Hydraulic Fracturing in North Carolina and the Implications of Possible Methane Water Well Contamination

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I. Introduction

This paper will first address the federal legislative history concerning the regulation of water standards as they apply to the process of hydraulic fracturing (fracking). Specifically, it will look at the possibility of methane contamination resulting from fracking and at studies determining whether such contamination is detrimental to human health. This will be followed by a discussion about the regulation of fracking in North Carolina and an analysis of its groundwater standards statutes. Finally, the possibility for tort liability as a result of this contamination will be assessed.

II. An Introduction to Shale Gas and Hydraulic Fracturing

Shale gas refers to a naturally occurring gas, usually methane, that is typically found in shale formations created 300 to 400 million years ago.[1] Formed during earth's Devonian period, these shale formations were created when "fine silt and clay particles" were deposited "at the bottom of relatively enclosed bodies of water."[2] Then, as methane from organic matter such as plants and animals became trapped in compacted sedimentary rock, called a shale layer, it became shale gas.[3] Such shale gas formations are considered "unconventional reservoirs" of "low permeability," where permeability refers to the ability of the substance to "transmit a fluid."[4] The U.S. Department of Energy explains this concept succinctly using the analogy of a kitchen sponge.[5] Picture a conventional reservoir as functioning like a sponge.[6] The gas is

[1] U.S. Department of Energy, *What is shale gas?*, SHALE GAS 101, http://energy.gov/sites/prod/files/2013/04/f0/what_is_shale_gas.pdf. (last visited Oct. 29, 2015).
[2] *Id.*
[3] *Id.*
[4] *Id.*
[5] *Id.*
[6] *Id.*

located in the pores, and it flows easily because of the interconnected nature of those pores.[7] This makes the gas relatively easy to collect.[8] By contrast, an unconventional reservoir must be "mechanically stimulated" in order to create the permeability needed to collect the gas.[9] The process used to accomplish this is known as hydraulic fracturing (fracking), and it has been in use for the last 60 years.[10]

Fracking was first used in the 1940s, with the first experiment performed in 1947 in Grant County, Kansas, and the first commercial use occurring in Stephens County, Oklahoma, just two years later.[11] By the 1950s, fracking had achieved wide commercial acceptance, and 100,000 fracking "treatments" had been performed by 1955.[12] During the following decades, innovations in technology, such as horizontal drilling, made fracking easier and more economical.[13] This increase in the ease of access means that fracking is currently becoming an issue in more and more states.

Given this trend towards increasing use, it seems clear that the importance of shale gas is growing. In fact, the Energy Information Administration (EIA) predicts that there is an estimated "482 trillion cubic feet" of "unproved technically recoverable U.S. shale gas resource."[14] Technically recoverable means the shale gas can be physically obtained, but without consideration of the economic burdens of doing so. Considering the total potential of U.S. dry gas resources is "2,203 trillion cubic feet," the unproven shale gas represents a significant portion of this.[15] Additionally, natural gas, including shale gas, accounts for a quarter of all U.S.

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[7] *Id.*
[8] *Id.*
[9] *Id.*
[10] *Id.*
[11] U.S. Department of Energy, *Where is shale gas found?,* SHALE GAS 101 http://energy.gov/sites/prod/files/2013/04/f0/where_is_shale_gas_found.pdf. (last visited Oct. 29, 2015).
[12] *Id.*
[13] *Id.*
[14] U.S. Department of Energy, *Why is shale gas important?,* SHALE GAS 101, http://energy.gov/sites/prod/files/2013/04/f0/why_is_shale_gas_important.pdf. (last visited Oct. 29, 2015) [hereinafter Shale].
[15] *Id.*

energy.[16] Natural gas currently "provides heat for 56 million residences and businesses; . . . and delivers 35 percent of the energy and feedstocks needed by U.S. industry."[17] Shale gas alone generates "$175 billion in labor income" and "$250 billion annually in government revenue."[18] Thus, the importance of shale gas cannot be overstated.

III. Shale Gas and Possible Water Contamination

Although shale gas is very useful, it is not free from environmental challenges. One major area of concern regarding fracking is possible water contamination. Water is used for drilling as the fracturing fluid necessary to split apart the rock to release the shale gas, and a single water well can require as much as 10 million gallons of water.[19] Some of this water can "flowback" to the surface with "chemical residues from the frac fluid."[20] This flowback water, in addition to the production brine that is produced by the well over its lifetime, has to be properly disposed of.[21] This is commonly done "through underground injection" into the wells, but if this is not possible then the Clean Water Act (CWA) regulates the discharge of flowback into "navigable waters" (streams, lakes, rivers, etc.).[22] The goal of the CWA is to eliminate water pollution, but it is possible to obtain a permit under the National Pollutant Discharge Elimination System (NPDES) to permit flowback discharges that would otherwise be prohibited by the CWA.[23]

Another important piece of federal legislation is the Safe Water Drinking Act (SWDA), which was passed to protect underground sources of drinking water from contamination.[24] The Energy Policy Act of 2005 amended the SDWA by stating that the "Underground Injection

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[16] *Id.*
[17] *Id.*
[18] *Id.*
[19] *Id.*
[20] ADAM VANN, BRANDON J. MURRILL & MARY TIEMANN, CONG. RESEARCH SERV., R43152, HYDRAULIC FRACTURING: SELECTED LEGAL ISSUES 7 (2014) [hereinafter CRS].
[21] *Id.*
[22] *Id.*
[23] *Id.*
[24] CRS, *supra* note 20, at 1.

Control (UIC) requirements found in the SDWA do not apply to hydraulic fracturing."[25] In other words, the EPA does not have the ability to "regulate hydraulic fracturing generally under the SWDA." [26] However, "the underground injection of wastewater" still requires permit.[27]

Finally, the Resource Conservation and Recovery Act (RCRA) exempts the wastes associated with the "exploration, development, or production" of natural gas "from regulation as hazardous wastes."[28] However, under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) "[f]acility owners and operators and other potentially responsible parties could potentially face liability . . . if hydraulic fracturing results in the release of hazardous substances."[29]

Thus, there appears to be a trend towards federal exemptions for hydraulic fracturing, but of critical significance is the caveat for hazardous substances. There is a specific concern that the methane gas released during the fracturing of the rock can contaminate the aquifer which supplies drinking water for human consumption.[30] There are two issues that arise out of this concern: the first is whether fracking actually causes methane contamination, and the second is whether methane is hazardous to human health.

The first systematic study to look at methane contamination of drinking water was published in 2011 in the *Proceedings of the National Academy of Sciences of the United States of America*.[31] In this study researchers reported that in shale gas extraction areas in the Marcellus and Utica formations in Pennsylvania and New York, methane concentrations were "seventeen

[25] *Id.*
[26] CRS, *supra* note 20, at 5.
[27] CRS, *supra* note 20, at 1.
[28] CRS, *supra* note 20, at 1.
[29] CRS, *supra* note 20, at 1.
[30] Pam Frost Gorder, *Fracking: Gas leaks from faulty wells linked to contamination in some groundwater*, SCIENCEDAILY (Sept. 15, 2014), http://www.sciencedaily.com/releases/2014/09/140915095851.html.
[31] ROBERT B. JACKSON ET AL., CTR. ON GLOB. CHANGE, RESEARCH AND POLICY RECOMMENDATIONS FOR HYDRAULIC FRACTURING AND SHALE-GAS EXTRACTION (2011).

times higher in areas with active drilling and extraction."[32] This finding spurred more research into this question, and in 2014 Duke researchers published in the same journal reaching a strikingly different conclusion. According to their data on 133 drinking water wells in Pennsylvania and Texas, the ground water contamination was blamed on "leaky well shafts near the earth's surface, not on the process of hydraulic fracturing itself, which takes place thousands of feet underground."[33] This study supports the pro-fracking argument that methane does not escape during fracking and subsequently contaminate aquifers, but rather it escapes due to faulty wells. Wells can be fixed, but "an irreversible economical problem" of escaping methane cannot.[34] Finally, in 2015 the latest study addressing this question was published in the *Journal of Environmental Science and Technology*. This study looked at 11,309 drinking water wells in Pennsylvania and concluded, "that background levels of methane in the water are unrelated to the location of hundreds of oil and gas wells that tap hydraulically fractured, or fracked, rock formations."[35] Researchers emphasized that the large sample size of their study could account for the difference between their findings, and the findings of the earlier 2011 study.

However, criticisms have emerged against each of these studies. For example, critics point out that the samples used in the 2015 study could have been measured inside houses, "after the water may have had time to release its methane fumes, or after it has passed through purification systems."[36] On the other hand, critics of the 2011 study argue that the small sample size could be skewing results in favor of the methane contamination perspective.

Thus, whether or not methane contamination results from fracking remains in controversy. But assuming a worst case scenario where methane contamination is caused by the

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[32] *Id.*
[33] John Murawski, *Duke scientists: faulty wells, not fracking, contaminated drinking water in Texas, Pennsylvania*, THE NEWS&OBSERVER (Raleigh) (Sept. 15, 2015), http://www.newsobserver.com/news/business/article10060727.html.
[34] *Id.*
[35] Eric Hand, *Methane in drinking water unrelated to fracking, study suggests*, AMERICAN ASS'N FOR THE ADVANCEMENT OF SCIENCE (March 30, 2015, 3:00 AM), http://news.sciencemag.org/environment/2015/03/methane-drinking-water-unrelated-fracking-study-suggests.
[36] *Id.*

process of fracking, is methane considered dangerous human health? Would methane then be considered a hazardous compound subject to regulation? Typically, methane is not considered a human health hazard.[3738] Though methane can cause explosions and asphyxiation, studies have not found any acute or chronic heath effects caused by consuming water containing methane. [39] However, there are not many studies that have been conducted on the effects of methane contaminated water.[40]

As it stands, methane in drinking water is not regulated through the EPA's SWDA[41] or the CWA, and it is also unregulated by most states, including North Carolina.[42] If methane is not considered a hazardous substance, then even if fracking were causally linked to the contamination facility owners would likely be able to escape lialbity under the CERCLA.[43] Policy makers thus face a decision between supporting fracking due to the lack of evidence of harm, or to pass regulations to prepare for the emergence of evidence of harm. One possible solution would be to take the approach of The Precautionary Principle, which would advocate erring on the side of caution in an ill-defined situation such as this.[44] The basis of this principle involves shifting the burden of proof to demonstrate safety to those attempting to introduce the technology.[45] In the absence of such evidence, the decision would be to prevent harm. In other words, according to the Precautionary Principle, if companies seeking to extract shale gas cannot prove safety, then they should not be allowed to move forward. However, the economic importance of shale gas and the prevalence of hydraulic fracturing seems to demand a more definitive answer. An interesting approach to this dilemma was presented by Stephen Charest in

[37] JACKSON, *supra* note 31, at 4.
[38] Minnesota Department of Health, *Methane in Well Water*, MINNESOTA DEPARTMENT OF HEALTH (Feb. 26, 2015, 4:09 PM), http:// www.health. state.mn.us/divs/eh/wells/ waterquality/methane.html.
[39] JACKSON, *supra* note 31, at 5.
[40] Minnesota Department of Health, *supra* note 38.
[41] Jackson, *supra* note 31, at 9.
[42] 15A N.C. ADMIN. CODE 2L.0202 (2014).
[43] *See* CRS, *supra* note 20, at 1 (stating that facility owners are only liable for the release of hazardous substances).
[44] Stephen Charest, *Bayesian Approaches to the Precautionary Principle*, 12 DUKE ENVTL. L. & POL'Y F. 265, 266 (2002).
[45] *Id.* at 267.

the *Duke Environmental Law & Policy Forum*.[46] His technique applied Bayesian statistical analysis of risk and probability distributions to the Precautionary Principle in determining whether to adopt "environmental regulations under conditions of true scientific uncertainty."[47] Perhaps applying this statistical analysis of the risk of methane contamination and fracking could yield useful information in determining how to move forward legislatively in this area of great uncertainty.

IV. Hydraulic Fracturing in North Carolina

The interest in developing fracking sites in North Carolina centers on the possibility for potential energy development[48] that began with the 2008-2009 North Carolina Geological Survey, which "found evidence to suggest that commercially viable quantities of natural gas may exist in shale deposits in the state."[49] Unlike the large deposits developed during the Devonian period, such as the Utica and Marcellus formations, the shale gas deposits in North Carolina are contained in much narrower basins.[50] Specifically, these deposits are located in the Piedmont region, though there is also some interest in drilling in western areas of North Carolina, which has unknown potential.[51] In response to this, the North Carolina General Assembly "ordered a study of horizontal drilling and hydraulic fracturing in 2011" before taking any legislative actions.[52]

Fracking legislation in North Carolina began in earnest the following year with the passage of the Clean Energy and Economic Security Act.[53] The legislation followed months of

[46] *Id.*
[47] *Id.* at 291.
[48] Department of Geology at Appalachian State University, *Fracking in NC,* ASK A GEOLOGIST (2015) [hereinafter DOG], http://geology.appstate.edu/outreach/ask-geologist/fracking-nc.
[49] AMY H. FULLBRIGHT ET AL., K&L GATES POLICY INSIGHT, NORTH CAROLINA SET TO OPEN DOORS TO SHALE GAS PRODUCTION 1 (2014).
[50] DOG, *supra* note 48.
[51] *Id.*
[52] Fullbright, *supra* note 49, at 1.
[53] Holly Bannerman, *Fracking, Eminent Domain, and the Need for Legal Reform in North Carolina: The Gap Left by the Clean Energy and Economic Security Act*, 14 N.C.J.L. & Tech. On. 35, 36 (2012).

polarized debates over "energy security, environmental protection, and public health."[54] It places responsibility for developing "a modern regulatory program for the management of oil and gas exploration and development in the State and the use of horizontal drilling and hydraulic fracturing treatments for that purpose" on the the Mining and Energy Commission (Commission). [55] The Commission is responsible for instituting regulations and setting the stage for the issuance of permits.[56] A moratorium on fracking was instituted for the state until the Commission developed safety rules.

Then on June 4, 2014, Governor McCrory took another step towards fracking by signing the Energy Modernization Act, which legalized natural gas exploration in North Carolina.[57] The Act is designed to be the final legislative authorization before finalization of a full modern regulatory program and issuance of state permits for shale gas development in North Carolina. The Commission created 120 rules, including rules pertaining to water well construction, which went into effect on March 17, 2015,[58] effectively ending the state moratorium.

However, the moratorium was reinstated in May 2015 following the ruling of a Wake County Superior Court, which granted a preliminary injunction against the Commission,[59] preventing it from issuing any permits "pending the outcome of a constitutional challenge to the composition of the Commission itself."[60] When the Commission was created by the North Carolina General Assembly, many of the appointments were from the General Assembly itself. The plaintiff bringing the claim, the Southern Environmental Law Center, claims that this legislative control of an executive body violates the separation of powers doctrine provided in

[54] *Id.*
[55] Fullbright, *supra* note 49, at 1 (quoting S.L. 2012-143 § 2(c); N.C. Gen. Stat. § 113-391(a)).
[56] Fullbright, *supra* note 49, at 1.
[57] DOG, *supra* note 48.
[58] Associated Press, *Fracking law opens North Carolina to drilling*, FUELFIX (March 17, 2015), http://fuelfix.com/blog/2015/03/17/fracking-law-opens-north-carolina-to-drilling/.
[59] Southern Environmental Law Center, *Court reinstates fracking moratorium in North Carolina*, SELC (May 2, 2015), https://www.southernenvironment.org/news-and-press/news-feed/court-reinstates-fracking-moratorium-in-north-carolina.
[60] *Id.*

the state constitution.[61] If the Commission is found to be unconstitutional, then the rules which regulate the issuance of permits would be "null and void."[62]

V. Methane Contamination and North Carolina

According to the U.S. Census Bureau, the population of the Piedmont region, where fracking would be concentrated in North Carolina, is 1,680,845.[63] Considering the total population of North Carolina is 9,943,964,[64] fracking in this region could have a significant impact on state residents. This is especially true when considering the possibility of water contamination.

North Carolina currently regulates groundwater quality standards by formulating "maximum allowable concentrations resulting from any discharge of contaminants to the land or waters of the state, which may be tolerated without creating a threat to human health or which would otherwise render the groundwater unsuitable for its intended best usage."[65] Best usage has alternative meanings, but since the issue in question concerns drinking water, best usage would be defined as the ability to supply drinking water to humans.[66] If it were to be regulated, methane would likely fall under the Class GA Standards, which "refers to the total concentration in micrograms per liter of any constituent in a dissolved, colloidal or particulate form which is mobile in groundwater."[67] However, since there is currently no evidence that methane is a threat to human health, it is absent from the list acceptable standards. If evidence reveals methane is indeed harmful to human health, then corrective action could be taken to restore the groundwater as closely as possible to a standard that would need to be set based on the available evidence

[61] *Id.*
[62] *Id.*
[63] U.S. Census Bureau, *2014 population estimates- counties in the Piedmont Triad Region of NC*, PIEDMONT TRIAD REGIONAL COUNCIL (March 2015), http://www.ptrc.org/modules/showdocument.aspx?documentid=4127.
[64] *Id.*
[65] 15A N.C. Admin. Code 2L.0202 (2014).
[66] 15A N.C. Admin. Code 2L.0201 (2014).
[67] *Id.*

concerning methane's effect on human health.[68] The burden of this corrective action would fall on the "person conducting or controlling" the activity which caused the contamination.[69]

VI. Liability for the Contamination of Water Wells

Despite the fact that there is still a lack of comprehensive research into the effects of fracking, many people across the country have brought common law tort claims against oil and gas companies conducting fracking.[70] Among the list of damages plaintiffs claim is contamination of water wells, though they tend to be unsuccessful with this claim.[7172] For example, the District Court of Arkansas held that, "[m]issing are particular facts about particular tracking operations by particular fracking companies using particular substances that allegedly caused . . . the Tuckers' water problems. General statements about the many dangerous substances used in fracking, and conclusory statements about the migration of those substances, will not suffice."[73]

A common claim asserted by plaintiffs against these oil and gas companies is for strict liability. In order for these claims to succeed, a court must determine "as a matter of law whether an activity is abnormally dangerous."[74] Section 519 of the Restatement (Second) of Torts determines whether an activity is considered abnormally dangerous by weighing six factors:

> (a) existence of a high degree of risk of some harm to the person, land or chattels of others;
>
> (b) likelihood that the harm that results from it will be great;
>
> (c) inability to eliminate the risk by the exercise of reasonable care;

[68] 15A N.C. Admin. Code 2L.0106 (2014).
[69] *Id.*
[70] CRS, *supra* note 20, at 29.
[71] Berish v. Sw. Energy Prod. Co., 763 F.2d 702, 702 (M.D. Pa. 2011) ("A number of Pennsylvania cases with facts analogous to the instant suit have determined that the activities involved there were not abnormally dangerous.").
[72] Tucker v. Sw. Energy Co., No. 1:11-CV-44-DPM, 2012 WL 528253, at *1 (E.D. Ark. Feb. 17, 2012) ("Whether fracking is ultra-hazardous is a question of law, but one the Court cannot answer yet. The record lacks sufficient information to make this fact-intensive judgment.").
[73] *Id.* at *2.
[74] *Tucker*, 763 F.2d at 705.

(d) extent to which the activity is not a matter of common usage;

(e) inappropriateness of the activity to the place where it is carried on; and

(f) extent to which its value to the community is outweighed by its dangerous attributes.[75]

Though some courts have been willing to entertain the notion of strict liability of gas and oil companies based on these six factors in certain circumstances,[76] others, such as the District Court of Pennsylvania have held, "based on an analysis of the six factors set forth in the Restatement (Second) of Torts ... hydraulic fracturing does not legally qualify as an ultrahazardous activity giving rise to strict tort liability."[77]

Thus, without proof pertaining to the risk of harm it is difficult to establish strict liability for contamination of water wells. Additionally, without this evidence, facility owners do not face federal liability under the CERCLA. Under North Carolina law, "criteria for classifying activity as being ultrahazardous is whether reasonable care can eliminate risk of serious harm."[78] Again, this is predicated on the proof of the existence of a serious harm.[79] This would likely make it difficult to bring a successful claim against an oil and gas company for methane contamination in North Carolina, as the current evidence stands.

VII. Conclusion

The potential of shale gas deposits in North Carolina means that the state must face the issues that arise out of the process of hydraulic fracturing. An important possible consequence is methane contamination of water wells, but there is currently little-to-no evidence linking fracking to this contamination and a lack of support that methane is harmful to human health.

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[75] Restatement (Second) of Torts § 519 (1977).
[76] See *Berish*, 763 F.2d at 705 (holding that the strict liability claim resulting from the defendant's fracking operations would not be dismissed because it was sufficiently plead).
[77] CRS, *supra* note 20, at 31 (citing Ely v. Cabot Oil & Gas Corp. (M.D. Pa. April 23, 2014)).
[78] N.C. Gen. Stat. § 99B-1.1 (2014).
[79] *See* Travelers Ins. Co. (The Travelers) Inc. v. Chrysler Corp., 845 F.Supp. 1122 (M.D.N.C. 1994) ("Propane fuel is commonly used in many commercial products and through reasonable care there is a low risk of serious harm.").

This demonstration of harm, that methane is a hazardous substance to human health, is crucial to implementing regulations and for allowing recovery where contamination has already taken place. Unless either the state or federal legislature decides to take a preventative approach concerning this issue, this is currently the state of the regulation water wells as they concern fracking nationally and locally in North Carolina.