Technology/filmmaker-blasts-energy-alternative/story?id=10993095

[18] See also *DEBUNKING GasLand THE MOVIE*, a blog posted by Robin Fehrenbach Scala on June 15, 2010, at http://gomarcellusshale.com/profiles/blogs/debunking-gasland-the-movie

[19] Accessible online at http://anga.us/truthaboutgasland?gclid=CIKHydz5pKsCFREj7AodSg2c1A.

[20] *Shale Gas Industry Insider: We Are Losing the Messaging War on Fracking*, Natural Gas Watch, Sept. 13, 2011, at *http://www.naturalgaswatch.org/?p=939*

[21] Sara Eddington, Arkansas Earthquakes Decline After 'Fracking' Injection Well Closures, March 14, 2011, Huffington Post, http://www.huffingtonpost.com/2011/03/15/arkansas-earthquakes-2011-fracking_n_835868.html; http://www.foxnews.com/scitech/2011/03/01/fracking-earthquakes-arkansas-man-experts-warn/

[22] The first draft of the Energy Policy Act of 2005 proposed exempting hydraulic fracturing from SDWA regulation, and when the total package of energy reform legislation was nearing passage, the 2004 EPA report "greatly simplified the debate over the fracking issue." When the Senate approved a conference version of the Act on July 29, 2005, it included an amendment to the SDWA, exempting from its scope "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." Unless it was using diesel fuel, fracking would not be federally regulated, leaving states free to continue to regulate as they saw fit. Adam Orford, *Fractured: The Road to the New EPA "Fracking" Study*, September 17, 2010, http://www.martenlaw.com/newsletter/20100917-new-epa-fracking-study#_ftn20.

[23] "Marcellus Shale: Material Drinking Water Risks?" Nov. 25, 2008, http://www.duanemorris.com/alerts/alert3054.html

[24] 42 U.S.C. § 300h et seq.

[25] 42 U.S.C. § 300h(b)(1).

[26] Legal Envtl. Assistance Found., Inc. v. U.S. E.P.A., 118 F.3d 1467, 1471 (11th Cir. 1997).

[27] Id., 118 F.3d at 1478.

[28] Adam Orford, Fractured: The Road to the New EPA "Fracking" Study, September 17, 2010, http://www.martenlaw.com/newsletter/20100917-new-epa-fracking-study#_ftn12.

[29] Legal Envtl. Assistance Found., Inc. v. U.S. E.PA., 276 F.3d 1253 (11th Cir. 2001), cert. denied, 537 U.S. 989 (2002).

[30] Adam Orford, *Fractured: The Road to the New EPA "Fracking" Study*, September 17, 2010, http://www.martenlaw.com/newsletter/20100917-new-epa-fracking-study#_ftn12.

[31] http://www.frackinginsider.com/IPAA%20Petition.pdf

[32] 33 U.S.C. §1251-1376. See generally Clean Water Act Handbook 1-2, 32-33 (3d ed. Mark A. Ryan, Ed., ABA 2011) for a clear, thorough and informative overview of the CWA and its jurisdictional reach. The Rivers and Harbors Appropriation Act of 1899 was the first federal statute governing water pollution control, using a permit-based system administered by the U.S. Army Corps of Engineers, prohibiting unpermitted construction of bridges and other structures and discharges of refuse, dredged or fill material that could interfere with navigation. In 1948, Congress enacted the Federal Water Pollution Control Act, amended in 1965, which provided limited relief from pollution and authorized the adoption of water quality standards for interstate waters.

[33] 33 U.S.C.§1251(b).

[34] See Exxon Corp. v. Train, 554 F. 2d 1310, 1329 (5th Cir. 1977); Washington Wilderness Coal v. Heckla Mining Co., 870 F. Supp. 983, 989-90 (E.D. Wash. 1994); United States v. GAF Corp., 389 F. Supp. 1379 (S.D. Tex. 1975). Accord, Kelley v. United States, 618 F.Supp. 1103 (W.D.Mich.1985) (groundwaters not part of the CWA jurisdictional term "waters of the United States".)

[35] Village of Oconomowoc Lake v. Dayton Hudson Corp., 24 F. 3rd 962,965 (7th Cir. 1994) ("Neither the Clean Water Act nor the EPA's definition asserts authority over ground waters, just because these may be hydrologically connected with surface waters. … The omission of ground waters from the regulations is not an oversight. Members of Congress have proposed adding ground waters to the scope of the Clean Water Act, but these proposals have been defeated, and the EPA evidently has decided not to wade in on its own. S.Rep. No. 414, 92d Cong., 1st Sess. 73 (1972). See also Exxon Corp. v. Train, 554 F.2d 1310, 1325-29 (5th Cir.1977) (recounting this history).")

[36] Preamble to NPDES Permit Application Regulations for Storm Water Discharges, 55 Fed.Reg. 47990, 47997 (Nov. 16, 1990) ("[T]his rule-making only addresses discharges to waters of the United States, consequently discharges to ground waters are not covered by this rulemaking (unless there is a hydrological connection between the ground water and a nearby surface water body.")

[37] Hernandez v. Esso Standard Oil Co., 599 F. Supp. 175 (D. P.R. 2009) ("the CWA extends federal jurisdiction over groundwater that is hydrologically connected to surface waters that are themselves the waters of the United States."). See generally Idaho Rural Council v. Bosma, 143 F. Supp. 2d 1169, 1180 (D. Idaho 2001); Friends of Santa Fe County v. LAC Minerals, 892 F. Supp. 1333, 1357 (D. N.M. 1995); Sierra Club v. Colorado Ref. Co., 838 F. Supp. 1428, 1434 (D. Colo. 1993).

[38] Shelley DuBois, *Does the EPA have the tools to regulate fracking?* CNN Money, October 1, 2010, http://money.cnn.com/2010/10/01/news/companies/EPA_Clean_Water_Act_fracking.fortune/index.htm

[39] See, e.g., Ala. Admin. Code §335-6-6-.03;5 Colo. Code Regs. §1002-61.14;Ill. Admin. Code §309.102;N.Y. Admin. Code. §750-01; Tex. Admin. Code §305(b).

[40] Shelley DuBois, *Does the EPA have the tools to regulate fracking?* CNN Money, October 1, 2010, http://money.cnn.com/2010/10/01/news/companies/EPA_Clean_Water_Act_fracking.fortune/index.htm
[41] *Revised Draft Supplemental Generic Environmental Impact Statement On The Oil, Gas and Solution Mining Regulatory Program Well Permit Issuance for Horizontal Drilling and High-Volume Hydraulic Fracturing to Develop the Marcellus Shale and Other Low-Permeability Gas Reservoirs,* September 7, 2011, accessible at http://www.dec.ny.gov/data/dmn/rdsgeisfull0911.pdf
[42] Id., *Revised Draft,* SGEIS Executive Summary at 9.
[43] *N.J. and France Ban Fracking While N.Y. Is About to Lift Fracking Moratorium,* Aug 9, 2011, Global Energy Network Institute, http://www.geni.org/globalenergy/library/technical-articles/generation/powermag.com/fracking-moratorium/index.shtml
[44] John Romano, *Gov. Christie vetoes bill to ban "fracking" in NJ; proposes one-year moratorium*, Newark Environmental News Examiner, August 26, 2011, http://www.examiner.com/environmental-news-in-newark/gov-christie-vetoes-bill-to-ban-fracking-nj-proposes-one-year-moratorium?render=print#print
[45] http://energyboom.com/policy/texas-passes-landmark-hydraulic-fracturing-legislation
[46] Elizabeth E. Klingensmith, *Texas Signs Fracking Disclosure Bill Into Law*, June 24, 2011, http://www.haynesboone.com/texas_signs_fracking_disclosure_bill_into_law/
[47] Christopher Mims, *Texas Fracking Disclosure Law Has Huge Omissions*, June 22, 2011, http://www.grist.org/list/2011-06-22-texas-fracking-disclosure-law-has-huge-omissions.
[48] http://www.circleofblue.org/waternews/2010/world/fracking-regulations-vary-widely-from-state-to-state/
[49] http://energyboom.com/policy/pennsylvania-governor%E2%80%99s-marcellus-shale-advisory-commission-submits-recommendations
[50] http://www.circleofblue.org/waternews/2010/world/fracking-regulations-vary-widely-from-state-to-state/
[51] John Colson, *New fracking law aimed at greater 'transparency'*, June 18, 2009, The Aspen Times, http://www.aspentimes.com/article/20090618/NEWS/906189986/-1/RSS
[52]Lynn Kerr McKay, Ralph H. Johnson, and Laurie Alberts Salita, *Science and the Reasonable Development of Marcellus Shale Natural Gas Resources in Pennsylvania and New York*, 32 Energy L. J. 125, 132 (2011).
[53] The industry's position was that voluntary compliance worked, and one of its chief examples was the website "FracFocus," at http://fracfocus.org, the hydraulic fracturing chemical registry website that was a joint project of the Ground Water Protection Council and the Interstate Oil and Gas Compact Commission. This website was established to allow companies to voluntarily report the chemicals they used in the fracking process, thereby enabling the public to see what had been injected. In the recent report of the Department of Energy's SEAB Shale Gas Production Subcommittee, while the effort behind the FracFocus website was noted to be "off to a good start," the site itself was criticized as excluding information relevant to concerns over groundwater contamination and was presented in a way that prevented broad analysis of the chemicals. The SEAB Shale Gas Production Subcommittee Ninety-Day Report – August 11, 2011, http://www.shalegas.energy.gov/resources/081111_90_day_report.pdf; *Frack Panel to Industry: Fix Environmental Problems*, August 11, 2011, New York Times, http://www.nytimes.com/gwire/2011/08/11/11greenwire-frack-panel-to-industry-fix-environmental-prob-20662.html?pagewanted=all
[54] Clean Energy Jobs and Oil Company Accountability Act of 2010 (S. 3663), Title XLIII.
[55] Thomas, Bill Summary and Status, http://thomas.gov/cgi-bin/bdquery/z?d112:SN00587:@@@X
[56] *Energy: The FRAC Act is back in Congress*, March 16, 2011, http://summitcountyvoice.com/2011/03/16/energy-the-frac-act-is-back-in-congress/
[57] *Energy: The FRAC Act is back in Congress*, March 16, 2011, http://summitcountyvoice.com/2011/03/16/energy-the-frac-act-is-back-in-congress/
[58] "[C]oncern about groundwater contamination has received little substantive support from either regulators or the scientific community. …[T]he Commissioner of the New York State Department of Environmental Conservation, while expressing the need for study of the impact of water consumption on public water supplies, has publicly testified that no realistic risk of groundwater contamination from the fracking process exists … . '[H]ydraulic fracturing takes places many thousands of feet underground, well below any groundwater zones. Groundwater zones are typically hundreds, not thousands, of feet below the surface. The same geology that has sealed natural gas in the rock for millions of years - together with our strict well casing and cementing requirements - prevents any risk of groundwater contamination from the drilling and fracking operation." Alerts and Updates, *Marcellus Shale: Material Drinking Water Risks*? November 25, 2008, http://www.duanemorris.com/alerts/alert3054.html
[59] Acknowledging that risk exists for contamination at the ground surface resulting from spills, overflows from storage basins, but noting "most of the risks appear to be in line with those associated with the collection, storage,

transportation and overall management of wastewater streams generated by numerous other industrial processes. Permitting and regulatory programs already exist to address these risks, which are identifiable and quantifiable." Alerts and Updates, *Marcellus Shale: Material Drinking Water Risks*? November 25, 2008, http://www.duanemorris.com/alerts/alert3054.html

[60] "The amount of groundwater and/or surface water needed to perform hydraulic fracturing is, by all accounts, substantial. But will it lower aquifers and surface water bodies to levels that pose risks? The answers that are offered in response to these questions differ, of course, based on the source. … Ultimately, whether, and to what extent, water resource impairment is a significant concern will likely depend on the specific location of the proposed water withdrawal and the levels of available groundwater or surface water at the time of withdrawal. Areas not clearly subject to water withdrawal regulation and oversight are by definition more likely to see disputes and, perhaps, impacts." Alerts and Updates, *Marcellus Shale: Material Drinking Water Risks*? November 25, 2008, http://www.duanemorris.com/alerts/alert3054.html

[61] http://www.duanemorris.com/alerts/alert3054.html

[62] Id.

[63] Matt Armstrong, *The Process and Policy Implications of EPA's Hydraulic Fracturing Study*, 42 Trends 14, No. 6 (July/August 2011 Newsletter of the ABA Section of Environment, Energy and Resources).

[64] November 25, 2008 article "Marcellus Shale: Material Drinking Water Risks?" William Yeatman, 'Fracking' in Europe: Who's in, Who's Out, May 12, 2011, http://www.globalwarming.org/2011/05/12/%E2%80%98fracking%E2%80%99-in-europe-who%E2%80%99s-in-who%E2%80%99s-out/http://www.duanemorris.com/alerts/alert3054.html

[65] Testimony of Commissioner Alexander Grannis October 15, 2008 before the New York State Assembly Hearing on Natural gas Drilling, October 15, 2008.

[66] See http://www.iogcc.state.ok.us/hydraulic-fracturing.

[67] http://catskillmountainkeeper.org/node/290.

[68] Stephen G. Osborna, Avner Vengoshb, Nathaniel R. Warnerb, and Robert B. Jackson, *Methane contamination of drinking water accompanying gas-well drilling and hydraulic fracturing*, April 14, 2011, Proceedings of the National Academy of Sciences of the United States of America, http://www.pnas.org/content/early/2011/05/02/1100682108.full.pdf+html?sid=bde16321-e169-437d-a59c-798e7f65c479; http://www.pnas.org/content/suppl/2011/05/03/1100682108.DCSupplemental/pnas.1100682108_SI.pdf

[69] http://online.wsj.com/article/SB10001424052702303936704576398462932810874.html

[70] http://online.wsj.com/article/SB10001424052702303936704576398462932810874.html

[71] Robert W. Howarth1, Renee Santoro, and Anthony Ingraffea, *Methane and the Greenhouse-Gas Footprint of Natural Gas from Shale Formations* (Climatic Change 2011), published with open access at Springerlink.com and accessible at http://graphics8.nytimes.com/images/blogs/greeninc/Howarth2011.pdf, and http://rfflibrary.wordpress.com/2011/04/11/methane-and-the-greenhouse-gas-footprint-of-natural-gas-from-shale-formations/

[72] Written Testimony of Paul Anastas, PhD, Assistant Administrator for Research and Development, U.S. Environmental Protection Agency (EPA), Hearing on The Office of Research and Development Research Plan to Study the Potential Impacts of Hydraulic Fracturing on Drinking Water Resources Before the U.S. House of Representatives Committee on Science and Technology, May 11, 2011.

[73] Draft Plan to Study the Potential Impacts of Hydraulic Fracturing on Drinking Water Resources, Office of Research and Development U.S. Environmental Protection Agency, http://water.epa.gov/type/groundwater/uic/class2/hydraulicfracturing/upload/HFStudyPlanDraft_SAB_020711.pdf

[74] Id; http://www.epa.gov/safewater/uic/pdfs/hfresearchstudyfs.pdf

[75] Id.

[76] Matt Armstrong, *The Process and Policy Implications of EPA's Hydraulic Fracturing Study*, 42 Trends 1, No. 6 (July/August 2011 Newsletter of the ABA Section of Environment, Energy and Resources).

[77] Id. at 14.

[78] Matt Armstrong, *The Process and Policy Implications of EPA's Hydraulic Fracturing Study*, 42 Trends 14, No. 6 (July/August 2011 Newsletter of the ABA Section of Environment, Energy and Resources).

[79] http://www.whitehouse.gov/sites/default/files/blueprint_secure_energy_future.pdf

[80] http://www.whitehouse.gov/blog/2011/03/30/obama-administration-s-blueprint-secure-energy-future

[81] *The SEAB Shale Gas Production Subcommittee Ninety-Day Report*, August 11, 2011, http://www.shalegas.energy.gov/resources/081111_90_day_report.pdf
[82] http://www.shalegas.energy.gov/resources/081111_90_day_report.pdf
[83] Create a portal for access to a wide range of public information on shale gas development, to include current data available from state and federal regulatory agencies. The portal should be open to the public for use to study and analyze shale gas operations and results.
[84] Provide continuing annual support to STRONGER (the State Review of Oil and Natural Gas Environmental Regulation) and to the Ground Water Protection Council for expansion of the Risk Based Data Management System and similar projects that can be extended to all phases of shale gas development.
[85] Measures should be taken to reduce emissions of air pollutants, ozone precursors, and methane as quickly as practicable. Rigorous standards should be adopted for new and existing sources of methane, air toxics, ozone precursors and other air pollutants from shale gas operations, with these recommended actions:
(1) Enlisting a subset of producers in different basins to design and rapidly implement measurement systems to collect comprehensive methane and other air emissions data from shale gas operations and make these data publically available;
(2) Immediately launching a federal interagency planning effort to acquire data and analyze the overall greenhouse gas footprint of shale gas operations through out the lifecycle of natural gas use in comparison to other fuels; and
(3) Encouraging shale-gas production companies and regulators to expand immediately efforts to reduce air emissions using proven technologies and practices.
[86] A systems approach to water management should be adopted based on consistent measurement and public disclosure of the flow and composition of water at every stage of the shale gas production process. The following actions are recommended for shale gas companies and regulators – to the extent that such actions have not already been undertaken by particular companies and regulatory agencies:
(1) Measure and publicly report the composition of water stocks and flow throughout the fracturing and clean-up process.
(2) Manifest all transfers of water among different locations.
(3) Adopt best practices in well development and construction, especially casing, cementing, and pressure management. Pressure testing of cemented casing and state-of-the-art cement bond logs should be used to confirm formation isolation. Microseismic surveys should be carried out to assure that hydraulic fracture growth is limited to the gas producing formations. Regulations and inspections are needed to confirm that operators have taken prompt action to repair defective cementing jobs. The regulation of shale gas development should include inspections at safety-critical stages of well construction and hydraulic fracturing.
(4) Additional field studies on possible methane leakage from shale gas wells to water reservoirs.
(5) Adopt requirements for background water quality measurements (e.g., existing methane levels in nearby water wells prior to drilling for gas) and report in advance of shale gas production activity.
(6) Agencies should review field experience and modernize rules and enforcement practices to ensure protection of drinking and surface waters.
[87] The risk of fracturing fluid leakage into drinking water sources through fractures made in deep shale reservoirs is remote. Nevertheless there is no economic or technical reason to prevent public disclosure of all chemicals in fracturing fluids, with an exception for genuinely proprietary information. While companies and regulators are moving in this direction, progress needs to be accelerated in light of public concern.
[88] There is no technical or economic reason to use diesel in shale gas production and recommends reducing the use of diesel engines for surface power in favor of natural gas engines or electricity where available.
[89] Each relevant jurisdiction should pay greater attention to the combination of impacts from multiple drilling, production and delivery activities and make efforts to plan for shale development impacts on a regional scale. Possible mechanisms include:
(1) Use of multi-well drilling pads to minimize transport traffic and need for new road construction.
(2) Evaluation of water use at the scale of affected watersheds.
(3) Formal notification by regulated entities of anticipated environmental and community impacts.
(4) Preservation of unique and/or sensitive areas as off-limits to drilling and support infrastructure as determined through an appropriate science-based process.
(5) Undertaking science-based characterization of important landscapes, habitats and corridors to inform planning, prevention, mitigation and reclamation of surface impacts.

(6) Establishment of effective field monitoring and enforcement to inform ongoing assessment of cumulative community and land use impacts. Affected communities must have the opportunity to participate in this process and the rights of surface and mineral rights owners must be respected.

[90] Creation of a shale gas industry production organization dedicated to continuous improvement of best practice, defined as improvements in techniques and methods that rely on measurement and field experience, is needed to improve operational and environmental outcomes; a national approach could be used with regional mechanisms that recognize differences in geology, land use, water resources, and regulation, for which several different models are under discussion.

Activities relating to air and water deserve priority attention for developing best practices:

For Air: (a) Reduction of pollutants and methane emissions from all shale gas production/delivery activity;

(b) Establishment of an emission measurement and reporting system at various points in the production chain.

For Water: (a) Well completion – casing and cementing including use of cement bond and other completion logging tools; (b) Minimizing water use and limiting vertical fracture growth.

[91] The public should expect significant technical advances associated with shale gas production that will significantly improve the efficiency of shale gas production and that will reduce environmental impact. The move from single well to multiple-well pad drilling is one clear example. Given the economic incentive for technical advances, much of the R&D will be performed by the natural gas industry

[92] Id. at 137-38.

[93] Holly A. Vandrovec, *New Frontiers in Environmental Law: The Fight Over Fracking: Recent Hydraulic Fracturing Litigation in Texas*, 74 Tex. B. J. 390 (2011).

[94] 709 N.W. 2d 174 (Mich. App. 2005).

[95] Id. at 202.

[96] Id. at 203.

[97]Id. at 204.

[98] http://www.wvsoro.org/resources/marcellus/Weston.pdf

[99] 11 U. Denv. Water L. Rev. 239 (2008).