Overview of Environmental Issues and US Regulatory Framework Pertaining to US Shale Gas Development

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I. Overview of the Controversy Associated with Shale Gas Development in the United States

The development of shale gas in the United States has been widely recognized as one of the most promising trends in U.S. both in terms of job creation and economic benefits as well as its resulting increase in the domestic supplies of natural gas.[1] Many people view natural gas as a cleaner-burning fossil fuel that could enhance energy independence, reduce emissions and serve as a bridge fuel to renewable energy.[2]

Though there are many proponents of shale gas, there are also many who oppose it because of the hydraulic fracturing technology necessary to produce it.[3] This opposition has intensified as hydraulic fracturing has become more commonplace in wells around the country and around the world.[4] For its part, the gas industry contends that hydraulic fracturing is safe, well-regulated, and has a proven track record having been used in the United States since the 1940s in drilling more than one million wells.[5]

In support of the safety of hydraulic fracturing, the industry often points to a 2004 EPA study that assessed the potential for contamination of underground sources of drinking water from the injection of hydraulic fracturing fluids into CBM wells.[6] In that study, the EPA concluded that the injection of hydraulic frac-turing fluids into these wells posed “little or no threat to [underground drinking water].”[7] After reviewing incidents of drinking water well contamination, the EPA found “no confirmed cases that are linked to fracturing fluid injection into coalbed methane wells or subsequent underground movement of fracturing fluids.”[8]

The industry also maintains that the continued use of hydraulic fracturing is critically important to producing the natural gas America will need in the future.[9] It is estimated that “[80%] of natural gas wells drilled in the next decade will require hydraulic fracturing”[10] and that without it, the United States could lose “[45%] of domestic natural gas production.”[11]

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II. Environmental Issues Associated with Shale Gas Development in the United States

As discussed in more detail below, the US Environmental Protection Agency (EPA) is currently conducting a national study that should enhance the scientific knowledge of some of the water contamination concerns raised about shale gas extraction. Although the study is on-going, the EPA has already identified some of the potential impacts that shale gas development may have on the environment including:

1. Contamination of underground sources of drinking water and surface waters resulting from spills, faulty well construction, or by other means;
2. Stress on surface water and ground water supplies from the withdrawal of large volumes of water used in drilling and hydraulic fracturing (discussed in Section B below);
3. Adverse impacts from discharges into surface waters or from disposal into underground injection wells; and
4. Air pollution resulting from the release of volatile organic compounds, hazardous air pollutants, and greenhouse gases.[12]

For purposes of this initial article, the primary focus will be on water contamination and water quantity and flowback concerns (discussed in Sections A and B below) since these are the two primary concerns that have been raised by the public.

A. Water Contamination Concerns

Despite the industry's claims that hydraulic fracturing is a safe and proven technology, environmental organizations, public health groups, and local communities have expressed numerous concerns about the potential environmental impacts of the use of hydraulic fracturing around the country.[13] There have been many allegations that hydraulic fracturing has led to the contamination of drinking water in many communities.[14] This has led to increased calls for federal regulation of hydraulic fracturing under the Safe Drinking Water Act (SDWA), which would at least provide a minimum federal "floor" for drinking water protection in the states engaged in drilling shale gas.[15]

The nonprofit, investigative journalism or-ganization, ProPublica, has an extensive in-vestigation of hydraulic fracturing underway.[16] According to that investigation, numerous states have reported cases involving spills of hazardous materials or other occurrences of water contaminated by oil or gas operations.[17] There are also hundreds of cases of water contamination in drilling areas where hydraulic fracturing is used, including some pending lawsuits alleging contamination.[18]

ProPublica has also noted the difficulty scientists face in specifically determining "which aspect of drilling—the hydraulic fracturing, the waste water that accidentally flows into the ground, the leaky pits of drilling fluids or the spills from truckloads of chemicals transported to and from the site—causes [the reported] pollution."[19]

One challenge has been the refusal by the industry to make public the chemical makeup of the hydraulic fracturing fluid used on a particular well.[20] Without this information, "environmental officials say they cannot conclude with certainty when or how certain chemicals entered the water.[21]

B. Water Quantity and Flowback Concerns

Concerns have also been raised pertaining to the large volumes of water needed during the hydraulic fracturing process, and the disposal of the flowback or wastewater from fracturing operations. A recent U.S. Geological Survey (USGS) report noted these concerns in a report dealing with water resources and gas production in the Marcellus Shale.[22] According to the USGS report, "many regional and local water management agencies [in the Marcellus shale region] are concerned about where such large volumes of water will be obtained, and what the possible consequences might be for local water supplies."[23]

Chesapeake Energy Corp., one of the most active drillers in the Marcellus shale,[24] candidly admits water is an essential compo-nent of its deep shale gas development.[25] According to the company, “fracturing a typical Chesapeake Marcellus horizontal deep shale gas well requires an average of five and a half million gallons per well.”[26] Chesapeake also maintains that water resources are protected through stringent state, regional and local permitting processes and in comparison to other uses within the area, deep shale gas drilling and fracturing uses a small amount of water.[27]

Hydraulic fracturing also gives rise to concerns pertaining to the disposal of wastewater.[28] While some of the injected hydraulic fracturing fluids remain trapped under-ground, the majority—60–80% returns to the surface as “flowback.”[29] The USGS has noted that because the quantity of fluids is so large, the additives in a 3 million gallon job would yield about 15,000 gallons of chemicals in the flowback water.[30] Some states, such as West Virginia, have noted that wastewater disposal is “perhaps the greatest challenge” in hydraulic fracturing operations.

Other shale producing areas face the same challenges. In north Texas, increased water use stemming from a growing population, drought, and the Barnett Shale development has led to heightened concerns about water availability.[31] In January 2007, the Texas Water Development Board (TWDB) published a study of a nineteen-county area in North Texas that contains estimates of water used in the Barnett Shale development.[32] The TWDB report indicates that the fracturing of a horizontal well completion can use more than 3.5 million gallons (more than 83,000 barrels) of water.[33]

In addition, the wells may be re-fractured multiple times when the natural gas flow slows after being in production for several years.[34] However, the report estimates that the amount of water used for development has been a relatively small percentage of the total water use.[35] Although growing, the report calculated water used for the Barnett Shale accounted for only three percent of the total groundwater used.[36]

The TWDB report makes predictions of future water needs for the area, including Barnett Shale development.[37] These estimate an increase in the groundwater used from three percent in 2005 to seven to thirteen percent in 2025.[38]

III. Regulatory Framework for Shale Gas Development in the United States

As described above, hydraulic fracturing is a water intensive technology that raises many issues related to the environmental protection of U.S. water supplies. In the United States, the regulation of oil and gas exploration and production activities, including hydraulic fracturing and horizontal drilling, generally falls within the jurisdiction of the states.

However, there are also many federal laws that control certain aspects of oil and gas activities, which include the Safe Drinking Water Act (SDWA), Clean Water Act (CWA), Clean Air Act (CAA), and Resource Conservation and Recovery Act (RCRA). Over the past few years, there have been increasing calls for the Federal Government, through the EPA, to regulate hydraulic fracturing under the SDWA. So far, however, the US Congress has not passed legislation that would give EPA authority to do so.

In the US, there is constant and longstanding tension between the role of the federal government in regulating energy and the role of the states. That this tension exists in terms of shale gas development is not surprising or unique. The oil and gas industry has long maintained that state’s are in the best position to regulate shale gas development and that existing state regulations are adequate to protect water resources during the development of shale gas resources.[39] This view is also shared by the Ground Water Protection Council (GWPC), which represents state groundwater protection agencies and underground injection control (UIC) program administrators.[40]

However, there is a growing contingent of landowners, environmental groups and citizen groups calling for federal regulation and further investigation of hydraulic fracturing due to concerns about water usage and possible contamination.[41] Although a detailed discussion of the numerous state laws is beyond the scope of this article,[42] there are several important federal regulations that are relevant and discussed in detail below.

A. The Safe Drinking Water Act

The SDWA[43] is the primary federal law for protecting public water supplies from harmful contaminants.[44]Enacted in 1974,[45] and broadly amended in 1986 and 1996,[46] the SDWA is administered through a variety of programs that regulate contaminants in public water supplies, provide funding for infrastructure projects, protect underground sources of drinking water, and promote the capacity of water systems to comply with SDWA regulations.[47]

The EPA is the federal agency responsible for administering the SDWA[48] but a federal–state structure exists in which the EPA may delegate primary enforcement and implementation authority (primacy) for the drinking water program to states and tribes.[49] The state-administered Public Water Supply Supervision (PWSS) program remains the basic program for regulating public water systems,[50] and the EPA has delegated primacy for this program to all states, except Wyoming and the District of Columbia (which SDWA defines as a state).[51] The EPA has responsibility for implementing the PWSS program in these two jurisdictions and throughout most Indian lands.[52]

A second key component of the SDWA requires the EPA to regulate the underground injection of fluids to protect underground sources of drinking water. In terms of oil and gas drilling, the UIC program regulations specify siting, construction, operation, closure, financial responsibility, and other requirements for owners and operators of injection wells.[53] Thirty-three states (including West Virginia, Ohio, and Texas) have assumed primacy for the UIC program.[54] The EPA has lead implementation and enforcement authority in ten states, including New York and Pennsylvania, and authority is shared in the remainder of the states.[55]

Notwithstanding the SDWA's general mandate to control the underground injection of fluids to protect underground sources of drinking water, the law specifically states that EPA regulations for state UIC programs "may not prescribe requirements which interfere with or impede any underground injection for the secondary or tertiary recovery of oil or natural gas, unless such requirements are essential to assure that underground sources of drinking water will not be endangered by such injection."[56]

Consequently, the EPA has not regulated gas production wells, and historically had not considered hydraulic fracturing to fall within the regulatory definition of underground injection although it was a bit unclear under US law until the issuance of the Leaf v. EPA case.

Additional background information and insight from the U.S. Congressional Research Service CRS are presented in the paper "Hydraulic Fracturing and Safe Drinking Water Act Issues", published July 2012.

B. Leaf v. EPA

Until 1997, it was unclear whether hydraulic fracturing was regulated under the UIC programs.[57] In Leaf v. EPA, the U.S. Court of Appeals for the 11th Circuit ruled that the hydraulic fracturing of coal beds for coal bed methane (CBM) production constituted an underground injection that must be regulated.[58]However, since that decision was only applicable to states in the 11th Circuit, the only state actually required to revise its UIC program was Alabama.[59]

In response to the decision in Leaf v. EPA [60] and continuing citizen complaints about water contamination attributed to hydraulic fracturing used in CBM, the EPA began to study the impacts of hydraulic fracturing practices used in CBM production on drinking water sources in order to determine whether further federal regulation was needed.[61] In 2004, the EPA issued a final (phase I) report, based primarily on interviews and a review of the available literature, and concluded that the injection of hydraulic fracturing fluids into CBM wells posed little threat to underground sources of drinking water and required no further study.[62]

The EPA noted, however, that very little documented research had been done on the environmental impacts of injecting fracturing fluids.[63] It also noted that estimating the concentration of diesel fuel components and other fracturing fluids beyond the point of injection was beyond the scope of its study.[64]Some members of Congress and some EPA professional staff criticized the report, asserting that its findings were not scientifically founded.[65]

Subsequently, in the Energy Policy Act of 2005[66], the US Congress amended the SDWA Section 1421 to specify that the definition of "underground injection" excludes the injection of fluids or propping agents (other than diesel

fuels) used in hydraulic fracturing operations related to oil, gas, or geothermal production activities.[67] This exclusionary language effec-tively removed the EPA's (previously unexer-cised) authority under the SDWA to regulate the underground injection of fluids for hydraulic fracturing purposes.[68] Environmentalists and others opposed to hydraulic fracturing commonly refer to this exclusionary language as "The Halliburton Loophole," based on a New York Times editorial of the same title.[69]

C. The FRAC Act

As shale gas development spread across the United States, so too did public concern about the safety and environmental impact of hydraulic fracturing. These concerns ultimately made their way to Congress where companion bills H.R. 2766 and S. 1215 were introduced in 2009 an effort to amend the SDWA to specifically include hydraulic fracturing.[70]

Representative Diana DeGette introduced H.R. 2766 on June 9, 2009 and Senator Robert Casey Jr. introduced S. 1215 as the "Fracturing Responsibility and Awareness of Chemicals Act"—or "FRAC Act").[71]The FRAC Act would amend the SDWA definition of "underground injection" to expressly include "the underground injection of fluids or propping agents" used for hydraulic fracturing in oil and gas operation and production activities.[72] The bills would also require public disclosure of the chemical constituents (but not the proprietary chemical formulas) used in the fracturing process.[73] As of October 23, 2010, H.R. 2766 had sixty-nine co-sponsors but ultimately the FRAC Act did not reach the house floor before the 111th Congress recessed.[74] The Act was re-introduced in the 112th Congress where it is still pending.[75]

IV. The US EPA Hydraulic Fracturing Study

In December 2009, six months after the introduction of the FRAC Act 2009, the U.S. House of Representatives Appropriation Conference Committee concluded a focused study analyzing the relationship between hydraulic fracturing and drinking water.[76] The committee believed the EPA should conduct this study.[77] The EPA agreed with Congress that a study was warranted due to the serious concerns from citizens raised about the potential impact on drinking resources, public health, and environmental impacts in the vicinity of shale gas production areas employing hydraulic fracturing technology.[78]

A. EPA Study Approach

In addition to examining the potential relationships between hydraulic fracturing and drinking water, a key goal of the EPA study is to generate data and information that can be used to assess risks and ultimately inform decision makers. The EPA has proposed four approaches to achieve this goal:[79]

1. Compile and analyze background data and information;
2. Characterize chemical constituents relevant to hydraulic fracturing;
3. Conduct case studies and computational modeling; and
4. Identify and evaluate technological solutions for risk mitigation and decision support.

In conducting its study, the EPA intends to follow a case study approach, which is often used in in-depth investigations of complex issues like hydraulic fracturing. The EPA admits that, "developing a single, national perspective on [hydraulic fracturing] is complex due to geographical variations in water resources, geologic formations, and hydrology."[80] Nonetheless, the EPA's intention is that "the types of data and information that are collected through case studies should provide enough detail to determine the extent to which conclusions can be generalized at local, regional, and national scales."[81]

The initial set of research questions proposed by the EPA includes:

1. What sampling strategies and analytical methods could be used to identify potential impacts on sources of drinking water, water supply wells, and receiving streams?
2. Are there vulnerable hydrogeologic settings where HF may impact the quality and availability of water supplies?
3. How does the proximity of HF to abandoned and/or poorly constructed wells, faults, and fractures alter expected impacts on drinking water resources and human health?
4. Is there evidence that pressurized methane or other gases, HF fluids, radionuclides, or other HF-associated contaminants can migrate into underground sources of drinking water? Under what conditions do these processes occur?

B. Recent Developments in the EPA Study

On November 2, 2011, EPA released details of its hydraulic fracturing study plan.[82] As set forth in the study, EPA will focus on the entire hydraulic fracturing water lifecycle, which includes water acquisition to wastewater treatment and disposal.

EPA will use a case study approach and has selected seven case studies that EPA believes will provide the most useful information about the potential impacts of hydraulic fracturing on drinking water resources under a variety of circumstances. Two sites are prospective case studies where EPA will monitor key aspects of the hydraulic fracturing process at future hydraulic fracturing sites.

Five sites are retrospective case studies, which will investigate reported drinking water contamination due to hydraulic fracturing operations at existing sites. The EPA is expected to issue its first report of findings in 2012 and its final report in 2014.

C. Other EPA Actions

While the EPA study is on going, there are a number of other activities underway by the EPA that could impact shale gas development going forward.

1. Effluent Guidelines for Shale Gas Extraction

In October 2011, EPA initiated a rulemaking to set discharge standards for wastewater from shale gas extraction.[83]

In terms of background, according to the EPA, and based on information provided by industry, up to one million gallons of shale gas wastewater or “flowback” or “produced water,” may be produced from a single well within the first 30 days following fracturing. These produced waters generally contain elevated salt content (often expressed as total dissolved solids, or TDS), many times higher than that contained in sea water, conventional pollutants, organics, metals, and NORM (naturally occurring radioactive material). Additional data show that flowback waters contain concentrations of some of the fracturing fluid additives.

While some of the shale gas wastewater is re-used or re-injected, a significant amount still requires disposal. Some shale gas wastewater is transported to public and private treatment plants, many of which are not properly equipped to treat this type of wastewater. As a result, pollutants are discharged into surface waters such as rivers, lakes or streams where they can directly impact aquatic life and drinking water sources.

The initiation of a rulemaking is the very start of the rulemaking process and EPA plans to reach out to affected stakeholders to collect relevant data and information. EPA also plans to collect financial data on the shale gas industry to determine the affordability of treatment options for produced water.

2. Guidance for Diesel Fuels

A key element of the SDWA UIC program is setting requirements for proper well siting, construction, and operation to minimize risks to underground sources of drinking water. The Energy Policy Act of 2005 excluded hydraulic fracturing, except when diesel fuels are used, for oil and gas production from permitting under the UIC Program. This was because of concern about the risks to drinking water from diesel fuels.

Over the past year, there has been some confusion over whether the industry must disclose the use of diesel fuel in hydraulic fracturing activities and if so, how and when. In response to the confusion, EPA has formulated draft guidelines for the use of diesel fuel in hydraulic fracturing.[84]

3. New US air standards for hydraulically fractured natural gas wells

The use of "reduced emissions completion (REC)", also known as “green completion”, has been prescribed for hydraulically fractured natural gas wells from Jan. 2015 onwards. This is part of the final rule on New Source Performance Standards and National Emission Standards for Hazardous Air Pollutants[89], which was issued on April 17, 2012 by the U.S. Environmental Protection Agency (EPA).

V. Disclosure of Frac Fluid Chemicals

In addition to the FRAC Act and the EPA study, Congress has also separately request-ed information from the industry about the chemicals used in hydraulic fracturing.[85] On February 18, 2010, Henry A. Waxman, Chair-man of the Subcommittee on Energy and Environment, and Subcommittee Chairman Edward Markey sent letters to eight oil and gas companies that use hydraulic fracturing “requesting information on the chemicals used in fracturing fluids and the potential impact of the practice on the environment and human health.”[86]

On July 19, 2010, Congressmen Waxman and Markey sent another letter requesting additional information from companies involved in hydraulic fracturing, including a list of the total volume of flowback and produced water recovered from wells, how the water was disposed of and a variety of other well specific data to determine the chemical content of flowback and produced water.[87] The companies ultimately provided information to the US Congress on the chemicals being used in hydraulic fracturing operations.

More recently, there is a growing trend in the US towards requiring companies to disclose the chemicals used in hydraulic fracturing with a number of states now requiring this and more likely to come. Some states require or allow for the disclosure via FracFocus, which is a webbased national registry where companies can disclose the chemical additives used in the hydraulic fracturing process on a well-by-well basis.[88]

VI. Conclusion

The tremendous boom in shale gas production in the United States over the past five years has indeed been a game changer with potentially significant implications in terms of energy security and supply, climate change mitigation, and energy policy. While shale gas presents an enormous opportunity for the US and perhaps the world, there remain numerous legal, policy and environmental challenges that must be addressed before the full potential of shale gas can be realized.

In the United States, this analysis is currently underway with the on-going EPA investigation and a number of other studies assessing the environmental impact of shale gas development. While various studies are underway, some US state governments have begun to amend or enact state laws and regulations in an effort to pre-empt the need for further federal regulation of shale gas drilling operations. Some of the key actions taken by US States, such as the disclosure requirements for chemicals used in hydraulic fracturing, will be highlighted in other sections of the SHIP website.

[1]Adam J. Bailey, Comment, The Fayetteville Shale Play and the Need to Rethink Environmental Regulation of Oil and Gas Development in Arkansas, 63 ARK L. REV. 815, 843 (2010) ("The Fayetteville Shale is important to the economy and commerce of Arkansas, and natural-gas production is included in many plans for reducing American dependence on foreign oil and is a transitional framework to alternative energy.") (internal citation omitted).

[2]Jessie S. Lotay, Subprime Carbon: Fashioning an Appropriate Regulatory and Legislative Response to the Emerging U.S. Carbon Market to Avoid a Repeat of History in Carbon Structured Finance and Derivative Instruments, 32 HOUS. J. INT'L L. 459, 487 (2010).

[3]See, e.g., Wes Deweese, Fracturing Misconceptions: A History of Effective State Regulation, Groundwater Protection, and the Ill-Conceived FRAC Act, 6 OKLA. J. L. & TECH. 49, 6 (2010).

[4]As shale goes global, concerns have been raised in other countries as well. See e.g., Monique Beau Din, Shale-gas Opposition is Growing, Survey Concludes, THE GAZETTE (Montreal), Feb. 16, 2011, at A6; Exploration Ban in France Extended, CALGARY HERALD (Can.), Jan. 20, 2011, at B4.

[5]AM. PETROLEUM INST., FREEING UP ENERGY, HYDRAULIC FRACTURING: UNLOCKING AMERICA'S NATURAL GAS RESOURCES 5 (2010),www.api.org/~/media/Files/Policy/Exploration/HYDRAULIC_FRACTURING_PRIMER.ashx

[6]See id.

[7]ENVTL. PROT. AGENCY, EVALUATION OF IMPACTS TO UNDERGROUND SOURCES OF DRINKING WATER BY HYDRAULIC FRACTURING OF COALBED METHANE RESERVOIRS STUDY, at 7-5 (2004) ,water.epa.gov/type/groundwater/uic/class2/hydraulicfracturing/wells_coalbedmethanestudy.cfm. [hereinafter DRINKING WATER IMPACT STUDY].

[8]Id. at 7–6.

[9]Hydraulic Fracturing, AM. PETROLEUM INST, www.api.org/oil-and-natural-gas-overview/exploration-and-production/hydraulic-fracturing

[10]Id.

[11]API Global Insight, Measuring the Economic and Energy Impacts of Proposals to Regulate Hydraulic Fracturing: Task 1 Report 2 (2009) www.api.org/~/media/Files/Policy/Exploration/IHS-GI-Hydraulic-Fracturing-Natl-impacts.pdf

[12]See generally ENVTL. PROT. AGENCY, NATIURAL GAS EXTRACTION – HYDRAULIC FRACTURING,www.epa.gov/hydraulicfracturing/.

[13]See Amy Mall, Incidents Where Hydraulic Fracturing is a Suspected Cause of Drinking Water Contamination, SWITCHBOARD: NAT'L RES. DEF. COUNCIL STAFF BLOG (Oct. 4, 2010),switchboard.nrdc.org/blogs/amall/incidents_where_hydraulic_frac.html (listing incidents of drinking water contamination and supporting regulation of hydraulic fracturing under the Safe Drinking Water Act).

[14]Id.

[15]Id.

[16]See Buried Secrets: Gas Drilling's Environmental Threat, PROPUBLICA,www.propublica.org/series/buried-secrets-gas-drillings-environmental-threat (last visited May 1, 2012) (containing links to various investigative pieces concerning the environmental impact of gas drilling). In the Drilling Down series of articles, the New York Times is also examining the risks of shale gas drilling and efforts to regulate the rapidly growing industry. Drilling Down, N.Y. Times,topics.nytimes.com/top/news/us/series/drilling_down/index.html (last visited May 1, 2012).

[17]Abraham Lustgarten, Setting the Record Straight on Hydraulic Fracturing, PROPUBLICA, Jan. 12, 2009,www.propublica.org/article/setting-the-record-straight-on-hydraulic-fracturing-090112 [hereinafter Setting the Record Straight on Hydraulic Fracturing].

[18]Id.; Abraham Lustgarten, Pa. Residents Sue Gas Driller for Contamination, Health Concerns, PROPUBLICA, Nov. 20, 2009, www.propublica.org/article/pa-residents-sue-gas-driller-for-contamination-health-concerns-1120.

[19]Setting the Record Straight on Hydraulic Fracturing, supra note 18.

[20]Id.

[21]Id.

[22]DANIEL J. SOEDER & WILLIAM M. KAPPEL, WATER RESOURCES AND NATURAL GAS PRODUCTION FROM THE MARCELLUS SHALE 3–4 (2009) pubs.usgs.gov/fs/2009/3032/pdf/FS2009-3032.pdf.

[23]Id. at 4.

[24]Press Release, Chesapeake Energy, Chesa-peake Energy Corporation Confirms Decision Not to Drill for Natural Gas in the New York City Watershed (Oct. 28, 2009) available atwww.chk.com/news/articles/pages/1347788.aspx.

[25]Fact Sheet: Water Use in Marcellus Deep Shale Gas Exploration, CHESAPEAKE ENERGY (2010),http://www.chk.com/media/educational-library/fact-sheets/marcellus/marcellus_water_use_fact_sheet.pdf[hereinafter CHESAPEAKE ENERGY, Water Use].

[26]Id.

[27]Id.

[28]See DRINKING WATER IMPACT STUDY, at 3–11.

[29]Id.

[30]DANIEL J. SOEDER & WILLIAM M. KAPPEL, WATER RESOURCES AND NATURAL GAS PRODUCTION FROM THE MARCELLUS SHALE 3–4 (2009) pubs.usgs.gov/fs/2009/3032/pdf/FS2009-3032.pdf.

[31]JAMES E. BENÉ & ROBERT HARDEN, NORTHERN TRINITY/WOODBINE GROUNDWATER AVAILABILITY MODEL: ASSESSMENT OF GROUNDWATER USE IN THE NORTHERN TRINITY AQUIFER DUE TO URBAN GROWTH AND BARNETT SHALE DEVELOPMENT 1 (2007), https://www.twdb.texas.gov/groundwater/models/gam/trnt_n/TRNT_N_Barnett_Shale_Report.pdf

[32]Id.

[33]Id. at 14.

[34]Id. at 2-44.

[35]Id. at 2–3.

[36]Id.

[37]Id.

[38]Id. at 3.

[39]HYDRAULIC FRACTURING FACT SHEET, see Hannah Wiseman, Regulatory Adaptation in Fractured Appalachia, 21 VILL. ENVTL. L. J. 229, 288–89 (2010).

[40]HYDRAULIC FRACTURING FACT SHEET; About Us, GROUND WATER PROT. COUNCIL,www.gwpc.org/about_us/about_us.htm (last visited Apr. 5, 2011).

[41]See Mireya Navarro, 8,000 People? E.P.A. Defers Hearing on Fracking, GREEN: A BLOG ABOUT ENERGY & THE ENV'T (Aug. 10, 2010, 5:28 p.m.), green.blogs.nytimes.com/2010/08/8000.people-e-p-a-defers-hearing-on-fracking; see also Mike Soraghan, BP, Others Push Against Federal Regulation of Fracturing, N.Y. TIMES, Mar. 23, 2010, available at www.nytimes.com/gwire/2010/03/23/23greenwire-bp-others-push-against-federal-regulation-of-f-95671.html.

[42]See generally THOMAS E. KURTH, ET AL., LAW APPLICABLE TO HYDRAULIC FRACTURING IN THE SHALE STATES (2010) www.haynesboone.com/news-and-events/news/alerts/2010/07/08/law-applicable-to-hydraulic-fracturing-in-the-shale-states

[43]Safe Drinking Water Act, 42. U.S.C. § 300f (2005).

[44]Safe Drinking Water Act, OFFICE OF WATER, ENVTL. PROT. AGENCY,water.epa.gov/lawsregs/rulesregs/sdwa/index.cfm (last visited Apr. 5, 2011).

[45]Id.

[46]Id.

[47]See generally ENVTL. PROT. AGENCY OFFICE OF WATER, UNDERSTANDING THE SAFE DRINKING WATER ACT (2004),water.epa.gov/lawsregs/guidance/sdwa/upload/2009_08_28_sdwa_fs_30ann_sdwa_web.pdf[hereinafter UNDERSTANDING THE SAFE DRINKING WATER ACT].

[48]Id.

[49]See id.

[50]Public Water System Supervision (PWSS) Grant Program, OFFICE OF WATER, ENVTL. PROT. AGENCY, water.epa.gov/grants_funding/pws/index.cfm (last visited Apr. 5, 2011).

[51]UNDERSTANDING THE SAFE DRINKING WATER ACT, supra note 48.

[52]See id.

[53]Id. (noting that requirements for Class II wells are found in 40 C.F.R. §§ 144–46).

[54]Id.

[55]See id. To receive primacy, a state must demonstrate to the EPA that its UIC program is at least as stringent as the federal standards. Id. For Class II wells, states must demonstrate that their programs are effective in preventing pollution of underground sources of drinking water. Id. at 37 n.77.

[56]Safe Drinking Water Act, 42 U.S.C. § 300h(b)(2) (2005).

[57]Deweese, supra at 10.

[58]Legal Envtl. Assistance Found. (Leaf) v. Envtl. Prot. Agency (EPA), 118 F.3d 1467, 1477 (11th Cir. 1997).

[59]Id. In 2000, a second suit was filed against the EPA wherein the court approved Alabama's revised UIC program, despite several alleged deficiencies. Legal Envtl. Assistance Found. v. Envtl. Prot. Agency, 276 F.3d 1253, 1256 (11th Cir. 2001). The U.S. Court of Appeals for the 11th Circuit directed the EPA to require Alabama to regulate hydraulic fracturing under the SDWA. Id. at 1477–78. The court determined that the EPA could regulate hydraulic fracturing under the SDWA's more flexible state oil and gas provisions in section 1425, rather than the more stringent under-ground injection control requirements of section 1422. Id. at 1260–61.

[60]Legal Envtl. Assistance Found. v. Envtl. Prot. Agency, 118 F.3d 1467 (11th Cir. 1997).

[61]DRINKING WATER IMPACT STUDY, supra at ES-1.

[62]Id.

[63]Id. at 4-1.

[64]Id. at 4-12.

[65]Mike Soraghan, Natural Gas Drillers Protest Nomination of Fracking Critics for EPA Review Panel, N.Y. TIMES, Sept. 30, 2010, available at www.nytimes.com/gwire/2010/09/30/30greenwire-natural-gas-drillers-protest-nomination-of-fra-98647.html.

[66]Energy Policy Act of 2005, Pub. L. No. 109-58, 119 Stat. 594 (2005).

[67]Id. § 322.

[68]See Safe Drinking Water Act § 1421, 42 U.S.C. § 300h.

[69]See The Halliburton Loophole, Editorial, N.Y. TIMES, Nov. 3, 2009, at A28.

[70]Fracturing Responsibility and Awareness of Chemicals Act of 2009, S. Con. Res. 1215, 111th Cong. (2009);

Fracturing Responsibility and Awareness of Chemicals (FRAC) Act, H.R. Con. Res. 2766, 111th Cong. (2009).

[71]S. 1215; H.R. 2766.

[72]S. 1215 § 2(a); H.R. 2766 § 2(a).

[73]S. 1215 § 2(b).; H.R. 2766 § 2(b).

[74]Bill Summary and Status, H.R. 2766, 111th Congress (2009), The Library of Congress, Thomas,thomas.loc.gov/cgi-bin, (follow "Bills, resolutions" hyperlink; then follow "Bill summary and status" hyperlink; then search "Fracturing Responsibility and Awareness of Chemicals Act").

[75]S. 587, 112th Cong. (2011); H.R. 1084, 112th Cong. (2011).

[76]Department of the Interior, Environment, and Related Agencies Appropriations Act, H. Rep. 111-316, at 109 (2010); Hydraulic Fracturing, ENVTL PROT. AGENCY,water.epa.gov/type/groundwater/uic/class2/hydraulicfracturing/index.cfm (last visited Apr. 5, 2011) [hereinafter Hydraulic Fracturing Overview].

[77]Id.

[78]Id.

[79]Opportunity for Stakeholder Input on EPA's Hydraulic Fracturing Research Study: Criteria for Selecting Case Studies, ENVTL PROT. AGENCY, 1 (July 15, 2010),www.epa.gov/safewater/uic/pdfs/hydrofrac_casestudies.pdf [hereinafter Opportunity for Stakeholder Input].

[80]Id. at 2.

[81]Id.

[82]US EPA, Plan to Study the Potential Impacts of Hydraulic Fracturing on Drinking Water Resources, available atwater.epa.gov/type/groundwater/uic/class2/hydraulicfracturing/upload/hf_study_plan_110211_final_508.pdf

[83]EPA Fact Sheet, EPA Initiates a Rulemaking to Set Discharge Standards for Wastewater From Shale Gas Extraction, water.epa.gov/scitech/wastetech/guide/upload/shalereporterfactsheet.pdf.

[84]US EPA, Underground Injection Control Guidance for Permitting Oil and Natural Gas Hydraulic Fracturing Activities Using Diesel Fuels, available atwater.epa.gov/type/groundwater/uic/class2/hydraulicfracturing/wells_hydroout.cfm.

[85]Press Release, Comm. on Energy and Commerce, Energy & Commerce Committee Investigates Potential Impacts of Hydraulic Fracturing (Feb. 18, 2010), available athttp://democrats.energycommerce.house.gov/index.php?q=news/energy-commerce-committee-investigates-potential-impacts-of-hydraulic-fracturing

[86]Id.

[87]Id.

[88]Letter from Rep. Henry A. Waxman, Chairman, Comm. on Energy and Commerce, to 10 Oil and Gas Companies (July 19, 2010), available athttp://democrats.energycommerce.house.gov/documents/20100719/Letters.Hydraulic.Fracturing.07.19.2010.pdf; see also Press Release, Comm. on Energy and Commerce, Committee Requests More Details on Hydraulic Fracturing Practices (July 19, 2010), available at http://democrats.energycommerce.house.gov/index.php?q=news/committee-requests-more-details-on-hydraulic-fracturing-practices [hereinafter Committee Requests More Details]

[89]Final Air Rules for the Oil and Natural Gas Industry: http://www.epa.gov/airquality/oilandgas/actions.html