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An Examination of State Regulations of Hydraulic Fracturing

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An Examination of State Regulations of Hydraulic Fracturing

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Abstract

An Examination of State Regulations of Hydraulic Fracturing

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As hydraulic fracturing gains popularity in the energy industry, the state of Texas finds itself in a very advantageous position. With multiple regions which could have great potential for oil and natural gas extractable via the production technique, Texas has assumed a new importance for the energy industry. However, in order to fully utilize its advantages, the state of Texas should revise its oil and gas regulations, particularly with regard to groundwater use and contamination, air emissions, and discretion for municipal regulation of oil and gas operations, insofar as they may apply to hydraulic fracturing. This course of action only will this allow the state to efficiently utilize the production method while better balancing against the technique's risks.

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Chapter 1: Hydraulic Fracturing and Public Policy

A. INTRODUCTION

In current discussions of international supply and demand for energy, one topic that produces of strong opinions, both positive and negative, is hydraulic fracturing (hereinafter also referred to as fracing) for deposits of oil and natural gas in underground shale deposits. As reservoirs accessible by more conventional drilling become more depleted, fracing has shifted from a curiosity in the energy industry to a technique of importance. Although worldwide investigation of potential production zones is ongoing, shale formations with substantial potential have been found not only in the United States, but also in Canada, Mexico, northern Europe, China, Australia, and other regions.[1]

Indeed, there is rising international interest in hydraulic fracturing, such as China's investment in United States shale-gas drillers.[2] The United States is the leading nation in terms of developing production of domestic shale deposits.[3] The growth in this segment of the domestic energy industry has been immense. One recent federal study of production from shale gas deposits estimated that natural gas production from United States shale deposits increased approximately twelvefold between 2002 and 2012, and that substantial increases in production are expected to continue for at least twenty more years.[4] For example, in Pennsylvania's fracturing operations in the Marcellus Shale, total production

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[1] ENERGY INFO. ADMIN., TECHNICALLY RECOVERABLE SHALE OIL AND SHALE GAS RESOURCES: AN ASSESSMENT OF 137 SHALE FORMATIONS IN 41 COUNTRIES OUTSIDE THE UNITED STATES 5 fig.1 (2013), *available at* http://www.eia.gov/analysis/studies/worldshalegas/pdf/fullreport.pdf.

[2] Jeff McMahon, *Six Reasons Fracking Has Flopped Overseas*, FORBES (Apr. 7, 2013, 9:00 AM), http://www.forbes.com/sites/jeffmcmahon/2013/04/07/six-reasons-fracking-has-flopped-overseas/

[3] *North America Leads the World in Production of Shale Gas*, ENERGY INFO. ADMIN. (Oct. 23, 2013), http://www.eia.gov/todayinenergy/detail.cfm?id=13491; Grant Smith, *U.S. to Be Top Oil Producer by 2015 on Shale, IEA Says*, BLOOMBERG (Nov. 12, 2013, 10:47 AM), http://www.bloomberg.com/news/2013-11-12/u-s-nears-energy-independence-by-2035-on-shale-boom-iea-says.html.

[4] *Why Is Shale Gas Important?*, DEP'T ENERGY, 1, http://energy.gov/sites/prod/files/2013/04/f0/why_is_shale_gas_important.pdf (last visited Apr. 15, 2014).

increased to approximately 3.1 trillion cubic feet in 2013, more than twice the previous year's production.[5]

But while fracing has shown potential for increasing energy supplies, it sparked serious concerns regarding environmental risks. For example, in New York, which like Pennsylvania is located over the Marcellus Shale formation, its government has enacted a moratorium on fracing operations.[6] While the New York moratorium can be lifted at the request of the state's governor,[7] given a political environment unconducive for fracing,[8] it remains unlikely that fracing will occur in significant capacities in New York anytime soon.

This Professional Report seeks to explain how fracing has been able to expand energy supplies. It also reports on the basics of oil and gas extraction techniques and explains why fracing has created potential environmental risks as well as economic benefits. The report will then discuss Texas's regulatory regimes over fracing with regard to matters concerning groundwater, air emissions, and municipal regulation, along with two other states in each field which provide a substantial contrast with Texas's current frameworks. Finally, in light of the differing regulatory frameworks, the report includes recommendations about how Texas's regulations associated with hydraulic fracturing can be improved to better balance the energy potential of the technique with the risks that accompany it, particularly in light of potential obstacles or costs that would be involved with altering Texas's current regulatory frameworks.

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[5] *Pa. Marcellus Shale Production Increases*, YAHOO FIN. (Feb. 20, 2014, 9:55 AM), http://finance.yahoo.com/news/pa-marcellus-shale-production-increases-145558970.html.

[6] Mary Esch, *Pro-Gas Interests Decry NY Inaction on Fracking*, ABC NEWS (Dec. 28, 2013, 11:21 AM), http://abcnews.go.com/m/story?id=21356584&sid=81.

[7] *Id.*

[8] *See id.* ("[T]he industry is wary of investing in New York because of what [is described as] regulatory and legislative hostility.").

B. A DISCUSSION OF OIL AND NATURAL GAS EXTRACTION TECHNIQUES

Oil and natural gas are produced not from hollow reservoirs underground, but rather from solid sedimentary rock formations.[9] Two physical characteristics, porosity and permeability, can be used to characterize a formation's production potential.[10] Porosity refers to how much capacity a material has to contain volumes of another material. Permeability refers to the tendency of a substance to flow into or out of the material. To clarify these properties, in a sponge, porosity would refer to how much water the sponge could soak up, while permeability would refer to the ease with which water is absorbed by or squeezed out of the sponge.

In a conventional oil and gas well, the drilling operations are vertical, in that the drill bit remains virtually perpendicular to the surface for the length of the well, often to depths of thousands of feet.[11] Once the drill reaches the potential zone for producing oil or natural gas, tests are carried out to determine whether the well is worth bringing online as a producing well, after which energy resources may start to be produced.[12] Hydraulic fracturing wells, on the other hand, are almost always drilled horizontally for several thousand feet, with the drilling pipe curving from vertical to horizontal from an area known as the kick-off point.[13] The reason for the horizontal drilling reflects the nature of the rock formations' permeability and porosity: shales targeted for hydraulic fracturing generally possess relatively high levels of porosity but low permeability.[14] Even if such a formation is rich in oil or gas, simply piercing it with a drill bit will not be enough to produce energy

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[9] JOHN S. LOWE ET AL., CASES AND MATERIALS ON OIL AND GAS LAW 8 (6th ed. 2013).
[10] *Id.* at 14–15.
[11] *Id.* at 41; H. Philip Whitworth & D. Davin McGinnis, *Square Pegs, Round Holes: The Application and Evolution of Traditional Legal and Regulatory Concepts for Horizontal Wells*, 7 TEX. J. OIL GAS & ENERGY L. 177, 179 (2011–2012).
[12] LOWE ET AL., *supra* note 9, at 40–41.
[13] *Id.* at 39–40.
[14] *Id.* at 17.

resources from it in economically feasible amounts.[15] Furthermore, for the hydraulic fracturing process, the production capacity from a fully vertical well would generally be uneconomical. When a hydraulic fracturing well reaches the desired depth and length, the drilling apparatus is removed. Fracing fluids, comprised of water and other substances, are then pumped into the well at high pressure.[16] The high-pressure fluids create and deepen fractures in the underlying rock formations, and pressure is maintained until resulting cracks have been formed.[17] Even with cracks developed in a formation, the well may still not be productive in the absence of that pressure, the liquids would likely be forced out by target energy resources, and without that pressure, the cracks would reseal and any production would be short and relatively unproductive.[18] To maintain production, additional fluids are injected into the well, along with a variety of small pieces of solid material called proppant.[19] These objects are small solids which jam into the newly formed cracks and hold them open even in the midst of the massive internal pressure of the rocks. Once the proppant has been sufficiently lodged in the formation, the fracing fluids are pumped out of the well, and oil and gas production can commence.[20]

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[15] *See id.* at 18 ("[A]ll prospective shale formations require some form of well stimulation . . . to dramatically increase the permeability of the formation . . . ."). In addition, even if hydraulic fracturing operations were adjusted so as to take place in vertical wells, it would take more individual vertical wells in order to access the same quantum of resources as could be reached by a single horizontal well. David Blackmon, *Horizontal Drilling: A Technological Marvel Ignored*, FORBES (Jan. 28, 2013), http://www.forbes.com/sites/davidblackmon/2013/01/28/horizontal-drilling-a-technological-marvel-ignored/.

[16] THOMAS E. KURTH ET AL., AMERICAN LAW AND JURISPRUDENCE ON FRACING § 4.05 (2012), *available at* https://www.haynesboone.com/files/Uploads/Documents/Attorney%20Publications/CURRENT_RMMLF%20Fracing%202012%20Paper_Formatted.pdf.

[17] *Id.*

[18] *Id.*

[19] *Id.*

[20] *Id.*

C. TEXAS'S IMPORTANCE REGARDING HYDRAULIC FRACTURING

The state of Texas has long been of great importance to the nation's energy industry. And with the rising popularity of hydraulic fracturing, Texas's significance has been magnified substantially. With a number of high-potential shale formations located within the state's borders, such as the Barnett Shale in the vicinity of Fort Worth,[21] the state's production of energy has increased to the point where many concerns about the state's continuing energy relevance have been set aside. For instance, in May 2013, the state of Texas accounted for 34.5 percent of the national output of oil and had recorded the state's highest average daily oil output in a month since April 1982.[22] This position of strength also extends to natural gas, as in the same month, the state accounted for approximately 27 percent of United States natural gas production, and in total volume, excepting the remainder of the United States, natural gas production from Texas for that month would exceed that of all other nations with the exception of Russia.[23]

Given the particularly heavy importance of fracing in Texas, it is important that the state's regulations appropriately balance the economic benefits of the production method with its risks. Nationwide, these regulations can extend all the way towards governing fracing activities with lighter regulation to, as in the case of New York discussed above,[24] an outright ban on hydraulic fracturing. With the production technique having gained popularity in recent decades, the nationwide state of fracing regulation remains in considerable flux.[25] In this environment of changing oil and gas regulations, it is

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[21] LOWE ET AL., *supra* note 9, at 41.

[22] David Blackmon, *Texas Oil and Gas Numbers Fly off the Charts*, FORBES (Aug. 7, 2013, 3:42 PM), http://www.forbes.com/sites/davidblackmon/2013/08/07/texas-oil-and-gas-numbers-fly-off-the-charts/.

[23] *Id.*

[24] *See supra* text accompanying notes 6–8.

[25] *Cf.* Kaoru Suzuki, Note, *The Role of Nuisance in the Developing Common Law of Hydraulic Fracturing*, 41 B.C. ENVTL. AFF. L. REV. 265, 266 (2014) ("[C]itizens seeking legal redress for damages incurred by hydraulic fracturing must navigate murky legal territory mired with federal statutory loopholes and inadequate state regulation.").

particularly advisable for Texas's government to be open to revising its own regulations, and even developing new ones as needs and research arise, so as to better regulate what is fast becoming a very productive frontier in the energy industry.

D. A BRIEF REMARK ON FEDERAL REGULATION

It may be observed that in the previous discussion, there has not been a mention of any specific federal regulation of hydraulic fracturing. This silence is entirely intentional. In large part, regulation of oil and gas development in general has been left entirely to state, rather than federal, oversight.[26] Historically, there have been a few federal interventions centering on the industry's production specifically, but these have been due to extreme imbalances between supply and demand, whether in terms of a severe shortage of energy resources[27] or even equally market-crippling gluts of energy resources.[28]

While price regulation specifically of natural gas remained under substantial federal oversight from the 1950s to the early 1990s,[29] regulation of oil and gas production has remained nearly completely in the hands of state agencies specifically assigned to regulate such activities. In Texas, that authority has been placed with the Railroad Commission of Texas[30] (which, in spite of the name, has lacked authority over railroad activities for quite some time, retaining its longstanding name partly out of tradition and partly out of institutional inertia).

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[26] FRED BOSSELMAN ET AL., ENERGY, ECONOMICS AND THE ENVIRONMENT: CASES AND MATERIALS 13 (3d ed. 2010); HANNAH WISEMAN & FRANCIS GRADIJAN, REGULATION OF SHALE GAS DEVELOPMENT, INCLUDING HYDRAULIC FRACTURING 24 (2012).

[27] *See* DANIEL YERGIN, THE PRIZE: THE EPIC QUEST FOR OIL, MONEY & POWER 162–63 (2009) (discussing federal efforts to coordinate supply and demand for oil during World War I).

[28] *See id.* at 238–39 (describing federal efforts to counteract economic forces flooding markets with oil in the mid-1930s).

[29] At times, this oversight had the effect of causing and exacerbating supply disruptions, rather than alleviating them. Paul L. Joskow, *Natural Gas: From Shortages to Abundance in the United States*, 103 AM. ECON. REV. 338 (2013).

[30] *Railroad Commission Authority and Jurisdiction Frequently Asked Questions (FAQs)*, RAILROAD COMMISSION TEX., http://www.rrc.state.tx.us/about/faqs/rrcjurisdictions.php (last visited Apr. 15, 2014).

It should be noted that a federal regulatory regime exists for hydraulic fracturing operations taking place on federal public or Native American lands, which is overseen by the Bureau of Land Management.[31] The large share of oil and gas drilling involving fracing which occurs on federal lands[32] likely contributed to an ongoing push to update the rules governing such operations, especially since the last significant revision of the rules took place more than thirty years earlier.[33]

While there are multiple federal laws that have a significant bearing on hydraulic fracturing operations even outside of federal lands, such as the Clean Water Act and the Clean Air Act, and while extensive analyses could be made regarding how such federal laws can be better tailored to the needs and costs attributable to hydraulic fracturing, international comparisons are rather difficult. The United States is a far more prolific user of hydraulic fracturing methods than other nations, as previously mentioned. Consequently, not only will the regulatory environment differ between nations, but significant variation in external conditions could make comparisons substantially less valuable.

Furthermore, federal–state comparisons are hampered not only by federal law overriding contradictory state laws as a result of the Constitution's Supremacy Clause, but also because the state laws would have to be viewed in light of coexisting federal authority. Consequently, this paper will focus on comparing Texas regulatory systems to those of other states.

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[31] *Interior Releases Updated Draft Rule for Hydraulic Fracturing on Public and Indian Lands for Public Comment*, BUREAU LAND MGMT. (May 16, 2013), http://www.blm.gov/wo/st/en/info/newsroom/2013/may/nr_05_16_2013.html.
[32] *Id.*
[33] *Id.*

E. AN INTRODUCTION TO THE ISSUES BEING DISCUSSED

In this paper, focus will be placed on three different issues related to hydraulic fracturing: water, air, and municipal regulations. First, the paper will examine state laws related to water use for and contamination due to fracing activities. Issues relating to water have garnered considerable attention and concern from parties connected with the fields of energy and the environment. In fact, in a recent survey of experts in government, academia, business and non-governmental organizations regarding myriad sources of potential risks raised by hydraulic fracturing, out of the twelve "risk pathways" that the respondents most frequently agreed were priority concerns, nine of them were associated with risks to water contamination and/or use.[34] Given the broad federal jurisdiction provided by the Clean Water Act over even relatively small areas of surfacewater,[35] in order to provide a clearer focus on state regulations, this paper will limit its focus to groundwater contamination and use.

Second, this paper will examine state laws regulating air emissions associated with hydraulic fracturing. While much of the emissions associated with oil and natural gas are due to combustion, such as through use in electricity generation or conversion to motor vehicle fuel, the production production can in and of itself result in substantial air emissions. In fact, air emissions risks facing hydraulic fracturing in particular has sparked such concern that one environmental law expert surveyed the issue and concluded that, even though he felt that "concerns over hydraulic fracturing as a source of groundwater contamination shall dissipate" within a few years, "responsible management of air

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[34] ALAN KRUPNICK, HAL GORDON & SHEILA OLMSTEAD, PATHWAYS TO DIALOGUE: WHAT THE EXPERTS SAY ABOUT THE ENVIRONMENTAL RISKS OF SHALE GAS—OVERVIEW OF KEY FINDINGS 4, 6 (2013), *available at* http://www.rff.org/Documents/RFF-Rpt-PathwaystoDialogue_Overview.pdf.

[35] *See* BOSSELMAN ET AL., *supra* note 26, at 136 ("Federal jurisdiction [under the Clean Water Act] has been extended to small tributaries . . . , lagoons separated from the ocean, to land-locked lakes and associated wetlands.").

emissions . . . will be the environmental management issue that will require long-term attention."[36] It is to these matters that this paper will turn.

Third, and finally, this paper will examine the division of authority between state and municipal regulators. Although the benefits of energy production can be geographically very broad and well-distributed, the costs, by contrast, are generally experienced very locally. From effects on local air and water quality, to the availability of usable water supplies, extending even to the noise, traffic, road stress, and other costs associated with the substantial industrial-type activities needed to produce energy, areas in close proximity to fracing operations tend to experience the lion's share of the costs associated with such activities. As one analysis of the issue put it, the harms that may arise out of hydraulic fracturing may result not only in substantial risks to water supplies and air quality, but the dramatic scale of activity required for such operations "transforms the landscape and character of communities in both rural and urban areas" for the worse.[37] Towards the end of assuring that risks to localities directly experiencing hydraulic fracturing are adequately accounted for, it may be equitable to devolve substantial authority over fracing from state agencies to the localities which are home to hydraulic fracturing operations. Comparisons of distributions of authority between states and municipalities are thus a topic ripe for discussion in this paper.

While there is no way that all state laws on the aforementioned issues could be encompassed in a paper of this scope, the provided discussions should give a useful starting point, both within and outside of Texas, for discussions on not only what additional laws should be enacted to better achieve the benefits of and accommodate the potential costs of

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[36] Jim Wedeking, *Up in the Air: The Future of Environmental Management for Hydraulic Fracturing Will Be About Air, not Water*, 49 IDAHO L. REV. 437, 438 (2013).

[37] Rachel A. Kitze, Note, *Moving Past Preemption: Enhancing the Power of Local Governments over Hydraulic Fracturing*, 98 MINN. L. REV. 385, 389 (2013).

hydraulic fracturing, but also to examine how existing regulatory regimes can be modified to adapt to a burgeoning field of the energy industry. The stakes are high, and hopefully this paper can provide useful guideposts to policymakers as they consider next moves in this important area.

F. AN INTRODUCTION TO THE STATES BEING DISCUSSED

This paper will compare Texas's laws on each of the three issues just discussed to those of five states (Arkansas, Colorado, Louisiana, West Virginia, and Pennsylvania).[38] Each of these states has been experiencing extremely high levels of hydraulic fracturing activity. In fact, according to data provided by the states, these five states have been in the top seven U.S. states in terms of total wells drilled since 2005 (Texas holds the top spot in this regard).[39] Since each of these states is experiencing a relatively high proportion of the risks attendant to hydraulic fracturing, each one is facing similarly high incentives to providently address and limit those risks.[40] While the suitability of the regimes may be somewhat dependent on state characteristics, particularly due to climate, geography, and statewide energy industry practices,[41] each of the state regulatory regimes the paper will examine may be viewed as subject to the influence of the risks of hydraulic fracturing, and consequently are useful for comparison.

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[38] Colorado will be compared to Texas with regard to its laws on two issues: groundwater and air emissions.

[39] ELIZABETH RIDLINGTON & JOHN RUMPLER, FRACKING BY THE NUMBERS: KEY IMPACTS OF DIRTY DRILLING AT THE STATE AND NATIONAL LEVEL 30 tbl.7 (2013).

[40] Often, much regulation of hydraulic fracturing will arise out of oil and gas laws not specifically tailored to hydraulic fracturing. This arises both out of the regulators regimes predating the rise of fracing techniques as well as the fact that development of shale deposits involves many activities beside fracing, itself. WISEMAN & GRADIJAN, *supra* note 26, at 4.

[41] *Id.* at 8.

Arkansas's primary target for hydraulic fracturing is the Fayetteville Shale, located in the north-central region of the state.[42] This area has experienced major energy development in recent years, with natural gas production from the Fayetteville Shale quadrupling between 2004 and 2012.[43] In light of this dramatic progression in gas production, Arkansas hydraulic fracturing regulation is an interesting area for review.

Colorado's potential for hydraulic fracturing continues to grow. In particular, the Niobrara Shale, underlying portions of the state's northeastern area, is proving to be a particularly fruitful target for hydraulic fracturing.[44] Consequently, Colorado laws which can effect fracing, with regard to water or other aspects, are of elevated importance for the industry.

Louisiana's main focus for fracing has been the Haynesville Shale, located in the northwestern region of the state and extending into Texas. With more than 2,400 wells drilled into the formation, the formation still remains a prime target for future development in the industry.[45]

Much of the state of West Virginia overlays the Marcellus Shale. Not only has West Virginia experienced substantial growth as a result of this position, but that growth has been staggeringly rapid, with hydraulic fracturing contributing to an increase of natural gas

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[42] STATE REVIEW OF OIL AND NATURAL GAS ENVIRONMENTAL REGULATIONS, INC., ARKANSAS HYDRAULIC FRACTURING STATE REVIEW 8 (2012).

[43] *Id.*

[44] Mark Jaffe, *Colorado Oil Production Hits More than 50-Year High on Niobrara Wells*, DENVER POST (Mar. 11, 2013), http://www.denverpost.com/ci_22767517/colorado-oil-production-hits-more-than-50-year; Paula Moore, *In Colorado, Niobrara Riches Sparking Tug of War*, DENVER BUS. J. (July 13, 2012), http://www.bizjournals.com/denver/print-edition/2012/07/13/in-colorado-niobrara-riches-sparking.html?page=all.

[45] *Haynesville Shale Drilling Showing New Signs of Life*, LONGVIEW NEWS-J. (June 9, 2013), http://www.news-journal.com/business/local_business/haynesville-shale-drilling-showing-new-signs-of-life/article_ec69b364-cd84-514b-962f-ff21927dcbf7.html.

production in the state from 0.2 million mcf 2007 to 142 million mcf in 2011.[46] In light of this fast and high growth, West Virginia law is an excellent area for research and examination.

As mentioned earlier in the Introduction,[47] Pennsylvania has experienced a boom in hydraulic fracturing in the Marcellus Shale. In light of this state's importance to the industry, Pennsylvania laws on the subject are very relevant for this examination.

[46] *Which County Leads WV's Marcellus Production?*, ST. J., http://www.statejournal.com/story/19853093/which-county-leads-wvs-marcellus-production (last updated Nov. 17, 2012).
[47] *See supra* note 5 and accompanying text.

Chapter 2: Groundwater Use and Contamination

A. INTRODUCTION

It is difficult to find a more controversial issue connected with hydraulic fracturing than the production technique's potential effects on water supplies. Since the popularity boost for fracing within the energy industry, there have been myriad reports of deterioration in water supplies in close proximity to hydraulic fracturing wells, although demonstrating causation has been rather difficult.[48] For instance, a January 2014 report from the Associated Press, it was found that there had been a large number of complaints of water contamination in four states (Texas, Pennsylvania, Ohio, and West Virginia) experiencing substantial amounts of hydraulic fracturing.[49] However, the report was also careful to note not only that many of the complaints were not confirmed to be linked to oil and gas activities, but that it was plausible that alternative causes, such as natural production of methane gas or other issues entirely unrelated to oil and gas wells, could have accounted for water contamination.[50]

The nature of hydraulic fracturing does, admittedly, provide a basis rooted in logic for claims linking the method to contamination of public water supplies. The injection of large quantities of chemicals underground, at times in relatively close proximity to publically used groundwater supplies, could create a measurable risk of contaminating nearby groundwater. Although casing wells in an impermeable material like steel or a hard plastic, which is surrounded by cement for reinforcement and further sealing,[51] through to

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[48] *E.g.* David B. Spence, *Responsible Shale Gas Production: Moral Outrage vs. Cool Analysis*, 25 FORDHAM ENVTL. L. REV. 141, 160–61 (2013).

[49] Kevin Begos, *Some States Confirm Water Pollution from Drilling*, ASSOCIATED PRESS (Jan. 5, 2014, 6:07 PM), http://bigstory.ap.org/article/some-states-confirm-water-pollution-drilling.

[50] *Id.*

[51] Susan L. Sakmar, *The Global Shale Gas Initiative: Will the United States Be the Role Model for the Development of Shale Gas Around the World?*, 33 HOUS. J. INT'L L. 369, 378 fig.1 (2011); *Glossary*, GEOLOGICAL SOC'Y AM., http://www.geosociety.org/criticalissues/hydraulicFracturing/glossary.asp (last visited May 1, 2014).

impermeable bedrock, thus separating groundwater supplies from the producing rock formation, will dramatically reduce contamination risks, those risks could remain extant, particularly in light of the rapidly flowing liquids and gases involved in production as well as the heavy pressure placed on the materials.[52]

Not only could the injected fracing fluids be the source of water contamination, but produced gases, such as methane, could similarly contaminate groundwater supplies.[53] Although consumption of methane-containing water is not itself considered a health hazard, the contained methane can produce risks of fire and explosion, and even if not ignited, the gas can cause suffocation if it builds up in an enclosed area.[54]

Though various anecdotal instances of groundwater contamination attributable to hydraulic fracturing have been reported, as mentioned previously, scientific evidence verifying at least a strong causal link between the production method and groundwater contamination has been scant, but is still developing.[55] Notably, in a December 2011 draft report from the Environmental Protection Agency, research was discussed regarding potential sources of groundwater contamination, including hydraulic fracturing wells, near the town of Pavillion, Wyoming.[56] Although the report acknowledged that there is much complexity in detecting and attributing contamination from such deeply located activities, the report concluded that the best explanation for various forms of detected contamination

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[52] *See* MASS. INST. OF TECH., THE FUTURE OF NATURAL GAS 41, *available at* http://mitei.mit.edu/system/files/NaturalGas_Report.pdf (observing that "poor quality cementing of . . . surface casing" could allow for fluids to contaminate groundwater").

[53] Wedeking, *supra* note 36, at 437.

[54] *Methane in Well Water*, MINN. DEP'T HEALTH, http://www.health.state.mn.us/divs/eh/wells/waterquality/methane.html (last updated Apr. 3, 2013).

[55] *See, e.g.*, Avner Vengosh et al., *A Critical Review of the Risks to Water Resources from Unconventional Shale Gas Development and Hydraulic Fracturing in the United States*, 48 ENVTL. SCI. & TECH. (forthcoming 2014) (investigating links to surfacewater and groundwater contamination, particularly through methane contamination, spills, leaks, improper disposal, and overextraction of water).

[56] ENVTL. PROT. AGENCY, INVESTIGATION OF GROUND WATER CONTAMINATION NEAR PAVILLION, WYOMING (2011), *available at* http://www2.epa.gov/sites/production/files/documents/EPA_ReportOnPavillion_Dec-8-2011.pdf.

was that "constituents associated with hydraulic fracturing" had been released into the local aquifer even though the aquifer was located above the production zones for the fracing wells in the area.[57] While this report could provide significant evidence of a link between groundwater contamination and hydraulic fracturing, its persuasiveness is considerably reduced by the EPA's declining to finalize the report or submit it to peer review.

Other studies on the issue have been significantly less conclusive than the Pavillion study. A 2011 study of fracing activities along the Marcellus Shale in Pennsylvania found no significant evidence of contamination by fracing fluids in close proximity to drilling sites, although significant evidence was found of methane contamination close to drilling sites (although the causal mechanism was not clearly attributed to fracing techniques).[58] In one further instance, a comprehensive study on natural gas from the Massachusetts Institute of Technology turned part of its focus on the risks hydraulic fracturing poses to groundwater contamination and found that the technique itself does not create substantial risks of groundwater contamination, although various errors made during such activities, such as faulty well casings leading to leaks of fracing fluid, could themselves give rise to such risks.[59] While a potential link between fracing and water supply contamination remains plausible, further research remains to be done to discern the particulars of such a potential link.

On a related topic, the issue of water use for purposes of fracing is substantially less murky than the problem of groundwater contamination. In order to fracture a single well, an enormous quantity of water is required, with water comprising approximately ninety

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[57] *Id.* at 33.
[58] Stephen G. Osborn et al., *Methane Contamination of Drinking Water Accompanying Gas-Well Drilling and Hydraulic Fracturing*, 108 PROC. NAT'L ACAD. SCI. 8172 (2011).
[59] *See* MASS. INST. OF TECH., *supra* note 52.

percent of the materials that are injected into a hydraulic fracturing well.[60] Although the amount of water required varies considerably owing to different borehole lengths, physical properties of the producing rock formation, and other characteristics of individual wells, an individual well will generally use several million gallons of water over the course of fracing operations in a single shale formation, with the EPA estimating that such operations may require two to five million gallons of water per well.

It is difficult to authoritatively link hydraulic fracturing activities to local water shortages generally. In fact, compared to alternative methods of energy production, the production of natural gas from fracing takes a relatively small quantity of water, while shale oil production compares favorably in this regard to sources like tar sands, corn-based ethanol and enhanced oil recovery operations.[61] In addition, to further ease potential stresses on groundwater supplies, efforts are being made to better incorporate use of water recycled from prior hydraulic fracturing operations for fracing subsequent wells.[62] On the other hand, as hydraulic fracturing frequently takes place in areas which are independently experiencing heavy levels of water stress,[63] the potential for the elevated water needs of hydraulic fracturing to place severe difficulties on local groundwater supplies means that examination of matters of water use takes on increased importance.

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[60] *Water Sources and Demand for the Hydraulic Fracturing of Oil and Gas Wells in Colorado from 2010 Through 2015*, COLO. OIL & GAS CONSERVATION COMMISSION, 1, http://cogcc.state.co.us/Library/Oil_and_Gas_Water_Sources_Fact_Sheet.pdf (last visited Apr. 16, 2014).

[61] MATTHEW E. MANTELL, DEEP SHALE NATURAL GAS: ABUNDANT, AFFORDABLE, AND SURPRISINGLY WATER EFFICIENT 7 tbl.2 (2009), *available at* http://energyindepth.org/wp-content/uploads/2009/03/MMantell_GWPC_Water_Energy_Paper_Final.pdf.

[62] Alison Sider et al., *Drillers Begin Reusing 'Frack Water,'* WALL ST. J., Nov. 20, 2012, http://online.wsj.com/news/articles/SB10001424052970203937004578077183112409260.

[63] *See* Jennifer Hiller, *Report: Fracking Colliding with Other Water Uses During Drought*, SAN ANTONIO EXPRESS-NEWS, Feb. 5, 2014, http://www.mysanantonio.com/business/eagle-ford-energy/article/Report-Fracking-colliding-with-other-water-uses-5207224.php ("More than 55 percent of the wells fractured during an 18-month period in North America were in areas experiencing drought.").

It should be clear that protecting public water supplies requires both acceptable quality and acceptable quantity of water. If there is sufficient water available to meet public needs, this will be for naught if the water available would be likely to cause substantial negative health effects. On the other hand, even if water quality is maintained, there would remain problems if there was major difficulty in assuring the availability of water to public systems. Consequently, although water contamination is a more recognizable and acute risk linked to hydraulic fracturing and will be considered in this paper, it is necessary to consider regulations on that issue in tandem with laws regarding the use of groundwater, both for general and for fracing purposes. Overall, the use of groundwater relative to surfacewater depends heavily on the availability of each source, as can be seen in a comparison of fracing operations in Texas's Eagle Ford Shale, which utilize mostly groundwater due to a scarcity of surfacewater in that area of the state, to production in the Haynesville Shale in Louisiana, in which approximately 75 percent of water use comes from surfacewater.[64] Furthermore, relative utilization of the two sources can vary as time passes, or even between different operators in the same area, as has been the case in recent operations in the Barnett Shale.[65]

With regards to overlying federal law, the most important legislation regulating groundwater is the Safe Drinking Water Act (SDWA), which regulates the water quality of public water supplies.[66] With the injection of large quantities of liquids and solid particles underground for purposes of hydraulic fracturing operations, it would appear that

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[64] Jean-Philippe Nicot & Bridget R. Scanlon, *Water Use for Shale-Gas Production in Texas, U.S.*, 46 ENVTL. SCI. & TECH. 3580, 3583 (2012).

[65] *See* Jean-Philippe Nicot et al., *Source and Fate of Hydraulic Fracturing Water in the Barnett Shale: A Historical Perspective*, 48 ENVTL. SCI. & TECH. 2464, 2467 (2014) (noting that from 2006 to 2010, water use at the Barnett shale shifted from being mostly groundwater to 70 to 80 percent surfacewater with "considerable variations among operators and locations").

[66] Safe Drinking Water Act, Pub. L. No. 93-523, 88 Stat. 1660 (1974) (codified as amended at 42 U.S.C. 300f–300j-9 (2012)).

the SDWA's Underground Injection Control Program, which regulates the injection of liquids under the Earth's surface,[67] would be the prime source of authority regarding groundwater contamination. However, an amendment to the SDWA by the Energy Policy Act of 2005 excludes regulation of such injections by the Underground Injection Control Program for purposes of natural gas or oil production, with the exception of injections containing diesel fuel.[68] On the other hand, there is no such exclusion provided for underground injections for the purposes of disposing of such fluids when production operations have concluded. However, during the process of producing oil and gas via fracing, this exemption means that SDWA will generally have considerably reduced effect.

For purposes of this paper, focus will be limited to groundwater issues, with matters pertaining to surfacewater (such as rivers or lakes) excluded from the scope. Each of the states chosen for comparison with Texas (Arkansas and Colorado) differs substantially in how it regulates both groundwater use and contamination, thus allowing for a more significant cross-state comparison.

B. TEXAS LAWS ON GROUNDWATER USE AND CONTAMINATION

1. Groundwater Use

Texas's current regulatory regime for use of groundwater is rather unusual among western states. Its basic underpinning, known as the rule of capture, is no longer followed in the field of water law by the government of any western state except for that of Texas.[69] There is some irony in this scenario, in that at the time of the rule's promulgation by the

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[67] *Underground Injection Control Program*, ENVTL. PROTECTION AGENCY, http://water.epa.gov/type/groundwater/uic/ (last visited Apr. 16, 2014).

[68] Energy Policy Act of 2005, Pub. L. No. 109-58, § 322, 119 Stat. 594, 694 (2005) (codified at 42 U.S.C. § 300h(d) (2012)).

[69] Sipriano v. Great Spring Waters of Am., Inc., 1 S.W.3d 75, 82 (Tex. 1999) (Hecht, J., concurring).

Texas Supreme Court in 1904, this rule was supposedly followed by every single U.S. state except for New Hampshire.[70]

The rule of capture essentially holds that water extracted from the ground is the property of the person who brings it to the surface on their property, even if that water migrated from beneath another person's property.[71] As long as the water extraction was not done with malice and the water was being put to some legitimate use (a very hard standard for a complaining party to prevail against), the water producer had every right to extract whatever water they needed without having to pay neighbors any compensation at all.[72] Even if a landowner pumped so much water from underground that neighboring wells ran dry, in the absence of either malice or a lack of any use, they were doing nothing wrong in the eyes of the law.

This doctrine creates perverse incentives with regards to groundwater extraction in general, which are also in play with fracing operations. A fracing operator has an incentive to pump all the water he can use from beneath his land as quickly as practicable, otherwise neighboring landowners can pump that water from beneath their own plots. With the operator's optimal course of action in mind, neighboring landowners are likewise incentivized to quickly extract all the groundwater they can use from beneath their own lands, thus contributing to an overuse of the resource.

Although the rule of capture with regard to groundwater has been repeatedly reaffirmed by the Texas Supreme Court as late as 1999,[73] in much of the state, it has ceased to be the only limitation on use of groundwater. In 1917, thirteen years after the Texas Supreme Court's promulgation of the rule of capture, an amendment was made to the Texas

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[70] *Id.* at 81 (Hecht, J., concurring).
[71] Hous. & Tex. Cent. R.R. Co. v. East, 81 S.W. 279, 280 (Tex. 1904).
[72] *Id.* at 281–82.
[73] *Sipriano*, 1 S.W.3d at 80.

Constitution (which has subsequently been amended) in light of then-recent drought conditions which placed a duty on the state government to protect all natural resources, including water, within Texas's borders.[74] Although major action regarding groundwater would be a long time in coming, the Legislature in 1949 statutorily authorized the creation of groundwater conservation districts.[75] These are governing bodies at the local level and with leaders elected by residents within their boundaries[76] to regulate the quantity of and producible amounts from water wells within their respective jurisdictions.[77] The theory underlying these bodies is that they create a democratic method for managing groundwater within communities.[78] In large part, the permitted water quantities are determined both by the amount of water available in aquifers and users, as well as prior landholding interests' historical use of groundwater.[79] Although a limited number of regions have authority held not be groundwater conservation districts but rather by state agencies, such as the Edwards Aquifer Authority which regulates use of a major source of groundwater in central Texas,[80] most governing bodies regulating groundwater use are the local groundwater conservation districts. And in the absence of a groundwater conservation district (or equivalent state law body),[81] the rule of capture applies in full force, accompanied by the undiluted perverse incentives discussed earlier.

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[74] TEX. CONST. art. XVI, § 59; *Sipriano*, 1 S.W.3d at 77. *See also Sipriano*, 1 S.W.3d at 80 ("By constitutional amendment, Texas voters made groundwater regulation a duty of the Legislature.")

[75] *Sipriano*, 1 S.W.3d at 79.

[76] These do not have any direct relationships with municipal governments with authority within each district's boundaries.

[77] Edwards Aquifer Auth. v. Day, 269 S.W.3d 814, 834 (Tex. 2012); TEX. WATER CODE ANN. § 36.113(a) (West 2013) ("[A] district shall require a permit for the drilling, equipping, operating, or completing of wells . . . .").

[78] *See Edwards Aquifer Auth.*, 269 S.W.3d at 834 ("While districts have broad statutory authority, their activities remain under the local electorate's supervision.").

[79] *Id.* at 819–20.

[80] *Id.* at 818.

[81] This does represent a substantial amount of groundwater as measured by use, as evidenced by almost 15 percent of water usage taking place outside of groundwater conservation districts in 2008. *Groundwater*

State agencies have some regulatory authority over these districts. Groundwater management plans, which each district is required to develop, are required to be sent to the Texas Water Development Board in order to approve or deny them.[82] But once a plan is approved, implementation of said plan remains, by and large, with each groundwater conservation district.[83] In addition, the Texas Commission on Environmental Quality (TCEQ) has responsibilities regarding these districts, but interestingly, those responsibilities have more to do with administration than the environment. In short, TCEQ has the responsibility of maintaining records of directors of groundwater conservation districts and assuring that district directors are complying with the management plan submitted to TCEQ, but does have the authority to intervene in the district's activities if the district is not complying with its plan.[84] Responsibilities regarding groundwater quality are separate from TCEQ's authority over groundwater conservation districts.[85]

Aside from the mosaic of state and municipal authorities regulating groundwater use varying by region of the state of Texas (including regions where there is an absence of such authority), there is one additional complication specific to water used for fracing (as well as other oil and gas wells). In regions where there is a groundwater conservation district, the state's Water Code exempts operators of an oil or gas well, permitted by the Railroad Commission, from needing a permit to use groundwater for their well, provided that they themselves operate the water well on the same tract of land as the oil or gas well

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Conservation District Facts, TEX. WATER DEV. BOARD (last visited Apr. 13, 2014), http://www.twdb.state.tx.us/groundwater/conservation_districts/facts.asp.

[82] *Groundwater Conservation Districts*, TEX. WATER DEV. BOARD, http://www.twdb.state.tx.us/groundwater/conservation_districts/ (last visited Apr. 16, 2014).

[83] *Cf. Edwards Aquifer Auth.*, 269 S.W.3d at 834 ("Groundwater conservation districts have little supervision beyond the local level.").

[84] Liz Carmack, *Groundwater Conservation Districts*, TEX. COMMISSION ON ENVTL. QUALITY, http://www.tceq.state.tx.us/publications/pd/020/10-01/groundwater-conservation-districts (last modified July 24, 2013).

[85] *See infra* section 2.B.2.

and, more importantly for this discussion, the oil or gas well "is actively engaged in drilling or exploration operations."[86] The question raised by this statute is how fracing wells should be categorized for purposes of water use. At the point water is injected into the fracing well, drilling with a solid metal bit has been concluded. In addition, it is virtually certain that much investigation has been performed to determine that a fracing well will be a productive one, meaning that there is no need for the well to be an exploratory one to investigate the potential of the area for oil and gas production. But perhaps an argument could be made that, in some way, active fracing wells during flooding with water and other fluids can be found to be engaged in "drilling or exploration operations," such as by considering the widening and lengthening of underground cracks from high-pressure liquids to be analogous to drilling with a metal bit.

What is known is that some groundwater conservation districts have taken a more forbearing view of the statute with regard to fracing operations. Some do not require any water permit whatsoever for qualifying water used for fracing wells, while others are required to comply with water limits and reporting requirements in their use.[87] While there were multiple bills proposed at the eighty-third and most recent session of the Texas Legislature to resolve these inconsistencies and ambiguities related to the extent to which permits are required for groundwater used in hydraulic fracturing,[88] none of them were enacted into law.

To summarize the previous discussion, there is a set of perverse incentives for water use (even outside of fracing operations) due to the common law rule of capture, except in regions where there is countervailing municipal authority, unless the municipal authority

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[86] TEX. WATER CODE ANN. § 36.117(b)(2) (West 2013).
[87] Kate Galbraith, *Fracking Groundwater Rules Reflect Legal Ambiguities*, TEX. TRIB. (Mar. 13, 2013), http://www.texastribune.org/2013/03/13/fracking-groundwater-rules-reflect-legal-ambiguiti/.
[88] *Id.*

is one which exempts fracing-related water use from its regulation. It seems clear that there is considerable room for improvement with regard to Texas's regulation of water use in fracing.

2. Groundwater Contamination

Prevention of groundwater contamination directly from production operations can be the source of considerable variance among states since the federal SDWA does not apply to hydraulic fracturing production activities. Guarding against groundwater contamination from hydraulic fracturing is the responsibility of the Railroad Commission.[89] As the Commission is responsible for allocating permits to proposed wells, there is considerable authority to regulate the construction and the design of proposed fracing wells so as to considerably reduce the probability of groundwater contamination.[90]

Additionally, particular Railroad Commission rules aim to prevent and mitigate groundwater contamination from oil and gas operations generally. Statewide Rule 8 prohibits the contamination of water sources (whether groundwater or surfacewater) by wells permitted by the Commission.[91] The goal of preventing water contamination is strengthened by Statewide Rule 20, which requires that operators provide the Commission with notice in the event of a leak, spill, break, or fire, which must include a description of the incident and the volume of materials involved.[92] Unfortunately, there do not appear to be any standards in place for monitoring for the existence of leaks or groundwater contamination prior to the initial detection of a spill or other incident. The result of this is

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[89] 16 TEX. ADMIN. CODE § 3.13(a)(1) (2013).
[90] *See id.* ("When the [regulation] does not detail specific methods to achieve [the regulation's] objectives, the responsible party shall make every effort to follow the intent of the section . . . .").
[91] *Field Guide for the Assessment and Cleanup of Soil and Groundwater Contaminated with Condensate from a Spill Incident*, RAILROAD COMMISSION TEX., http://www.rrc.state.tx.us/environmental/spills/spillcleanup.php (last visited May 20, 2014).
[92] *Id.*

that effectiveness of the mechanism depends heavily on the effectiveness of measures taken independently by site operators.

In the event that actual groundwater contamination is detected from fracing activities, there are two Railroad Commission programs involved which oversee remediation activities. The first is the Operator Cleanup Program. This program requires oil and gas operators to clean up contamination caused by their operations and additionally requires oversight by the Railroad Commission of the operator's efforts to decontaminate the affected area.[93] On the other hand, there may be occasions where cleanup operations will not be performed by the site operator, whether due to insolvency, unwillingness, or inability to locate the operator. For such situations, the Railroad Commission oversees a cleanup fund financed through fees paid by oil and gas companies.[94] With these monies, the Commission bids out contracts for remediation of targeted sites by private contractors.[95]

C. ARKANSAS LAWS ON GROUNDWATER USE AND CONTAMINATION

1. Groundwater Use

Similar to Texas, the state of Arkansas utilizes a common law system of groundwater use that is heavily linked to ownership of the land. But unlike in Texas, the Arkansas system, a riparian one, is such that landowners overlying a groundwater source are subject to substantial limits on their right.[96] The most substantial limit is the doctrine of reasonable use.[97] While this may sound similar to the Texas requirement that groundwater use not be "unreasonable," the Arkansas version has more capacity to exercise

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[93] *Operator Cleanup Program*, RAILROAD COMMISSION TEX., http://www.rrc.state.tx.us/environmental/environsupport/operatorcleanup.php (last visited Apr. 17, 2014).
[94] *State Managed Cleanup Program*, RAILROAD COMMISSION TEX., http://www.rrc.state.tx.us/environmental/plugging/statemanagedcleanup.php (last updated July 22, 2013).
[95] *Id.*
[96] ARK. NATURAL RES. COMM'N, WATER LAW IN ARKANSAS 4 (2011).
[97] *Id.*

a limit on groundwater use. This is evidenced by the fact a reasonable use may not forever stay reasonable, but instead may become unreasonable through a change in conditions, including the subsequent use of groundwater by a nearby party.[98] In one further limitation, although Arkansas's riparian rights system does not generally prioritize one variety of use over another, use of water for domestic purposes (e.g., for household use) is given the highest priority over other uses.[99]

State government authority over groundwater use in Arkansas lies with the Arkansas Natural Resources Commission. The primary means of regulation is through the Commission's requirement that all groundwater use for non-domestic purposes be registered.[100] Although under normal conditions the authority is exercised only through the registration requirement, which does not in and of itself limit groundwater use, the Commission has the authority to impose additional limitations on areas which it designates as critical groundwater areas, based on significant declines in quantity or quality of groundwater.[101] Following designation of an area as a critical groundwater area, operation of a new water well in the area may require issuance of a water right from the Commission (with preexisting wells exempted from this limit).[102] However, although parts of Arkansas have been designated critical groundwater areas, this water right authority has not yet been exercised by the Commission.[103] Nevertheless, it remains available.

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[98] *Id.*
[99] *Id.*
[100] *Water-Use Registration Program*, ARK. NAT. RESOURCES COMMISSION, https://static.ark.org/eeuploads/anrc/Water-use-Reg-Fact-Sheet.pdf (last visited May 1, 2014).
[101] *The Facts About Critical Groundwater Designation*, ARK. NAT. RESOURCES COMMISSION, http://www.arkansas.gov/awwcc/gw_designation_graphic.pdf (last visited May 1, 2014).
[102] *Water-Use Registration Program*, *supra* note 100.
[103] *The Facts About Critical Groundwater Designation*, *supra* note 101.

2. Groundwater Contamination

In Arkansas, regulation of oil and gas activities generally (including hydraulic fracturing) is under the authority of the Arkansas Oil and Gas Commission (AOGC). The AOGC's Rule B-19 specifically regulates hydraulic fracturing operations.[104] Although full coverage of Rule B-19 is beyond the scope of this paper, one notable aspect will be mentioned. This regulation sets a variety of guidelines in place which are designed to protect groundwater supplies. One of the more notable guidelines is that it requires the well operator to make a report to the agency when either a change in casing pressure would indicate a leak of fluids within the well casing during fracturing of the underlying rock formation, or a pressure that exceeds the burst pressure of the well casing.[105] The mechanism is designed to be very swift, as the report must be made within twenty-four hours of the pressure event.[106]

The mechanism does not limit itself to reporting. The regulation allows for additional testing or documentation to determine whether the pressure event indicates that any groundwater supplies have been endangered by the fracing fluids.[107] The Commission's Director consequently has the authority to order any additional repair or engineering of the well to remedy whatever might have gone wrong during the pressure incident and has discretion to halt operations at the well even beyond the fracing itself.[108] Furthermore, after reporting to the Commission at its following regular hearing, the Commission has wide discretion to "take such further action as it deems necessary and appropriate under the circumstances."[109]

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[104] ARK. OIL & GAS COMM'N, RULE B-19 REQUIREMENTS FOR WELL COMPLETION UTILIZING FRACTURE STIMULATION (2011).
[105] *Id.*
[106] *Id.*
[107] *Id.*
[108] *Id.*
[109] *Id.*

D. COLORADO LAWS ON GROUNDWATER USE AND CONTAMINATION

1. Groundwater Use

Compared to the two groundwater management regimes described above, Colorado utilizes a system which is substantially more elaborate. Colorado's system of water rights, regulated by a permitting system overseen by the Division of Water Resources within the Department of Natural Resources, utilizes what is called the prior appropriation doctrine.[110] Essentially, this doctrine grants priority of water rights over a supply to those who have appropriated and used water from that supply at an earlier time.[111] Although the amount of water rights over a given source may exceed the supply available over a time period, those persons with more senior water rights must have an earlier opportunity to satisfy their rights before junior water rights holders get their opportunities.[112]

Unlike in Texas (arguably), this system of water rights does not contain an exemption for hydraulic fracturing or other methods of producing natural gas and oil. So while fracturing operators can apply for and receive permits from the Division of Water Resources, they would not be of any use if more senior water rights exhausted all of an available resource before they had an opportunity to utilize it. So what methods are available for avoiding this potential obstacle?

One measure is simply to contract with more senior water rights holders in order to transfer rights to the water. While this could be done by simply selling water rights to fracing operators, the rights could instead be leased for a period of time, such that while the original party still retains the water rights, the lessee would still obtain the legal capacity to use the water for purposes of hydraulic fracturing. This technique was utilized by the

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[110] DIV. OF WATER RES., GUIDE TO COLORADO WELL PERMITS, WATER RIGHTS, AND WATER ADMINISTRATION 1 (2012), *available at* http://water.state.co.us/DWRIPub/Documents/wellpermitguide.pdf.
[111] *Id.*
[112] *Id.*

city of Aurora, which approved a leasing deal with Anadarko Petroleum to lease used water, which would otherwise flow downriver after being treated, for the purposes of hydraulic fracturing.[113]

2. Groundwater Contamination

Although there are a variety of Colorado regulations regarding drilling and decontamination activities, more interesting for this discussion is a rule promulgated by the Colorado Oil & Gas Conservation Commission just last year.[114] With the exception of certain wells which already provide for similar testing, the new Rule 609 requires testing of available water sources within a half-mile radius of an oil or gas wells (including hydraulic fracturing wells) for which a drilling permit is applied for no earlier than May 1, 2013.[115] Results of the tests must be provided to the Commission's Director, as well as neighboring landowners, in order to determine whether groundwater supplies are being harmed by oil and gas operations and, in the event that harms arise, to identify problems that arise.[116]

This rule is meant to help provide assurance that energy production does not adversely impact nearby water supplies, as well as to provide early indicators of contamination in the event of groundwater contamination.[117] Samples must initially be taken from targeted sources within twelve months of starting to lay pipe for a well, and then at the same points between six and twelve months after the completion of the well,

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[113] Sara Castellanos, *Aurora OKs $9.5 Million Fracking Water Deal with Anadarko*, AURORA SENTINEL, http://www.aurorasentinel.com/news/aurora-oks-9-5-million-fracking-water-deal-with-anadarko/ (last updated July 12, 2012).

[114] *COGCC Approves Pioneering New Groundwater Protections*, OIL & GAS CONSERVATION COMMISSION (Jan. 7, 2013), http://cogcc.state.co.us/RR_HF2012/Groundwater/COGCC_APPROVES_PIONEERING_NEW_GROUNDWATER_PROTECTIONS.pdf [hereinafter *Rule 609 Press Release*].

[115] COLO. CODE REGS. § 404-1:609(a)(1), (b) (2013).

[116] COLO. CODE REGS. § 404-1:609(f) (2013); *Rule 609 Press Release*, *supra* note 114, at 1.

[117] *Rule 609 Press Release*, *supra* note 114, at 1.

with one additional sampling required between sixty and seventy-two months after well completion.[118]

E. BRIEF ANALYSIS

With regard to Texas groundwater use, both the current common law (rule of capture) and statutory (groundwater conservation districts) regimes are substantially flawed solutions with regard to hydraulic fracturing. The rule of capture, in particular, does not encourage the use of conservation measures to protect the availability of the resource. Even assuming that fracing operators act prudently in their use of groundwater, neighboring landowners are strongly incentivized, to an increased extent in conditions of water scarcity, to extract and use whatever they can as quickly as they can. Even if the existence of groundwater conservation districts in an area supersedes the rule of capture, the diversity of such districts creates issues of uniformity which can create substantial costs of administrative compliance with multiple jurisdictions, with added ambiguity regarding whether or not fracing activities are exempt from permitting requirements by groundwater conservation districts.[119] This suggests two remedies. First, groundwater use should be placed under the regulatory authority of a single state agency, as in Arkansas and Colorado, which is capable of enacting a uniform set of regulations over groundwater use. As needed, these regulations should account for geographical differences, such as variability in groundwater scarcity and condition of aquifers. Second, the Texas legislature should clarify the exemption status of fracing operations (potentially with oil and gas production more generally), with regard to groundwater permitting requirements. This paper would hold that permitting requirements should be extended to fracing operations for purposes of equalizing incentives for reasonable use of groundwater.

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[118] COLO. CODE REGS. § 404-1:609(d) (2013).
[119] *See supra* notes 86–88 and accompanying text.

The standards which should be used by such an agency, however, are less clear. It seems like a matter of common sense that groundwater regulation should be based on the amount of water available for use. But what else should be considered? One could argue that past historical use of water from the aquifer could be considered, as in Colorado's prior appropriation system. But the burden of demonstrating historical use of water could be quite arduous. This could entail gathering a plethora of evidence necessary to prove historical use (as well as the commencement of such use, in a full prior-appropriations system), such as testimony and affidavits by previous landowners, some quantum of documentation of water use (which might not exist in a given case), and circumstantial evidence that water was being used.[120] The burden on landowners could be very substantial indeed. What about a riparian system that considers the reasonableness of various uses, as is in place in Arkansas? If this were enacted in Texas, it would likely rely heavily on idiosyncrasies and political preference, seeing as how it is very difficult to compare different uses, such as household use, fracing, agriculture, and others, on a scale of reasonableness, as different people would express very different views based on how they use water. While this would involve much lighter evidentiary burdens than under a historical use system, the variability of uses would make it controversial in implementation.

On the topic of water contamination, while Texas's Railroad Commission framework for guarding against groundwater contamination is sound in theory, particularly in its programs for collaborating with and/or overseeing private entities in decontamination procedures, it appears to lack effectiveness prior to contamination incidents in that it lacks guidelines or procedures to facilitate relatively early detection of groundwater

[120] For a demonstration of how landowners can heavily fail to receive a requested quantity of groundwater, see the example of *Edwards Aquifer Authority v. Day*, 369 S.W.3d 814, 820–21 (Tex. 2012), in which a landowner was only granted a permit for 14 acre-feet of water per year rather than the 700 acre-feet he requested.

contamination. Although Arkansas and Colorado each specify particular methods as warning systems for contamination (pressure readings and water quality tests, respectively), perhaps it is not necessary for Texas to specify particular measures which are necessary in every case. With regard to groundwater testing in particular, while is a very direct way of mitigating the extent of contamination, any implementation should be carefully developed not only for reasons of effectiveness, but also because an excessive testing program could spark controversies with landowners neighboring fracing sites who could view the use of groundwater in testing as a taking of their property.[121] With landowners in Texas holding a property interest in the groundwater underlying their own land, even water they are restricted from extracting,[122] this issue should not be discounted.

Perhaps a more advisable standard would be to establish a set of measures adjudged to be effective in early detection of groundwater contamination incidents (such as pressure readings, periodic water quality tests, or others), and allow for site operators to choose from among them according to which would be the best to use, whether due to cost, expertise, or another reason.[123] Doing so could allow for operator flexibility while the goal of protecting groundwater quality.

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[121] WISEMAN & GRADIJAN, *supra* note 26, at 6.

[122] Edwards Aquifer Auth. v. Day, 369 S.W.3d 814, 838 (Tex. 2012).

[123] *See* WISEMAN & GRADIJAN, *supra* note 26, at 100 (noting that, with regard to water testing, determining who should pay for testing costs "should take into account which parties have the most knowledge of appropriate testing procedures, can afford the testing, and will ensure that testing is conducted consistently and accurately"). To give one prior example of such a flexibility-providing standard, the U.S. Department of Transportation from 1972 to 1986 required passenger cars to include air bags and other passive protection systems or seat belt mechanisms, but did not require (although it allowed) a combination of both types to be installed. Geier v. Am. Honda Motor Co., 529 U.S. 861, 865 (2000).

Chapter 3: Air Emissions

A. INTRODUCTION

Although there is substantial concern about the contribution combustion of oil or natural gas adds to air emissions, the resources' production operations themselves are significant contributors of air emissions independent of the end uses of the produced resources. These emissions are proving to be a key issue for state policymakers.

These emissions are not simply the result of produced gases escaping through leaky production pipes and storage containers. A major source of emissions from fracing can be found in the standard pre-production process of flowback, whereby the fracing fluids, water, and substances from the reservoir return through the drilled pathway to the surface.[124] Often contained in this mixture is a variety of substances which might have substantial adverse health effects. In focused research, an investigation of hydraulic fracturing operations in Garfield County, Colorado indicated that persons living within half a mile of hydraulic fracturing wells were at elevated risk of negative health effects, particularly arising out of exposure to gaseous trimethylbenzenes, xylenes, benzene, and other substances, which were attributed in large part to flowback processes.[125]

There have also been a variety of anecdotal reports which, although not causally linked to hydraulic fracturing, have raised substantial concerns. In fact, two of the more dramatic reports originate from Texas's Barnett Shale region, very active in hydraulic fracturing. In the town of Dish, the two sons of the town's one-time mayor, Calvin Tillman, suffered nosebleeds that occurred in the presence of what were described as "strong gas

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[124] Lisa M. McKenzie et al., *Human Health Risk Assessment of Air Emissions from Development of Unconventional Natural Gas Resources*, 424 SCI. TOTAL ENV'T 79, 79 (2012).
[125] *Id.* at 83–86.

odors."[126] These occurrences became so serious for Tillman's family that he decided to move them away from the town.[127] In one further instance, in the Dallas-Fort Worth metropolitan area, the town of Flower Mound reported a "seemingly excessive" number of childhood cases of leukemia between 1998 and 2009, which residents feared were due to air emissions of benzene from hydraulic fracturing, which sparked an investigation by the state's Department of State Health Services that failed to confirm the existence of a cancer cluster from these reports.[128] Instances such as these, although not conclusively linked to hydraulic fracturing, have helped precipitate concern about the risks of air emissions from hydraulic fracturing.

To a significant extent, federal law can play a major role in this area. Many sources of air emissions are regulated under federal standards (via programs overseen by states) through the Clean Air Act. In fact, in 2012, the Environmental Protection Agency promulgated rules regulating certain air emissions associated with hydraulic fracturing wells.[129] The EPA claims that these regulations will result in a dramatic reduction in a variety of emissions from both current and future fracing wells.[130] On its face, this federal development might leave relatively little room for states to exercise their discretion in regulating hydraulic fracturing emissions. In fact, among the comments received by the EPA prior to finalizing these rules, one focused specifically on concerns that the EPA was

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[126] Rachael Rawlins, *Planning for Fracking on the Barnett Shale: Urban Air Pollution, Improving Health Based Regulation, and the Role of Local Governments*, 31 VA. ENVTL. L.J. 226, 230 (2013)
[127] *Id.*
[128] DEP'T OF STATE HEALTH SERVS., SUMMARY OF INVESTIGATION INTO THE OCCURRENCE OF CANCER ZIP CODES 75022 AND 75028, FLOWER MOUND DENTON COUNTY, TEXAS 1998–2007, 2007–2009, at 1–2 (2010); Rawlins, *supra* note 126, at 230–31.
[129] Oil and Natural Gas Sector: New Source Performance Standards and National Emission Standards for Hazardous Air Pollutants Reviews, 77 Fed. Reg. 49,490 (Aug. 16, 2012) (codified at 40 C.F.R. pts. 60, 63).
[130] *Id.* at 49,534.

dramatically expanding the scope of its authority in the absence of a legal basis for doing so.[131]

However, even if the federal government retains substantial authority over air emissions from hydraulic fracturing operations, there remains considerable room for state agencies in this area. Unlike federal surfacewater regulation under the Clean Water Act, under which substantial direct federal oversight is triggered according to the nature of the surfacewater body under consideration,[132] regulation of air emissions from the Clean Air Act is most frequently governed in accordance with the provisions of EPA-approved State Implementation Plans, which are developed by states in order to meet federal air quality standards.[133] In particular, states retain much discretion in how they regulate sources of air pollutants which do not qualify as major sources under the Clean Air Act, and hydraulic fracturing operations may frequently not meet the federal definition of a major source.[134] Although there may be a need for states to regulate minor sources such as various fracing operations in order to meet federal air quality standards, the means by which they are regulated is a matter generally given to state policymakers. Consequently, there can still be substantial regulation of fracing at the state level, differing significantly from federal requirements, with which fracing operators will have to comply. This report will now turn

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131 *Id.* at 49,514.

132 *See* 33 U.S.C. § 1362(12) (2012) (limiting by location "discharge of a pollutant" under the Clean Water Act to "navigable waters" or various coastal areas); 33 U.S.C. § 1362(7) (defining navigable waters as "the waters of the United States, including the territorial seas"); Rapinos v. United States, 547 U.S. 715, 732 (2006) (noting that the Clean Water Act's definition of navigable waters "does not refer to water in general").

133 42 U.S.C. § 7410 (2012); *see also* JJ England, Note, *Saving Preemption in the Clean Air Act: Climate Change, State Common Law, and Plaintiffs Without a Remedy*, 43 ENVTL. L. 701, 707 (2013) ("So long as the [State Implementation Plan] meets [the goal of achieving attainment with air quality standards], states retain significant regulatory discretion regarding stationary sources not otherwise regulated by the Act.").

134 *See* Arthur P. Mizzi, *EPA's New Source Review and Routine Maintenance, Repair, and Replacement Reforms*, COLO. LAW., July 2004, at 105, 106 ("Major sources are directly regulated by the Clean Air Act; minor sources are indirectly regulated through the states' implementation of the Clean Air Act."); Rawlins, *supra* note 126, at 267 ("Gas industry operations have been largely slipping under EPA regulations because they do not qualify as 'major sources' of air pollution.").

to examples of regulations at the state level of fugitive emissions from hydraulic fracturing operations.

For purposes of this discussion, Texas's regulatory framework will be compared to those in two other states: Colorado and Louisiana. There are substantial quantitative and qualitative differences in how each state works to limit fugitive emissions, thus allowing for a more useful comparison relative to Texas.

B. TEXAS REGULATIONS OF FUGITIVE EMISSIONS

Although Texas has been a major player in hydraulic fracturing production, there has been relatively little regulation of the process's air emissions at the state level. TCEQ has long had a role of regulating air emissions from Texas oil and gas wells generally. However, the rules governing air emissions from oil and gas wells were not adjusted to account for the rise of hydraulic fracturing operations until 2011.[135]

In fact, this adjustment cannot really accurately be described as a full adjustment targeting hydraulic fracturing, since the modification only applies geographically to operations in the Barnett Shale.[136] For other Texas regions highly conducive to hydraulic fracturing, such as the Eagle Ford Shale, the previously utilized regulations, which govern oil and gas operations generally, will apply irrespective of whether hydraulic fracturing is involved.[137] Perhaps this special focus on the Barnett Shale, which is more heavily

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[135] *See* 36 Tex. Reg. 943, 944 (Feb. 18, 2011) (codified at 30 TEX. ADMIN. CODE § 106.352) ("While the technology for drilling wells and producing oil and gas has evolved, the laws governing this industry have not.").

[136] 30 TEX. ADMIN CODE § 106.352(a)(1) (2013).

[137] *Id.* (noting that "all other new projects and related facilities" in other parts of the state are governed by § 106.352(l)); *What are the Requirements for New Oil and Gas Projects NOT Located in Barnett Shale Counties?*, TEX. COMMISSION ON ENVTL. QUALITY, http://www.tceq.texas.gov/permitting/air/newsourcereview/chemical/og-reqnot2.html (last visited Mar. 27, 2014) (noting that the requirements of § 106.352(l) were originally fully comprised in § 106.352 prior to the Barnett Shale modifications).

populated than other Texas shale plays, can be justified on account of more heavily populated areas facing heavier burdens of air pollution.[138]

But although the scope of the regulations targeting hydraulic fracturing is dramatically limited by geography, it is worth examining adjustments made via the Barnett Shale modifications regarding detecting sources of fugitive emissions. Not all emissions may be foreseen in a hydraulic fracturing operation. Some emissions can result from leaks, which even though they might very small in scale, could release substantial emissions over a period of time. To this end, part of the Barnett Shale regulations comprises an inspection requirement in order to guard against such fugitive emissions.[139] However, as the inspections are only required to be on a quarterly basis, this still leaves much room for fugitive emissions, commencing well prior to a planned inspection, to have a notable impact on emissions levels. Furthermore, even if a leak is discovered, repair does not have to be performed for thirty days (if the facility is manned) or sixty days (if the facility is unmanned), with a delay permitted longer to the next planned shutdown of the facility if the repair would require such a shutdown and would create more emissions than would be eliminated by the repair.[140] Failure to comply with these requirements will subject violating operators to enforcement from TCEQ, with penalties set in accordance with the agency's Penalty Policy.[141] Although the Policy does not set out specific penalty ranges for noncompliance, beyond a maximum for civil and administrative penalties of $25,000 per violation per day and a civil penalty minimum of $50 per violation per day, it does set out

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[138] *See* Rhonda L. Ross & Tammy Asher Brown, *A Fatal Flaw in the Clean Air Act: How the Clean Air Act Fails to Adequately Regulate Ambient Concentrations of Hazardous Air Pollutants*, 32 UTAH ENVTL. L. REV. 55, 64 (2012) (noting that research has found that populations in urban areas tend to have "a greater exposure of both carcinogenic and non-carcinogenic [Hazardous Air Pollutants]").

[139] 30 TEX. ADMIN CODE § 106.352(e)(5) (2013).

[140] 30 TEX. ADMIN CODE § 106.352(e)(5)(B) (2013).

[141] *The Enforcement Process: From Violations to Actions*, TEX. COMMISSION ON ENVTL. QUALITY, http://www.tceq.state.tx.us/enforcement/process.html (last modified Jan. 7, 2014).

a variety of factors which are to be considered in assessing penalties, including the nature of the violation, the impact of the violation, the violator's past and present actions, and any other matters that justice may require.[142]

While it is an encouraging sign that TCEQ has developed and implemented rules specifically regulating air emissions from hydraulic fracturing, it should be clear based on the limited geographical scope of current targeted rules, as well as the apparent deficiencies with the regulations on emissions monitoring and leak inspection, that there is considerable room for improvement.

C. COLORADO REGULATIONS OF FUGITIVE EMISSIONS

In February 2014, Colorado's Air Quality Control Commission made substantial revisions to its regulations governing air emissions from the oil and gas industry.[143] Although these regulations do not specifically focus on hydraulic fracturing,[144] it is widely believed that the adjusted rules will have a very substantial effect on such activities.[145] These standards are generally based on industry standards promulgated by the EPA.[146] Although the revisions cover a wide variety of matters related to air emissions from fracing

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142 TEX. WATER CODE ANN. § 7.053 (West 2013); TEX. COMM'N ON ENVTL. QUALITY, PENALTY POLICY 2 tbl.1, 7–22 (2014).

143 *Oil and Gas Rulemaking Hearing - February 19 Thru 23, 2014: Adopted Regulations and Associated Information*, COLO. DEP'T PUB. HEALTH & ENV'T, http://www.colorado.gov/cs/Satellite/CDPHE-AQCC/CBON/1251647985820 (last visited Mar. 28, 2014).

144 *See* COLO. AIR QUALITY CONTROL COMM'N, REVISIONS TO COLORADO AIR QUALITY CONTROL COMMISSION'S REGULATION NUMBERS 3, 6, AND 7 FACT SHEET 1 (2014) [hereinafter COLO. FACT SHEET] (summarizing changes made to "oil and gas control measures" generally).

145 In fact, in multiple contemporaneous news stories on the updated regulations, the rules were framed as targeting hydraulic fracturing in particular, rather than general oil and gas activities in Colorado. *See, e.g.*, Ken Silverstein, *Colorado Fracking Rules Could Become National Blueprint*, FORBES (Feb. 25, 2014, 12:11 PM), http://www.forbes.com/sites/kensilverstein/2014/02/25/colorado-fracking-rules-could-become-national-blueprint/; Jennifer Oldham, *Colorado First State to Clamp Down on Fracking Methane Pollution*, BLOOMBERG (Feb. 23, 2014, 8:20 PM), http://www.bloomberg.com/news/2014-02-24/colorado-first-state-to-clamp-down-on-fracking-methane-pollution.html.

146 *See* COLO. FACT SHEET, *supra* note 144 (stating that the new regulations "fully adopt[]" EPA standards).

operations, such as emissions controls and equipment standards, this paper will focus on leak inspection and repair requirements.

The updated regulations, similarly to those implemented in Texas, contain leak inspection requirements for oil and natural gas sites. For well production facilities, an initial inspection is required fifteen to thirty days after operations commence at the site if the facility is constructed no earlier than October 15, 2014.[147] Even for sites started earlier, a phase-in of a periodic inspection schedule is required.[148] This schedule, based on VOC emissions from production sites, requires Approved Instrument Monitoring Method (AIMM) inspections to be performed at all sites with any VOC emissions, with the frequency ranging from a one-time-only inspection for the smallest sites to monthly inspections for the largest sites.[149] In addition, Audio/Visual/Olfactory (AVO) inspection is required on a monthly basis for all but the largest emitting production sites, which, although they are exempt from the AVO requirement, would still have to have monthly AIMM inspections.[150] It should be noted that each of these requirements may be exempted on a component-by-component basis for those components at a production site which are "unsafe, difficult, or inaccessible to monitor."[151]

In addition, detection of a leak triggers a repair requirement mandating quicker action than under Texas's standard. The Colorado regulation generally requires an initial repair attempt to be made within five days of detection, with remonitoring of the leak within fifteen days of the attempt to test the repair's effectiveness.[152] The initial repair timeframe

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147 *Id.* at 3.
148 *Id.*
149 *Id.*
150 *Id.*
151 *Id.*
152 COLO. AIR QUALITY CONTROL COMM'N, REGULATION NUMBER 3: STATIONARY SOURCE PERMITTING AND AIR POLLUTANT EMISSION NOTICE REQUIREMENTS 26 (2014).

is extended when needed parts are unavailable (in which case those parts must be ordered promptly and the repair must be completed within fifteen days of receiving the needed parts), when a shutdown is needed (in which case the repair must be completed during the next scheduled shutdown of the equipment), or if other good cause exists for delaying the leak (in which case the repair must be completed within fifteen days after that cause no longer applies).[153]

D. LOUISIANA REGULATIONS OF FUGITIVE EMISSIONS

Recent Louisiana regulations on hydraulic fracturing, promulgated in 2009, have considerable similarities to the Texas regulations discussed, for better and worse. The regulations contain a similar geographic limitation on their applicability, in that they apply only to operations in the Haynesville Shale.[154] In addition, the order, similar to Texas's regulations, has as a strong motivating factor a desire to protect certain sensitive needs of the community.[155] But unlike the Texas regulations, the Louisiana regulations provide only minimal guidance as to what practices will bring compliance with emissions.

Take a regulation on muffling exhaust, for example. The Louisiana regulation requires that exhaust from any engine or compressor used in conjunction with drilling or production shall not release emissions into the air "unless it is equipped with an exhaust muffler, or an exhaust box . . . sufficient to suppress noise and disruptive vibrations."[156] Although guidance is provided in the order as to allowable noise levels at a production

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153 *Id.*

154 OFFICE OF CONSERVATION, ORDER NO. U-HS 2–3 (2009) [hereinafter ORDER NO. U-HS], *available at* http://dnr.louisiana.gov/assets/OC/eng_div/20090806-U-HS.pdf.

155 *Compare* 30 TEX. ADMIN CODE § 106.352(b)(2) (2013) (including among "receptors" any "residence, school, day-care, hospital, business, or place of worship") *with* ORDER NO. U-HS, *supra* note 154, at 3 (making the regulation applicable to certain wells within 750 feet of any "residence, religious institution, public building or public park in an urban area").

156 ORDER NO. U-HS, *supra* note 154, at 4.

site,[157] no guidance is provided as to how much suppression must be provided for an individual piece of equipment.

In one further example, the Louisiana regulations contain measures regarding gas venting and flaring from wells. Similarly, little concrete guidance is provided. The regulation mandates the "employ[ment of] appropriate equipment and processes as soon as practicable to minimize" releases of gas.[158] The regulations permit either venting or flaring, with the only additional guidance being that any flaring shall not be located less than 200 feet from any non-operations building on the production site (more concrete guidance) and that the flame "shall be screened . . . as to minimize detrimental effects" to landowners next to the production site (minimally concrete).[159] In short, while this Louisiana regulation is potentially useful, the considerably lower level of concrete guidance it provides leaves considerable room for improvement in terms of specifying more precise standards for achieving compliance with the state regulation, such as by specifying numerical measures to be considered or establishing a particular technology standard to be achieved in fracing operations.

In addition, the new Louisiana regulations, unlike the Texas and Colorado regulations, do not contain a special inspection and monitoring requirement for fracing sites, a rather inferior quality in that regard. Instead, they rely on the adapting of standards derived from federal regulations targeting oil and gas production generally, rather than hydraulic fracturing in particular, to set requirements for the industry.[160] According to these

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[157] *Id.* at 4–5.
[158] *Id.* at 4.
[159] *Id.*
[160] *Louisiana Consolidated Fugitive Emission Program Stringency Table*, LA. DEP'T ENVTL. QUALITY, http://www.deq.louisiana.gov/portal/portals/0/programs/LDAR/Strigency%20Table%20Update.pdf (last visited May 19, 2014); *Louisiana Fugitive Emission Program Consolidation Guidelines*, LA. DEP'T ENVTL. QUALITY,

adapted standards, required monitoring is to be done quarterly through the examination of pressure relief devices in order to investigate discrepancies in pressure readings, which could indicate a leak.[161] In addition, the monitoring for fugitive emissions from individual components of potential hydraulic fracturing sites is governed by an amalgam of federally created standards, which depending on the component can be as short as a month[162] to lacking any apparent schedule.[163]

E. BRIEF ANALYSIS

While Texas deserves credit for trying to account for and mitigate the risks for fugitive emissions from hydraulic fracturing, it is apparent that considerable improvements can be made. First, and most plainly, is the geographical limits on the fracing regulation. Although Texas is not alone in using such restrictions, as evidenced by the example of Louisiana discussed above, there does not appear to be a rationale for limiting the scope of fracing regulations to the vicinity of a single producing shale formation.

Although the frequency of monitoring for sources of fugitive emissions in Texas is less than under the Colorado regulation and (for some components, at least) in the Louisiana regulation, it is unclear what impact this has on air emissions. Although intuition would indicate that more frequent monitoring of fracing sites would lead to a substantial reduction in leaks and a consequent significant reduction in air emissions, it is unclear what quantity of emissions would be reduced by such inspections. Since it is plausible that smaller leaks would need more detailed inspections to be detected, while larger and, hence more polluting leaks can manifest in more noticeable ways (such as through equipment

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http://www.deq.louisiana.gov/portal/portals/0/programs/LDAR/Consolidated%20Guidelines%20Updated.pdf (last visited May 19, 2014).

[161] 40 C.F.R. § 63.7690(c)(1) (2013).

[162] 40 C.F.R. § 61.242–7 (2013) (valves).

[163] 40 C.F.R. § 61.242–3 (2013) (compressors).

malfunctions), the scale of fugitive emissions detectable by more frequent inspections could be rather slight. In addition, as increased inspections would entail increased costs on the part of site operators, it is plausible that avoided harm from earlier detected leaks could be dwarfed by the added cost of additional inspections. These matters merit careful examination before implementing any accelerated inspection schedule.

Finally, not only the quantity, but the quality of inspections could be deserving of further consideration. Although the Texas regulatory regime does establish a general inspection requirement, it does not establish specific methods for carrying out the required inspections, which could result in considerable variation in detection methods (and possibly success rates. By contrast, Colorado does require the use of two specific methods (Approved Instrument Monitoring Method and Audio/Visual/Olfactory) for carrying out required inspections. While this does promote greater uniformity and while the inspection methods no doubt have considerable merit, care needs to be taken that such methods do not impose excessive cost, as evidenced by Colorado's declining to impose an AVO inspection requirement on larger hydraulic fracturing sites.

However, Texas's current regulation of fugitive emissions from hydraulic fracturing sites is, overall, at least a very good start. Its initial efforts appear to be quite workable and, in contrast to Louisiana's create a relatively straightforward mechanism and schedule for mitigating the risks of unanticipated air emissions from hydraulic fracturing operations.

Chapter 4: Municipal Regulation of Hydraulic Fracturing

A. INTRODUCTION

Many of the impacts attributable to hydraulic fracturing, from the air and water pollutions discussed above, to the wear and tear placed on roads and lands linked to fracing, the aesthetic effects created by fracing operations, are very locally focused. To the extent that many of the negative impacts of fracing most heavily impact surrounding communities, municipalities have a substantial incentive to regulate hydraulic fracturing operations, perhaps even to the extent of an outright prohibition on fracing. Furthermore, as interested municipalities are closer in proximity to the operations compared to regulators stationed in state capitals, their greater familiarity with affected land may give them some proficiency over state regulators in setting boundaries on hydraulic fracturing.

On the other hand, heterogeneity of local regulations may impose substantial costs on its own. Although centralized regulation does sacrifice a degree of familiarity with local conditions, it allows for much greater regulatory uniformity as overseen by one (or possibly a small number of) regulatory authority. By contrast, a lack of coordination among local authorities can cause well operators to face a veritable plethora of regulations, with which they will have to comply with in a quantity in direct relation to the scope of their operations. For companies operating a larger number of wells, the need to organize operations so as to comply with multiple municipal regimes can be very onerous.[164] In light of this, it is advisable to examine the extent to which states permit municipalities to place their own regulations on hydraulic fracturing operations.[165] While these regulations have at times

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[164] *See* Sorell E. Negro, *Fracking Wars: Federal, State and Local Conflicts over the Regulation of Natural Gas Activities*, ZONING & PLAN. L. REP., Feb. 2012, at 1, 5 (recording a gas-well coordinator's observation that, for companies operating in adjacent localities, "'the biggest problem is between municipalities,' not between municipalities and the state").

[165] The extent to which municipal restrictions could be preempted by federal, rather than state, law is a separate matter. *See* Tex. Midstream Gas Servs., L.L.C. v. City of Grand Prairie, No. 3:08-CV-1724-D, 2008

extended to outright bans on hydraulic fracturing,[166] these restrictions may take a wider variety of forms.

This segment will provide a comparison between Texas's approach to the issue and the approaches of two other states, West Virginia and Pennsylvania, which not only are significant participants in the area of hydraulic fracturing,[167] but also have experienced very recent legal developments concerning municipal regulation of such activities. These developments have placed municipal authority in the two other states on opposing portions of a spectrum, extending from considerable municipal authority over fracing (Pennsylvania) to virtually no municipal authority at all beyond replicating state fracing regulation (West Virginia). While Texas's system provides authority to municipalities to a degree between those two poles, to an extent favored by this report, the flexibility comes with substantial ambiguity regarding the extent of municipal authority in Texas, which can create substantial costs of its own.

WL 5000038, at *12 (N.D. Tex. Nov. 12, 2008), *aff'd*, 608 F.3d 200 (5th Cir. 2010) (finding a municipal fencing requirement for a natural gas compressor likely to be preempted by federal law).

166 Shaun A. Goho, *Municipalities and Hydraulic Fracturing: Trends in State Preemption*, PLAN. & ENVTL. L., Jul. 2012, at 3, 4 (claiming that "well over 100 municipalities have imposed either permanent bans or temporary moratoria on fracking"); Melinda Taylor, *Anti-Fracking Ordinances and Public Trust in Unconventional Drilling*, ENERGY CENTER (Nov. 13, 2013), http://www.utexas.edu/law/centers/energy/blog/2013/11/anti-fracking-ordinances-and-public-trust-in-unconventional-drilling/ (highlighting the Colorado cities of Boulder, Fort Collins, and Lafayette and the Ohio city of Oberlin as three cities which, like many others, have approved various moratoria or limits on fracing).

167 *See* Patrick Reis, *In Fracking, West Virginia Sees a Second Chance*, NAT'L J. (Oct. 27, 2013), http://www.nationaljournal.com/new-energy-paradigm/in-fracking-west-virginia-sees-a-second-chance-20131027 (attributing fracing to production of 400 billion cubic feet of natural gas in West Virginia in 2011, more than twice the state's production of ten years prior); Ken Silverstein, *Pennsylvania and New York Are a Thousand Miles Apart on Shale Gas Fracking*, ENERGYBIZ (Aug. 19, 2013), http://www.energybiz.com/article/13/08/pennsylvania-and-new-york-are-thousand-miles-apart-shale-gas-fracking (estimating that shale gas production in Pennsylvania was 1.5 trillion cubic feet in the first half of 2011).

B. MUNICIPAL FRACING REGULATION IN TEXAS

Texas towns with populations of more than 5,000 people have broad powers accorded to themselves by way of the state's home-rule constitutional provision.[168] Under state law, such home rule municipalities are not only accorded all of the powers of self-government, but also look to state law only for limitations on their authority, rather than to see what specific powers are enumerated to them.[169]

Municipal authority is not preempted simply due to any inconsistency with state law or regulation. Rather, preemption by state law must be done with "unmistakable clarity" of the intentions of the State Legislature.[170] Even if a municipal ordinance imposes a requirement that unmistakably differs from one imposed by state law, it may still not be subject to preemption, even without modification.[171]

With the key question being whether regulation (or even permit grants) of the Railroad Commission preempt municipal restrictions on hydraulic fracturing, the answer generally appears to be no.[172] Municipal regulation of fracing within the state has taken a variety of forms, such as spacing regulations placed on natural gas wells within the city limits of Dallas,[173] as well as a moratorium on new applications for natural gas well drilling

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[168] TEX. CONST. art. XI, § 5; CAL JILLSON, TEXAS POLITICS: GOVERNING THE LONE STAR STATE 229 (4th ed. 2013).

[169] S. Crushed Concrete, LLC v. City of Hous., 398 S.W.3d 676, 678 (Tex. 2013).

[170] Dall. Merchant's & Concessionaire's Ass'n v. City of Dall., 852 S.W.2d 489, 491 (Tex. 1993).

[171] *Cf. In re* Sanchez, 81 S.W.3d 794, 797 (Tex. 2002) ("[C]ourts will not hold a state law and a city charter provision repugnant to each other if they can reach a reasonable construction leaving both in effect.").

[172] Unger v. State, 629 S.W.2d 811, 812 (Tex. App.—Fort Worth 1982, pet. ref'd) ("[T]he Legislature – in so delegating that authority to the Railroad Commission – did not intend to . . . repeal [the law] . . . that municipalities in Texas have . . . authority to regulate the drilling for an production of oil and gas within their corporate limits . . . ." (quoting Klepak v. Humble Oil & Refining Co., 177 S.W.2d 215 (Tex. Civ. App.—Galveston 1944, writ ref'd n.r.e.)).

[173] Amy Silverstein, *Dallas Council Passes Tough New Fracking Rules Industry Calls a "Moratorium" on Dallas Drilling*, DALL. OBSERVER (Dec. 12, 2013, 7:00 AM), http://blogs.dallasobserver.com/unfairpark/2013/12/not_ready_gas_industry_would_r.php.

in the city of Denton.[174] Overall, the scope for municipal regulation of fracing in Texas appears to be quite broad.

C. MUNICIPAL FRACING REGULATION IN WEST VIRGINIA

The atmosphere for municipal regulation of hydraulic fracturing in West Virginia is decidedly less favorable than Texas's. Unlike under Texas's home rule statute, which looks to other state laws for limitations on rather than grants of municipal authority, the authority of West Virginia home rule cities is limited mostly to what the legislature specifically grants to cities.[175] In further contrast, whereas Texas law requires strong evidence of preemption in order for it to be found, West Virginia shifts the burden in disfavor of municipal authority.[176] Consequently, West Virginia law is highly likely to find a municipal ordinance preempted due to an inconsistency with state law.[177]

This practice has been confirmed in the realm of municipal regulation of hydraulic fracturing. In Morgantown, located within the Marcellus Shale formation, the City Council enacted an outright ban on hydraulic fracturing up to one mile outside the city's limits.[178] In a lawsuit brought by a permitholder for hydraulic fracturing within the zone effected by the municipal ban, a state trial court found that the municipal fracing ban was preempted by West Virginia's comprehensive state regulation of the activity.[179] The trial court's

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[174] Peggy Heinkel-Wolfe, *Council Extends Drilling Moratorium*, Denton Record-Chron. (Sept. 11, 2012, 11:01 PM), http://www.dentonrc.com/local-news/local-news-headlines/20120911-council-extends-drilling-moratorium.ece.

[175] State *ex rel.* City of Charleston v. Hutchinson, 176 S.E.2d 691, 696 (W. Va. 1970) ("A city has only the powers granted to it by the legislature, and it must be expressly granted or necessarily or fairly implied or essential and indispensable.").

[176] *See id.* ("If any reasonable doubt exists as to whether a municipal corporation has a power, the power must be denied.").

[177] *See* Vector Co. v. Bd. of Zoning Appeals, 184 S.E.2d 301, 304 (W. Va. 1971) (declaring as "fundamental . . . the legal principle that where an ordinance is in conflict with a state law the former is invalid").

[178] *See* Ne. Natural Energy, LLC v. City of Morgantown, No. 11-C-411, 2011 WL 3584376 (W. Va. Cir. Ct. Aug. 12, 2011).

[179] *Id.*

opinion, while limited to the issue of a municipal ban on hydraulic fracturing, took a similarly skeptical view even of less absolute restrictions on the activity by municipalities.[180]

This is not necessarily the last word on municipal fracing regulations in the state, as the state's highest court did not have the opportunity to hear this case on appeal. In fact, Morgantown City Council passed a new ordinance regulating hydraulic fracturing via zoning restrictions, albeit in the face of caution regarding making the municipal ordinance stricter than state law.[181] However, the environment remains very much unfavorable to West Virginia municipal fracing regulations, meaning that local interests are likely more difficult to incorporate into overall regulation of hydraulic fracturing.[182]

D. MUNICIPAL FRACING REGULATION IN PENNSYLVANIA

The situation of municipalities in Pennsylvania vis-à-vis hydraulic fracturing is somewhat curious. While there appears to be substantial capacity for Pennsylvania municipalities to regulate fracing activities, this goes beyond the realm of authority and approaches an affirmative duty for municipalities to regulate fracing.

The Pennsylvania Constitution guarantees the right of citizens to "clean air, pure water, and to the preservation of the natural, scenic, historic and esthetic values of the environment."[183] In association with these rights, the state's natural resources are public property and, in the function of a trustee of the resources, "the Commonwealth shall conserve and maintain them for the benefit of all the people."[184] In a recent decision by

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[180] *See id.* (noting that the state's "regulations do not provide any exception or latitude to permit the City of Morgantown to impose a complete ban on fracking or to regulate oil and gas development and production").
[181] *Morgantown Adopts New Zoning for Extractive Industries*, STATE J., http://www.statejournal.com/story/18949807/morgantown-adopts-new-zoning-for-extractive-industries (last updated Aug. 3, 2012, 10:15 AM).
[182] Goho, *supra* note 166, at 7.
[183] PA. CONST. art. I, § 27.
[184] *Id.*

Pennsylvania's highest court,[185] this duty was, in the context of hydraulic fracturing, framed in terms of duties not only for the state government, but for municipalities.

In 2012, Pennsylvania's state government enacted Act 13, which created a new comprehensive, statewide regime for oil and gas operations generally and hydraulic fracturing in particular.[186] Among the myriad changes made to existing oil and gas law was a wide-ranging preemption of municipal ordinances regulating oil and gas operations.[187] In an effort to make this arrangement more palatable for municipalities, the statute created a new "impact fee," collected by the state but imposed on individual wells by municipalities, for which municipalities would only be entitled to revenues if they declined to ban drilling operations and declined to enact stricter drilling regulations than the state regulatory regime.[188] Multiple municipalities challenged the state law's preemption of their ordinances regarding such operations, and these challenges eventually reached the state's highest court.

A divided Pennsylvania Supreme Court overturned multiple provisions preempting municipal regulations of oil and gas operations. The Court's plurality opinion, holding that the Pennsylvania Constitution placed duties on municipalities to uphold the environment-related rights of residents,[189] found that such constitutional duties of municipalities could

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[185] Robinson Twp. v. Commonwealth, 83 A.3d 901 (Pa. 2013). While a majority of the court agreed with the ultimate result, there was no single opinion which a majority of the Court joined. *Id.* at 913.

[186] Janet L. McQuaid & Michael P. Gaetani, *Pennsylvania Act 13 (HB1950) Rewrites Law Concerning Oil and Gas Activities*, NORTON ROSE FULBRIGHT (Mar. 12, 2012), http://www.nortonrosefulbright.com/knowledge/publications/93482/pennsylvania-act-13-hb1950-rewrites-law-governing-oil-and-gas-activities.

[187] 58 PA. CONS. STAT. § 3302 (2013) (stating that, with limited exceptions, "all local ordinances purporting to regulate oil and gas operations . . . are hereby superseded").

[188] Paige Anderson, Note, *Reasonable Accommodation: Split Estates, Conservation Easements, and Drilling in the Marcellus Shale*, 31 VA. ENVTL. L.J. 136, 151 & n.106

[189] *See Robinson Twp.*, 83 A.3d at 977 (stating that the Legislature "can neither offer political subdivisions purported relief from [constitutional] obligations . . ., nor can it remove necessary and reasonable authority from local governments to carry out these constitutional duties").

not be overridden simply through passage of a state statute.[190] Consequently, municipalities retained substantial authority to regulate oil and gas operations, including hydraulic fracturing, through local ordinance.

By no means does this mean that a plethora of municipal fracing regulations are sure to come in Pennsylvania in the near future. In fact, there are a number of towns in the state with only relatively minimal rules restricting hydraulic fracturing activities.[191] However, in light of the recent decision from the Pennsylvania Supreme Court which at least implies a duty on the part of municipalities to regulate oil and gas activities, including hydraulic fracturing, to uphold environment-related rights, this remains a fascinating area for further observation.

E. BRIEF ANALYSIS

Overall, the Texas framework for municipal regulation of fracing appears to be a favorable compromise between polar opposites. On one hand, it provides municipalities, which directly experience a very substantial share of the costs and risks arising out of fracing, with considerable authority to minimize and account for the negative aspects of the process. On the other, unlike what has apparently arisen in Pennsylvania, it does not place an implied obligation on municipalities to regulate fracing to a greater extent than they might find advisable, due to a judicial determination that they are not sufficiently protecting environmental rights.[192] While the frequently local impact of fracing do favor a

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[190] *Id.* at 978.

[191] Katie Colaneri, *Pa. Towns with No Zoning Rules Unlikely to Limit Gas Drilling*, STATEIMPACT (Feb. 11, 2014, 12:50 PM), http://stateimpact.npr.org/pennsylvania/2014/02/11/pa-towns-with-no-zoning-rules-unlikely-to-limit-gas-drilling-2/.

[192] An argument could be made that placing a duty on municipalities to regulate fracing may be advisable if municipalities appear unwilling to assist in efforts to guard against the risks of such activities. *See id.* (noting that many Pennsylvania municipalities declined to regulate fracing via zoning ordinances). Although creating duties for municipalities might be an appropriate goal for state authorities, examination of this claim is beyond the scope of this paper.

significant degree of local authority over such activities,[193] limiting discretion by requiring local action could impose substantial costs on its own.

While Texas's current framework generally does provide municipalities with considerable discretion and flexibility in regulating fracing, the fact that the validity of a Texas municipal regulation hinges on a judicial finding regarding the Legislature's preemption intentions can give rise to considerable uncertainty. There is no guarantee that reasonable jurists will agree on what legislative intent, given the wide variety of sources legislative intent can be said to arise,[194] and when the validity of a municipal law is unclear, conditions are favorable for litigation to determine such validity. Unfortunately, even if such litigation involves only matters of law (reducing the need for extensive judicial factfinding efforts), it may still take a long time to finally resolve the underlying preemption issue,[195] and in the interim, fracing operators will be faced with a variety of unfavorable options, such as postponing or halting operations during the pendency of litigation or making an effort to comply with municipal regulations which could eventually be voided.

In light of this, even though Texas' overall municipality-favoring home rule system has advantages, clearer legislative statements regarding hydraulic fracturing regulation appear in order. While this could take the form of enumerating certain aspects of the fracing process which are expressly permitted to be addressed by municipal regulation, in light of Texas courts often giving substantial importance to a statute's silence on a matter by

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[193] *Cf.* Matthew D. Fortney, Comment, *Devolving Control over Mildly Contaminated Property: The Local Cleanup Program*, 100 NW. U. L. REV. 1863, 1905 (2006) (finding that innovations in state and federal cleanup programs "depend on local information and local land use control," and that sustaining those innovations is "not [] sustainable without local government cooperation").

[194] *See* Dall. Merchant's & Concessionaire's Ass'n v. City of Dall., 852 S.W.2d 489, 490 (Tex. 1993) (reversing an appeals court finding that a state statute lacked the necessary clarity for preemption of a municipal ordinance).

[195] *See, e.g.*, *id.* (reaching a final judgment in the preemption case almost three years after the lawsuit was first filed).

contrast with what the statue expressly says,[196] if legislative efforts are made to clarify the field, care should be taken to assure that any inadvertent failures to address a particular aspect of fracing in such a statute are not given special meaning.

[196] Ron Beal, *The Art of Statutory Construction: Texas Style*, 64 BAYLOR L. REV. 339, 398–39 (2012).

Chapter 5: Some Concluding Observations

In light of the variety of state laws concerning hydraulic fracturing, such as those which center on water use and quality, air emissions, and related municipal authority, what can Texas do to make itself more of a positive example in the regulatory field among states with extensive hydraulic fracturing operations?

With regard to the municipality–state balance, it would appear that the current framework is generally sound. The current regime allows for considerable authority over hydraulic fracturing to be exercised by municipalities, which can have a greater familiarity with on-site conditions than state regulators, while not automatically placing a legal duty on municipalities to potentially regulate such activities to a greater extent than they find necessary (as might be the case in Pennsylvania), however, as there is significant ambiguity regarding the extent of the outer bounds of permissible municipal authority, more clarity in this regard would likely be beneficial.

The regulation of air emissions, particularly fugitive emissions, on the other hand, is an area in which considerable improvement can be made. Even aside from the limited geographic scope of current fracing-oriented regulations, the rigor of the regulations could be significantly enhanced, such as through requiring more frequent inspections for leaking equipment and clarifying standards for performing inspections.

Groundwater-related matters, unfortunately, are likely to prove more problematic. With regard to water contamination, although there is little reason to doubt that the Railroad Commission has been performing quite competently in its task of overseeing water decontamination (and preventing contamination) due to production of oil and gas, it does seem rather inefficient to have water contamination matters distanced from TCEQ, seeing as how its primary duties and expertise are centered on environmental tasks. Furthermore,

in the field of groundwater use, with the plethora of local authorities in the form of groundwater conservation districts (or lack thereof, in some cases), achieving a more uniform array of regulatory schemes may necessitate either a set of standards imposed on conservation districts from above (which could engender considerable resistance) or the replacement or simply supplement of the districts by more state authority, whether of TCEQ or a new regulatory agency (which could spark still more resistance). As important as groundwater use is both for hydraulic fracturing and for the general needs of populations, this is likely to be an area particularly resistant to further reform.

Nevertheless, with Texas in a particularly notable position attributable to its potential for oil and gas production from hydraulic fracturing, adjusting state regulations to better account for the risks attributable to the process while allowing for the state's production capacity to be more fully utilized will not only better sustain environmental quality, particularly in areas in close proximity to fracing sites, but will also ensure the overall utility of the technique for supplying energy to markets for years to come. In light of the stakes involved, Texas should remain mindful in considering further measures which should be taken in light of the considerable benefits and risks hydraulic fracturing can bring.

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