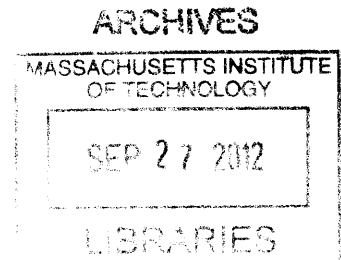


Regulation of Shale Gas Development:  
An Argument for State Preeminence with Federal Support

by

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Submitted to the Department of Urban Studies and Planning  
in partial fulfillment of the requirements for the degree of

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By Tushar Kansal

Submitted to the Department of Urban Studies and Planning in September, 2012 in partial fulfillment of the requirements for the degree of Master in City Planning.

## **Abstract**

Shale gas development has become big business in the United States during the past decade, introducing drilling to parts of the country that have not seen it in decades and provoking an accelerating shift in the country's energy profile. State governments, which have historically regulated the oil and gas industry and continue to do so today, were in many cases caught by surprise by the speed and the scale of the shale gas boom and are still trying to update and adapt their regulatory practices to respond to the impacts that shale gas development is causing in communities in their states. In some instances, these impacts have included groundwater and surface water contamination, air pollution, exploded homes, and damage to wetlands and other habitats, among other impacts. Shale gas development has also created jobs, brought economic development to distressed communities, lowered fuel costs, and has begun to supplant coal in the nation's electricity supply.

The thesis seeks to understand whether primary regulatory authority over shale gas development should rest with the states or with the federal government. In answering this question, the author applies theory from the field of regulatory federalism to the practice of shale gas development to ascertain whether the federal government or state governments are best suited to regulate shale gas development. Grounding the analysis in both regulations as-written and as-applied in a number of states that have active shale gas industries, the author uses four key criteria to gauge whether regulatory authority should rest with the central government or with the states. These four criteria are: the geographic distribution of costs and benefits associated with shale gas development; regulatory capacity at the federal level and at the state level; which level can better foster innovation, flexibility, and adaptability; and which level can better provide efficiency, certainty, and stability. The analysis finds that, in most cases, states are better situated than the federal government to regulate shale gas development on the basis of each of the four criteria. The author also subjects current regulatory practice to a two-part test to determine whether regulatory failure is currently occurring that would compel the federal government to assume regulatory authority. The results from this test are negative. The author concludes that primary regulatory authority over shale gas development should remain with state governments. Finally, the author provides four policy recommendations, two each to state governments and to the federal government, to improve regulatory practice and outcomes in the future.

Thesis Supervisor: Lawrence Susskind

Title: Ford Professor of Urban and Environmental Planning

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## Chapter 1 – Introduction

### A Snapshot of Shale Gas Development

Exploration of the possibility of extracting natural gas from shale first began in the 1970s when declining production from conventional gas deposits spurred the U.S. Department of Energy to initiate the Eastern Gas Shales Project in 1976.<sup>1</sup> Technological advances over the following twenty years in the technologies of hydraulic fracturing, horizontal drilling, and the use of fiber optics in microseismic imaging allowed for the first successful commercial shale gas development in Texas' Barnett Shale in 1997.<sup>2</sup> Shale gas production spread from the Barnett to other shales in Texas, Louisiana, and Arkansas in the mid-2000s and sparked a rush in the Marcellus Shale in Pennsylvania in 2008 after a report by Professors Terry Engelder and Gary Lash estimated that estimates of recoverable natural gas in the Marcellus were up to 250 times larger than previously thought.<sup>3</sup> A map of shale plays in the lower 48 states is included in Figure 1 to provide a visual representation of the varied locations in which shale gas (and oil) development is occurring.

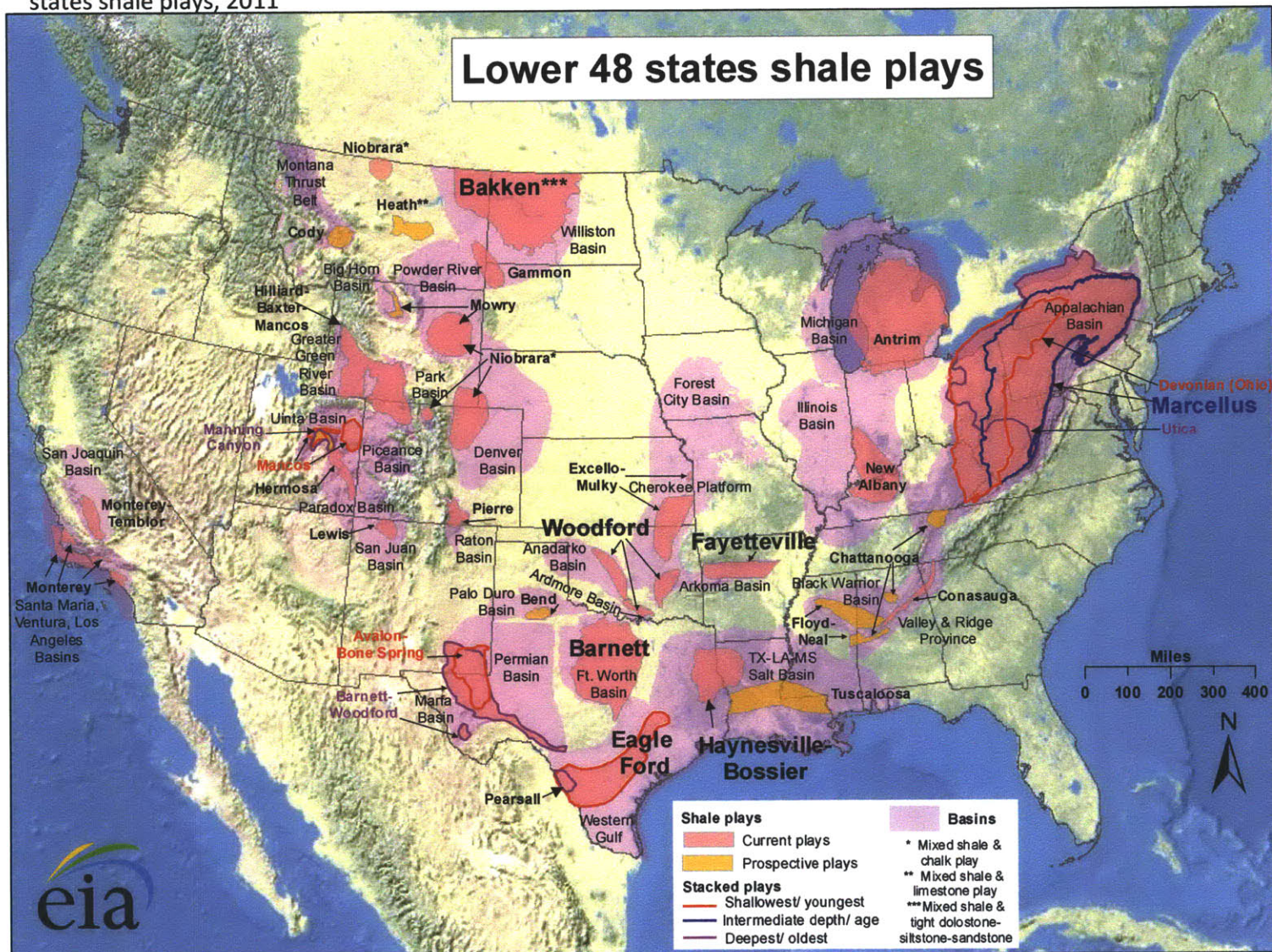
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<sup>1</sup> Alex Trembath et al., *Where the Shale Gas Revolution Came From: Government's Role in the Development of Hydraulic Fracturing in Shale*.

<sup>2</sup> Railroad Commission of Texas, "Water Use in the Barnett Shale."

<sup>3</sup> "Unconventional Natural Gas Reservoir In Pennsylvania Poised To Dramatically Increase US Production."

Figure 1: Lower 48 states shale plays, 2011



Source: Energy Information Administration based on data from various published studies.  
Updated: May 9, 2011

Source: U.S. Energy Information Administration, "Maps: Exploration, Resources, Reserves, and Production."

The boom in shale gas production in recent years is rapidly altering projections for future energy supply and usage both in the United States. The U.S. Energy Information Administration (EIA) estimates that the United States will transition from being a net importer of natural gas to being a net exporter early during the next decade.<sup>4</sup> In addition, electricity generated from natural gas has already begun to supplant electricity from coal-fired power plants and the EIA projects that this trend will continue over the next 25 years.<sup>5</sup> These transitions are projected to be largely driven by shale gas, as the share of U.S. natural gas production from shale is expected to grow from 23 percent in 2010 to 49 percent in 2035.<sup>6</sup> The sharp uptick in natural gas production is creating a number of positive benefits, including cheaper natural gas, economic development and wealth generation in localities where extraction is taking place, and reduced carbon emissions.<sup>7</sup>

The process of shale gas development includes many stages both before and after the hydraulic fracturing procedure that has commanded significant public attention. Laying out these steps here will provide some context for understanding the myriad regulations governing shale gas development that will be discussed in this paper. In contrast to the comparatively straightforward process of conventional drilling, the structure of shale does not allow hydrocarbons to flow through a vertical well to the surface at an economical rate. In order to extract the gas and oil that is trapped in shale, a relatively complex, multi-stage development process is required. First, the shale gas operator conducts seismographic testing to locate a promising site in which to drill for gas. Having decided on a site, the operator constructs a well pad, which is a large cement platform that hosts the well (and in the case of shale gas development, often multiple wells) and other associated equipment.<sup>8</sup> The next step is to drill the well itself and case it; casing involves the installation of concentric steel tubes of varying diameters and lengths, all secured by cement.<sup>9</sup> Once drilling reaches the depth at which the shale gas is found, it usually proceeds horizontally in order to maximize exposure to the resource. During drilling, fluid called “produced water” usually flows to the surface through the well and must be

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<sup>4</sup> U.S. Energy Information Administration, *Annual Energy Outlook 2012*, 3.

<sup>5</sup> *Ibid.*, 3–4.

<sup>6</sup> *Ibid.*, 3.

<sup>7</sup> Although natural gas generally produces fewer greenhouse gas (GHG) emissions than does coal, there are some concerns about leakage of methane directly into the atmosphere during the production and transport processes. Two studies that come to differing conclusions about the GHG footprint of shale gas production are: Timothy J. Skone, *Life Cycle Greenhouse Gas Analysis of Natural Gas Extraction & Delivery in the United States*; and Howarth, Santoro, and Ingraffea, “Methane and the Greenhouse-gas Footprint of Natural Gas from Shale Formations.”

<sup>8</sup> N.Y. Dept. of Environmental Conservation, “Revised Draft SGEIS on the Oil, Gas and Solution Mining Regulatory Program,” 5–91 –97.

<sup>9</sup> *Ibid.*, 5–91 –97.

disposed of along with other drilling wastes such as drill cuttings (mostly rock that comes out of the well) and used drilling fluids.<sup>10</sup>

After the well is drilled and casing has been installed, the well is hydraulically fractured. The process of hydraulic fracturing involves punching holes into the portion of the well that has been drilled through gas-containing shale and forcefully injecting high volumes of fracturing fluids (comprised of water, sand or ceramic “propping” agents that hold fractures open, and a specialized cocktail of chemicals) down the well and out through the holes into the surrounding rock.<sup>11</sup> The fracturing fluid fractures the rock, creating passageways by which the gas can flow out of the rock in which it was trapped and through the well to the surface.<sup>12</sup> The entire well is not fractured at once but rather in stages of a few feet at a time. Usually, some quantity of the solution that is injected into the well returns to the surface; this fluid is called “flowback water” and must also be disposed of.<sup>13</sup> The operator installs equipment at the wellhead to control and collect the natural gas that is flowing to the surface and uses pipes to transport the gas to a processing plant. Figure 2 presents a diagram that illustrates some aspects of the shale gas development process, with a focus on hydraulic fracturing.

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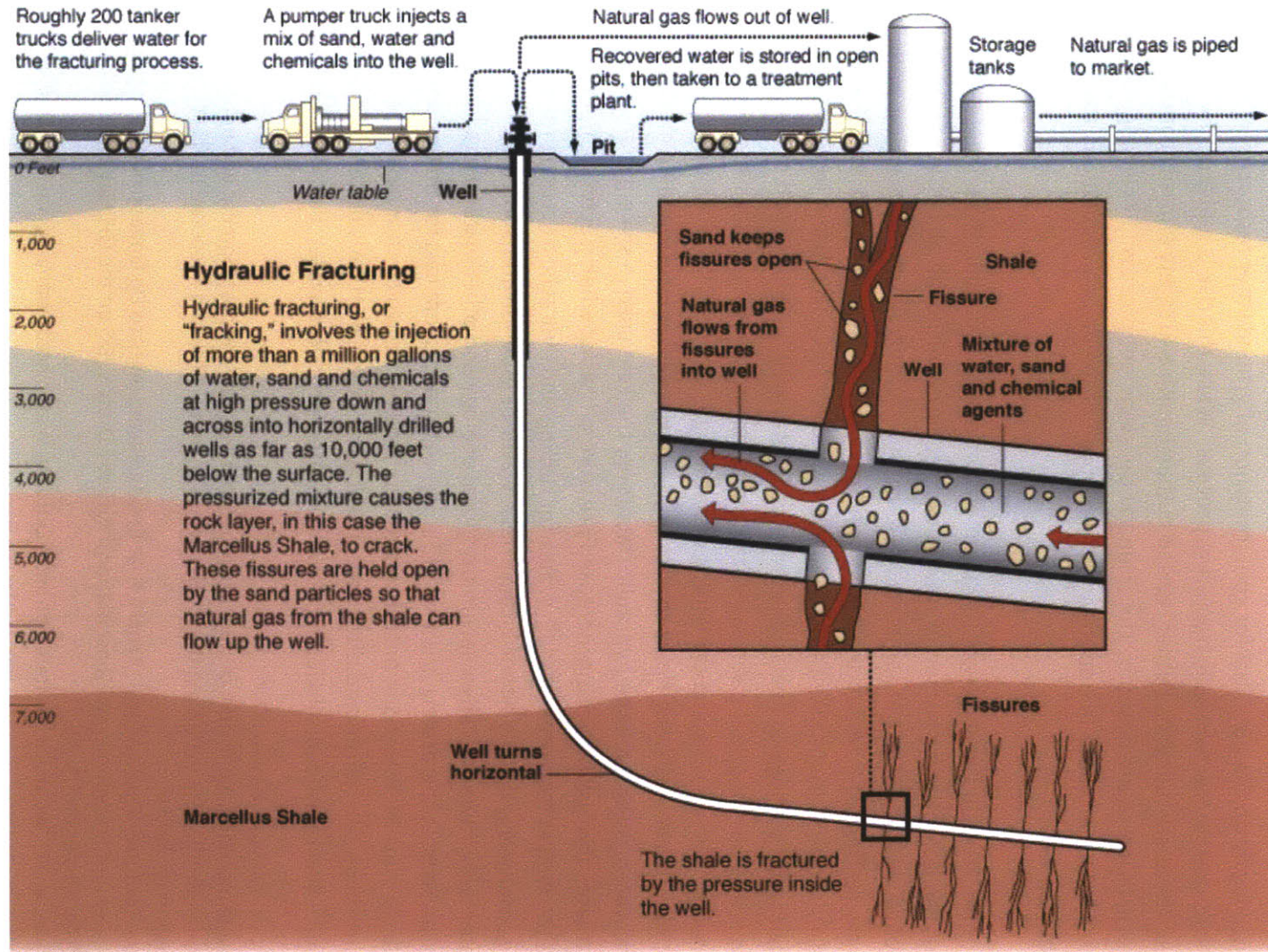
<sup>10</sup> Ibid., 5–91 –97.

<sup>11</sup> Ibid.

<sup>12</sup> Ibid.

<sup>13</sup> Ibid.

Figure 2: Illustration of Shale Gas Development Process



Graphic by Al Granberg

Source: Pro Publica, "What is Hydraulic Fracturing"

### **Risks Presented by Shale Gas Development**

Much of the public concern around shale gas development has focused on hydraulic fracturing, and specifically on the potential for contamination of groundwater resources by the injection of chemicals used in the hydraulic fracturing process. While this risk is real and must be guarded against, there are numerous other risks to human health and safety and environmental wellbeing that also are posed by the shale gas development process. Reviewing these risks here will help the reader to understand the purpose of the myriad regulations governing shale gas development.

Each of the steps in the shale gas development process described in the previous section creates the potential for human or environmental harm. Although all of the potential effects will not be described here, a sampling will illustrate the diversity of potential impacts.<sup>14</sup> For example, testing for locations in which to drill gas wells often involves the use of large trucks called “thumpers” that strike the ground with sufficient force to cause it to vibrate and shake.<sup>15</sup> This can cause damage to nearby buildings and water wells. Construction of well pads and access roads can fragment natural habitat and cause erosion that washes into nearby waterways.<sup>16</sup> The casing and cementing of natural gas wells can be faulty or can deteriorate over time, thereby allowing fluids to pass between the well and surrounding media, including groundwater.<sup>17</sup> High volume hydraulic fracturing, the kind used in shale gas development, accentuates this risk by placing increased pressure on casing when fracturing fluid is pumped down the well at high pressures.<sup>18</sup> Water for drilling and hydraulic fracturing must be obtained from somewhere, usually either local surface water or groundwater sources, and high volumes of water withdrawal can adversely impact local ecology and other water users.<sup>19</sup> Various materials used in the drilling process, including water and chemicals for drilling and hydraulic fracturing must be trucked in or transported via pipeline (in which case pipelines must be laid) and stored on site before and after use, creating the possibility that substances may be spilled.<sup>20</sup> Waste products including flowback water, produced water, used fracturing and

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<sup>14</sup> For a comprehensive review of the risks presented by shale gas development and policy recommendations for mitigating these risks, see, Wiseman, “Risk and Response in Fracturing Policy” (forthcoming, 2013).

<sup>15</sup> “How Thumper Trucks Work – Trucks That Create Earthquakes to Do Underground Imaging.”

<sup>16</sup> N.Y. Dept. of Environmental Conservation, “Revised Draft SGEIS on the Oil, Gas and Solution Mining Regulatory Program,” 6–68.

<sup>17</sup> Osborn et al., “Methane Contamination of Drinking Water Accompanying Gas-well Drilling and Hydraulic Fracturing.”

<sup>18</sup> Ibid.

<sup>19</sup> N.Y. Dept. of Environmental Conservation, “Revised Draft SGEIS on the Oil, Gas and Solution Mining Regulatory Program,” ES–9.

<sup>20</sup> Ibid., 6–315.

drilling fluids, drill cuttings, and other industrial products can also spill during on-site storage and transportation for disposal.<sup>21</sup> In addition, all of these wastes – many contaminated with chemicals from the fracturing and drilling processes, or very high mineral content or low-level radioactivity picked up from rocks deep underground – must be disposed of, and operators have struggled to come up with safe disposal methods.<sup>22</sup> The drilling and fracturing processes also release volatile organic compounds, methane (a very potent greenhouse gas), and other pollutants into the air, both from the well and also from the running of diesel engines on the well pad and the heavy truck traffic that accompanies drilling.<sup>23</sup>

Most of these risks are not specific to shale gas development and are part and parcel of any operation that drills for oil and natural gas. There are some risks that are particular to shale gas development, such as the larger quantities and greater diversity of chemicals used in hydraulic fracturing, the greater pressure placed on the well casing, and the significantly larger volumes of water that must be withdrawn and ultimately disposed of, that are associated with high volume hydraulic fracturing. But even these risks are not unique to shale gas development as hydraulic fracturing is coming into increased usage to stimulate wells that are not drilled into shale also. It should be highlighted, however, that the recent boom in drilling caused by the shale gas boom has significantly increased the number of wells that are drilled each year and has expanded drilling activity to areas that previously had relatively little. Not only does this increased activity increase the likelihood of adverse social and environmental impacts, it also magnifies the risks associated with cumulative environmental impacts.<sup>24</sup>

While all of the risks catalogued here, among many others, are real, there still remains significant contention and controversy about the likelihood of adverse impact from shale gas development and the severity of consequence if adverse events do occur. Simply stated, scientists, policy-makers, and regulators know that risks of various kinds exist but are still struggling to understand the severity of these risks and how to prioritize them. In the meantime, claims and counterclaims have proliferated and proponents and opponents of shale gas development grasp at the limited information available to make their respective cases. For example, to cite perhaps the most prominent controversy related to shale gas development and hydraulic fracturing, there exists significant public concern regarding the threat of contamination of groundwater resources by the chemicals that are contained within fracturing

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<sup>21</sup> Ibid.

<sup>22</sup> Wiseman and Gradjan, “Regulation of Shale Gas Development, Including Hydraulic Fracturing,” 126.

<sup>23</sup> Pennsylvania Department of Environmental Protection, *Northcentral Pennsylvania Marcellus Shale Short-Term Ambient Air Sampling Report*; Howarth, Santoro, and Ingraffea, “Methane and the Greenhouse-gas Footprint of Natural Gas from Shale Formations.”

<sup>24</sup> Wiseman, “Fracturing Regulation Applied,” 365.

fluids.<sup>25</sup> Numerous regulators, researchers, and industry sources have stated that the threat to groundwater does not arise from hydraulic fracturing itself but rather from poorly constructed wells that can suffer blowouts or otherwise allow for fluid travel between the wellbore and surrounding groundwater sources.<sup>26</sup> Contrary to these assertions, however, an EPA study found likely groundwater due to seepage of fracturing chemicals through rock in Pavillion, Wyoming and a recent study modeled the accelerated rate by which this travel could occur.<sup>27</sup> The methodologies and utility of both of these findings have been heatedly debated, however.<sup>28</sup> In addition, concerns and criticisms have been raised about claims that, as long as wells are constructed properly, the risk of groundwater contamination is minimized by allegations that drilling companies are aware that the cement around wells begins to degrade within years, not decades, and that this can lead to accelerated well failure.<sup>29</sup> This debate is nowhere near its conclusion and even EPA's ongoing study about groundwater contamination may very well fail to settle the matter.

### Current Regulatory Structure

Oil and gas production has historically been regulated primarily by the states. States and some municipalities passed the first regulations governing oil drilling (and later, drilling for natural gas) in the 1930s in an effort to "conserve" oil (that is, promote orderly development of reservoirs so that oil was not "wasted" and left unrecovered underground) and to protect oil wells from contamination by groundwater.<sup>30</sup> Sporadically, different states also enacted legislation and promulgated rules designed to guard against risks to public health and environmental damage during succeeding decades.<sup>31</sup> The wave of federal environmental legislation that was enacted during the 1970s also sparked the passage of environmental legislation at the state level, and some of these regulations apply to oil and gas development.<sup>32</sup>

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<sup>25</sup> Clean Water Action, "Fracking."

<sup>26</sup> See, for example, Urbina, "Tainted Water Well Challenges Claim of Fracking's Safety"; Elizabeth Ames Jones, Chairman Railroad Commission of Texas, *Review of Hydraulic Fracturing Technology*; David Neslin Director, Colorado Oil and Gas Conservation Commission, *Natural Gas Drilling: Public Health and Environmental Impacts*.

<sup>27</sup> Myers, "Potential Contaminant Pathways from Hydraulically Fractured Shale to Aquifers"; US EPA, "Pavillion."

<sup>28</sup> See, for example, Jim Efstathiou Jr, "Fracking Fluids May Migrate to Aquifers, Researcher Says"; Christopher Helman, "Questions Emerge On EPA's Wyoming Fracking Study - Forbes."

<sup>29</sup> Josh Fox, *The Sky Is Pink*.

<sup>30</sup> Ground Water Protection Council, *State Oil and Natural Gas Regulations Designed to Protect Water Resources*, 13.

<sup>31</sup> *Ibid.*, 14.

<sup>32</sup> *Ibid.*, 14–15; Barry G. Rabe, "Power to the States: The Promise and Pitfalls of Decentralization," 34–35.

As will be detailed in Chapter 3, state regulation covers the entire process of shale gas development (and drilling for natural gas and oil more broadly) from beginning to end. States regulate testing for natural gas, the location of gas wells and well pads, the construction of well pads, the construction of wells, the withdrawal of water for drilling and hydraulic fracturing, disclosure of chemicals used, spill prevention and reporting, testing and replacing contaminated water supplies, and the storage and disposal of wastes. The bulk of these regulations are written and enforced by the states, although most states also have primacy to apply applicable state regulation under the Clean Water Act, Clean Air Act, and Safe Drinking Water Act. As will be detailed in Chapter 3, the states have adopted a wide range of approaches to regulating shale gas development, with some adopting stricter environmental and public safety and health protections and some setting standards that are more lax, and with some states favoring prescriptive regulations and other states favoring performance standards. Each state sets its own unique, implicit balance between reaping the benefits and mitigating the costs of shale gas development. States also take a variety of approaches to enforcing regulations, as will be described in Chapter 4, with different states focusing only on certain types of violations and each state issuing comparatively fewer or more notices of violation, and administering fewer or more fines, for different types of violations, of varying dollar amounts.

The federal government also regulates certain aspects of shale gas development, although there is not federal legislation that focuses on onshore drilling and exemptions have been created in some of the federal environmental regulations that would otherwise apply to shale gas development. Remembering that various exemptions apply, the federal laws (and associated rules and regulations) that apply to aspects of the shale gas development process are the Clean Water Act; and Clean Air Act; the Safe Drinking Water Act; Comprehensive Environmental Response, Compensation, and Liability Act; the Endangered Species Act; the Migratory Birds Treaty Act; the Emergency Planning and Community Right-to-Know Act; and the Occupational Safety and Health Act.

Finally, although this thesis focuses on state and federal regulation of shale gas, some local governments also exercise some regulatory authority.<sup>33</sup> Different states have adopted very different approaches to granting localities jurisdiction to manage their engagement with fracturing, with some allowing broad latitude and others keeping all decision-making within the statehouse. Texas has relatively lax statewide regulations but allows municipalities significant

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<sup>33</sup> For additional descriptions and discussions of local regulation of shale gas development and oil and gas development, see Kennedy, “The Exercise of Local Control Over Gas Extraction”; Kramer, “Local Land Use Regulation of Extractive Industries”; Sorell E. Negro, “Fracking Wars: Federal, State and Local Conflicts over the Regulation of Natural Gas Activities”; Charles Davis, *Fracking and Sub-state Federalism: State Preemption of Local Regulatory Decisions in Colorado*.

latitude to set stricter regulations. For example, the city of Fort Worth, which is estimated to have over 1,000 wells within the city limits, sets its own fees for drilling permits and requires a significant commitment on the part of operators to minimize and mitigate adverse impacts. As a condition of receiving a permit, the city requires (among many other items) submission of a Stormwater Pollution Prevention Plan, a Noise Management Plan, and a City-Wide Road Maintenance Agreement; waivers from all neighbors and public buildings within 600 feet of the wellhead, minimum bonding and insurance standards, and a panoply of operational and technical requirements.<sup>34</sup> Pennsylvania allows counties to impose unconventional gas well fees on shale gas development and allows municipalities to impose the fee if a county fails to do so.<sup>35</sup> Act 13 in Pennsylvania also contains a provision that sharply limits the ability of municipalities to use their land use authority to restrict shale gas development. Pennsylvania's Commonwealth Court struck down this provision of Act 13 on July 27, 2012, and at the time of writing, Governor Corbett's administration was expected to appeal to the state Supreme Court.<sup>36</sup> As a third example, New York, which has had a long-running moratorium on shale gas development, may release a plan in which local communities in five counties abutting Pennsylvania will be given an opportunity to decide whether they want to allow shale gas development to occur in their towns.<sup>37</sup>

### **Calls for Federal Regulation**

Accompanying the recent boom in shale gas production and its spread to parts of the country, such as Pennsylvania, that have not experienced significant amounts of drilling in recent decades, have been calls for the federal government to step in and take a more forceful regulatory role. These calls have come from various parties, generally based on the premise that federal regulation would provide stronger protections for public health and safety and for the environment than state-directed regulation.

For example, some journalists and media outlets have argued that state enforcement of their own regulations and of federal regulations over which they have primacy are inadequate. A report in the *New York Times* expressed concern that state regulators in Pennsylvania were not adequately enforcing regulations controlling the types and levels of contaminants that can be sent to wastewater treatment plants. In particular, the article cited government and industry documents as well as interviews with state environmental officials stating that drilling

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<sup>34</sup> City of Fort Worth, *Ordinance No. 18449-02-2009*; Rahm, "Regulating Hydraulic Fracturing in Shale Gas Plays"; Riley, "Wrangling with Urban Wildcatters."

<sup>35</sup> Pennsylvania Public Utility Commission, "Act 13 of 2012."

<sup>36</sup> Sarah Hoyer, "Pennsylvania Court Strikes down Key Part of Law Limiting Local Control of Fracking - CNN.com."

<sup>37</sup> Hakim, "Hydrofracking Under Cuomo Plan Would Be Restricted to a Few Counties."

operators were taking water contaminated with radioactive materials to wastewater treatment facilities that were not equipped to remove these contaminants and that the contaminated water was being released into the state's rivers.<sup>38</sup>

Some scholars have suggested that the current system may inadequately protect human health and the environment, and that the federal government should set a minimum regulatory floor following the doctrine of "cooperative federalism." Wiseman articulates a variety of arguments for a stronger federal role, including scenarios in which states do not strengthen their own regulations to better deal with the risks presented by shale gas development or if those risks are found to be particularly significant.<sup>39</sup> Wiseman also suggests that the current pattern of significantly disparate standards and strategies for environmental and health protection among the states could be evidence for the existence of a "race to the bottom" in which states are competing to loosen regulation to attract drilling.<sup>40</sup> She raises the possibility of, "developing a federal regulatory floor to ensure minimum standards of environmental and human health protection – whether under the Safe Drinking Water Act to address concerns about the quality of underground sources of drinking water, under RCRA, or a new federal act...."<sup>41</sup> Similarly, Freeman asserts that the current patchwork of state regulations is inadequate to protect public safety, health, and environmental wellbeing because some states have regulations that are insufficiently rigorous while others do not have sufficient experience and resources to enforce their standards.<sup>42</sup> Freeman also calls for a federal regulatory floor that would require a defined minimum level of public health and environmental protection in all states, but would allow states to set higher standards if they so desire.<sup>43</sup>

### **Thesis Question, Outline, and Summary of Findings**

The current regulatory structure for shale gas development places the bulk of regulatory responsibility squarely on the states. States regulate the shale gas development process from start to finish and have developed an extensive body of regulations to control various aspects of site location, drilling, fracturing, disposal, and handling of waste products. States put these written regulations into effect by inspecting well sites, noting violations, requiring that operators bring operations into compliance, and, in some cases, taking enforcement actions such as issuing administrative orders, entering into consent orders, and imposing penalties.

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<sup>38</sup> Urbina, "Regulation Lax as Gas Wells' Tainted Water Hits Rivers."

<sup>39</sup> Wiseman, "Regulatory Adaptation in Fractured Appalachia," 285–286; Hannah Wiseman, "Questions Re: Shale Gas Regulation (personal Correspondence with Author)."

<sup>40</sup> Wiseman, "Regulatory Adaptation in Fractured Appalachia," 289–290.

<sup>41</sup> *Ibid.*, 287.

<sup>42</sup> Freeman, "The Wise Way to Regulate Hydraulic Fracturing."

<sup>43</sup> *Ibid.*

The federal government and municipalities and counties (and in some limited cases, regional authorities such as the Delaware River Basin Commission) also regulate aspects of shale gas development. Yet, even in these situations, the states have significant roles to play. Most states have gained primacy to apply and enforce the federal Clean Water Act, Safe Drinking Water Act, and Clean Air Act. In addition, states define how much regulatory authority to delegate to municipalities and counties and while some, such as Texas and New York, seem to allow for a significant degree of local decision-making, most states retain most regulatory authority in the state capitol.

In this context, scholars, journalists, policy-makers, and members of the public have questioned the adequacy of state regulation of shale gas development. Many commentators have claimed that state governments are insufficiently protecting public health and safety or are insufficiently protecting the environment. Some have called on the federal government to step in and assume a stronger regulatory role. Wiseman and Freeman have both suggested that the federal government could, or should, create comprehensive federal regulations for shale gas development grounded in the idea of cooperative federalism in which all states would have to meet and enforce a federal baseline standard, but would then be allowed to exceed that standard. As Freeman notes, the federal government has taken action of this sort before. She draws a parallel to the enactment of the Surface Mining Control and Reclamation Act (SMCRA) of 1977.<sup>44</sup> Congress enacted the SMCRA because the existing state laws that regulated surface coal mining were deemed to be inadequate at preventing severe environmental degradation.<sup>45</sup> Congressman Udall, a primary force behind the passage of the bill, wrote that:

[Congress] found that the legitimate and irresistible urge on the part of a state to protect its coal industry from competitive disadvantage, vis-à-vis coal producers in other states, usually overwhelmed most state legislatures' desire to impose sound reclamation laws. Well motivated people on the state level did what they could, but without federal standards political reality militates in favor of loose controls.<sup>46</sup>

Does a similar imperative face regulators of shale gas production today?

This thesis seeks to answer the question: *Given the state of regulation of shale gas development, should the federal government seize primary regulatory authority, leave primary regulatory authority with the states, or take some other set of actions to improve regulatory outcomes?*

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<sup>44</sup> Ibid.

<sup>45</sup> Morris K. Udall, "Enactment of the Surface Mining Control and Reclamation Act of 1977 in Retrospect," 553–555.

<sup>46</sup> Ibid., 553.

I seek to answer this question by analyzing the current practice of shale gas regulation at the federal and, particularly, at the state level and by applying what we know about regulatory federalism, especially as it relates to environmental regulation, to the regulation of shale gas development.

Chapter 2 provides an overview of federal regulation of shale gas development. This survey of federal legislation as it applies to shale gas development finds that there is no federal legislation aimed specifically at the regulation of shale gas development, or even at oil and natural gas development more generally. Instead, a number of environmental laws concerning water, air, hazardous materials, and protected animal species apply to numerous aspects of shale gas development. Critically, however, Congress has carved out various exemptions over the years for oil and gas development and, in 2005, for hydraulic fracturing, thereby limiting the reach and applicability of all of these federal laws. In addition, most states have gained primacy status with regard to enforcing federal regulations under three key laws that apply to shale gas development: the Clean Water Act, and Clean Air Act, and the Safe Drinking Water Act.

My survey of federal regulation is followed by a review of state regulation of shale gas development in Chapter 3. I look at applicable regulations in a sample of seven states active in shale gas development in different parts of the country (or, in the case of New York State, likely soon to be active), with different histories of oil and gas development, diverse geological and environmental conditions, and varying attitudes toward the appropriate role of government in regulating economic activity. As of 2010, these seven states constituted 95 percent of shale gas production in the United States. Chapter 3 is organized around the stages involved in digging a natural gas well and developing shale gas, tracing how states regulate shale gas development from the initial hunt for a drilling site up to final disposal of waste products. I find that most states have at least some sort of regulation on the books for most steps in shale gas development. The purpose of the regulations, however, varies greatly, with some prioritizing the protection of physical structures, some attaching greater importance to the safety of public water supplies, some protecting sensitive habitat areas. In addition, states employ varying strategies: some states have prescriptive regulations, some use measurable performance standards, and some rely only on narrative-based descriptions of the intended purpose of regulation. All the states reviewed have responded to the shale gas rush by updating their regulations, although in some states this has only covered disclosure requirements (e.g. Texas) while in Pennsylvania the entire regulatory framework governing drilling was overhauled in early 2012. There is very significant diversity among the states regarding regulation of many aspects of shale gas development, but all seven of the states do regulate almost all aspects of the development process.

Regulations, as written, tell only part of the story; to see the whole picture, it is necessary to look at how regulations are applied and enforced. Chapter 4 reviews regulatory enforcement data to understand how state regulators interpret the law and apply the enforcement tools at their disposal for purposes of protecting public health, safety, and environmental quality. The data that are available are limited. Nevertheless, the composite picture that begins to emerge is that most state regulatory agencies are struggling to catch up with the drilling and production boom, and this is occurring in an era of fiscal austerity and lean government budgets. The types of violations that are detected, as reflected in state records, vary from state to state and most would be observable from a visual site inspection or a review of paperwork (as opposed to regulatory violations that occur underground or involve air emissions, which are more difficult to observe). Most states employ what might be called a “cooperative regulatory model” in which regulators work closely with shale gas operators to bring them into compliance with the law. Most violations initially receive no formal sanction; instead, operators are given a chance to remedy the violation and bring their operation into compliance without incurring any sort of penalty. In most states, a very small percentage of recorded violations receive a fine or involve some other enforcement action beyond a basic citation of noncompliance. Regulatory authorities are far more likely to issue a fine for violations of permitting and reporting requirements than for spills or blowouts – events that present a more immediate threat to public safety and health and to environmental quality.

Chapter 5 offers an argument for why primary regulatory authority should remain with the states, as opposed to being shifted to the federal level. My argument is grounded in the theory of regulatory federalism, particularly as it usually applies to environmental regulation. Regulatory federalism seeks to assign the appropriate level of government for the exercise of particular regulatory authority, including the creation, application, and enforcement of regulations. I interpret regulatory federalism in terms of criteria that can be used to evaluate whether the states or the federal government is best suited to oversee a given economic activity from a public interest perspective. Chapter 5 employs two types of criteria, which will be described here in turn. The first set of criteria are “level-neutral” and seek to ascertain whether the federal government or the states might be better suited to regulate shale gas development. These four primary criteria are: geographic distribution of costs and benefits; regulatory capacity; innovation, flexibility, and adaptability; and efficiency, certainty, and stability. I use a second set of criteria to diagnose whether, notwithstanding the findings of the first set, regulatory failure is occurring often enough that the states (which hold primary regulatory responsibility over shale gas development) appear not to be handling their regulatory responsibilities adequately (in which case the federal government should assume greater regulatory responsibility). These second type of criteria follows from two questions: “Is

competition among the states to attract limited capital investment causing downward pressure on state regulations? (often known as a “race to the bottom”),” and “Is regulatory capture by industry players occurring in state capitals or state agencies?” If the answer to either of these questions is yes, even in a subset of states, there would be a strong case that regulatory failure is occurring at the state level, and that further federal intervention and, likely, federal assumption of regulatory authority is required.

The analytical findings in Chapter 5 are summarized here:

- Most of the costs and benefits of shale gas development are experienced within the geographic boundaries of the state where the development is occurring. Furthermore, the practice of shale gas development varies by geography, due in part to geological and environmental factors. As a result, states appear to be best suited to regulate most aspects of shale gas development since they are in the best position to decide how to strike a balance between the costs and benefits of shale gas development as experienced by their own residents. The exception to this finding arises when externalities cross state borders, as occurs with air emissions, contamination of navigable waterways, and earthquakes resulting from underground injection of wastewater – all of which are already regulated under the federal Clean Air Act, Clean Water Act, and Safe Drinking Water Act, respectively.
- Both the federal government and the states possess the requisite technical know-how to regulate shale gas development. The states, however, have greater experience regulating oil and gas development than the federal government does (although the federal government does have experience regulating off-shore drilling). The states are also better positioned to understand the unique geological, environmental, and land use factors that impact how shale gas development and its regulation are likely to play out in specific locations. The states edge out the federal government in possessing superior regulatory capacity.
- A virtue of a federal system is that states can experiment with different ways of doing things before the country adopts a single federal standards or method. States are engaging in this type of experimentation in their regulation of shale gas development. States are responding differently to the risks presented by shale gas development and are adopting a variety of strategies to mitigate these risks. States, and even the federal government, are learning from the experiences of other jurisdictions and are seeking to apply lessons and best practices from other states as they emerge. Therefore, the states appear to be better positioned to pursue regulatory innovation than is the federal government. The states are also in a better position to respond flexibly to the circumstances of the localities where shale gas development is occurring because they have a richer understanding of local conditions.

- States have been at the forefront of efforts to use economic incentives and performance standards to make environmental regulations more economically efficient. A similar trend can be observed in state regulation of shale gas development. An argument can also be made that states are more likely to provide regulatory stability and certainty because state regulatory agencies are arguably under less pressure from national interest groups and under less public scrutiny than federal regulatory agencies. State regulation can achieve greater regulatory efficiency and stability than can federal regulation.
- The nature of the shale gas industry belies the claim that there is a “race to the (regulatory) bottom” occurring. Decisions about where to drill appear to be driven more by a calculation of whether a particular well in a particular gas field will be profitable, with the cost side of the profit equation composed of varying geology, environment, land, infrastructure, and labor costs in addition to the regulatory costs and taxes imposed by the states. In addition, a number of states have been strengthening regulations in recent months, not weakening them. There does not appear to be a state regulatory failure that the federal government has to remedy.
- Finally, the answer to the question of whether state regulatory agencies have been “captured” by the oil and gas industry is unknown. On the one hand, the states have regulations in place. In some places these regulations are “stronger” than in others, and states are adapting and updating their regulations to address emerging risks associated with shale gas development. On the other hand, state regulators work cooperatively with the industry, and their enforcement practices appear to be more focused on encouraging compliance when a violation is found than with incentivizing the industry by meting out punishments. There are many possible reasons that could explain states’ enforcement practices, including a policy choice to favor the benefits of shale gas development over benefits that could be derived from greater regulation. Without a clearer understanding that regulatory capture has occurred, it would be premature for the federal government to usurp state regulatory authority at this time.

In Chapter Five I conclude that primary regulatory authority over shale gas development is best left with the states. They are better positioned to regulate most aspects of shale gas development, save for a few areas in which the federal government already exercises primary regulatory authority.

Finally, Chapter 6 offers policy recommendations regarding steps that both the federal government and state governments could take to improve the effectiveness of shale gas regulation. States could use revenues derived from taxes and fees derived from oil and gas development to hire more inspection and enforcement personnel. They should consider shifting liability from the public, where it now rests, to shale gas operators, thereby

incentivizing them to take greater responsibility for potential negative externalities caused by their operations. The federal government could invest in greater research, technical assistance, and disclosure and strengthen enforcement of existing federal laws that already regulate interstate environmental and health effects.

## Chapter 2 – Federal Regulations

### Introduction

Regulation of oil and gas operations was first enacted at the state level, as will be described in Chapter 3. With the emergence of the environmental movement in the 1960s and 1970s in the United States, however, the federal government enacted a number of laws that apply to oil and gas extraction and development and, specifically, to shale gas development. Federal laws that apply to aspects of the shale gas development process include the Clean Water Act; and Clean Air Act; the Safe Drinking Water Act; Comprehensive Environmental Response, Compensation, and Liability Act; the Endangered Species Act; the Migratory Birds Treaty Act; the Emergency Planning and Community Right-to-Know Act; and the Occupational Safety and Health Act. In addition, shale gas development that takes place on federal lands is subject to regulations promulgated by the Bureau of Land Management. It is important to note, however, that a number of exemptions have been carved out of these laws for oil and gas development and specifically for hydraulic fracturing, both by Congress and the Environmental Protection Agency, that sharply limit the exercise of federal regulatory authority over shale gas development.

This chapter will review the federal government's regulatory authority over shale gas development, noting what authority the federal government does, and does not, exercise.<sup>47</sup> In addition, this chapter will note instances in which federal authority is actually delegated to, and exercised by, the states. Finally, the chapter will document current activity at the federal level that could potentially lead to further action, whether regulatory or otherwise, at the federal level in the future.

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<sup>47</sup> This documentation of federal regulations pertaining to shale gas extraction draws on an analysis performed by Hannah Wiseman and Francis Gradjan in their white paper: "Regulation of Shale Gas Development, Including Hydraulic Fracturing." The white paper is part of a larger series published by the Energy Institute at the University of Texas at Austin titled *Fact-Based Regulation for Environmental Protection in Shale Gas Development*. The University of Texas study has come under scrutiny due to undisclosed financial ties between the study's Principal Investigator, Charles G. Groat, and an oil and gas company engaged shale gas development, Plains Exploration and Production. While this undisclosed financial relationship has come under scrutiny, the findings reviewing federal and state regulations and enforcement efforts by the states have not been called into question by most observers. In addition, a conversation by this author with Hannah Wiseman, the author of the relevant chapters in the University of Texas report, revealed that Wiseman was unaware of Groat's interest in Plains Exploration and Production. For a discussion of issues relating to conflict of interests in academia focused on shale gas development, including the University of Texas study, please see: Revkin, "A Deeper Look at Undisclosed Conflicts of Interest in 'Frackademia'."

## **Federal Statutes that Apply to Shale Gas Development**

There are a number of federal environmental and public safety laws that apply to the process of shale gas development. These laws, and how they apply to shale gas development, are reviewed here.

### ***Clean Water Act***

Some aspects of the Clean Water Act apply to shale gas development (and, more generally, oil and gas development). For example, the Act has provisions mandating the management of stormwater runoff during the construction and operation of oil and gas wells.<sup>48</sup> Congress has created an exemption from this regulation, which will be described further below. In addition, the Act requires that operators obtain a permit before discharging any pollutant into U.S. waters.<sup>49</sup>

Congress has exempted certain aspects of oil and gas development from Clean Water Act protections. Generally, the Clean Water Act requires that industrial facilities secure a stormwater permit for both construction of the facility (during which soil sediment can run off the construction site) and ongoing operation of the facility (during which pollutants can be carried off the site with stormwater. An exemption exists for “discharges of stormwater runoff from mining operations or oil and gas exploration, production, processing, or treatment operations or transmission facilities” when the stormwater runoff is “composed entirely of flows which are from conveyances or systems of conveyances (including but not limited to pipes, conduits, ditches, and channels) used for collecting and conveying precipitation runoff” and which are not contaminated due to contact with the actual products of oil and gas extraction.<sup>50</sup> In other words, the Act exempts operators from needing to secure a permit for runoff that only comes into contact with pipes and other structures intended solely to handle the runoff and is not polluted by contact with any other industrial substances.

In addition, the Energy Policy Act of 2005 that was enacted by Congress expanded the definition of oil and gas exploration and production activities under the Clean Water Act.<sup>51</sup> Following this definitional change, the Environmental Protection Agency revised its regulations under the Clean Water Act to exempt oil and gas construction activities from stormwater permitting requirements, but a subsequent lawsuit reversed this regulatory change.<sup>52</sup> As a result, the EPA has essentially reverted to the regulations for stormwater as they existed prior to the 2005 Energy Policy Act, in which oil and gas operators are required to secure a

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<sup>48</sup> 33 U.S.C. § 402(l).

<sup>49</sup> 33 U.S.C. § 1311; 33 U.S.C. § 1342.

<sup>50</sup> 33 U.S.C. § 402(l)(2).

<sup>51</sup> 33 U.S.C. § 1362(24).

<sup>52</sup> EPA, “Regulation of Oil and Gas Construction Activities.”

stormwater permit for construction and operation of a well pad and access road that is one acre or larger in size.<sup>53</sup>

To summarize, the Clean Water Act applies to shale gas development through two key mechanisms. The first is that operators must secure stormwater permits for both the construction and operation of well pads and access roads of a certain minimum size. As will be described in greater detail in Chapter 3, the permits require operators to submit a storm water pollution prevention plan that serve to control the sedimentation of waterways near well pads and limit the quantity of pollutants, such as diesel and other chemicals, that would enter waterways due to leakage from equipment and general industrial activity.<sup>54</sup> Since soil sediment counts as “contaminated runoff” under EPA regulation, and since most sites in the current phase of shale gas development are larger than one acre, these stormwater regulations apply to most sites. The second key control that the Clean Water Act and its associated regulations impose on shale gas development is to prohibit the discharge of pollutants into water bodies without a permit. The primary impact of this regulation is on the disposal of wastes from drilling and fracturing operations. Operators are prohibited from discharging wastes in such a way that contaminants from the disposal would adversely impact surface water bodies without obtaining a permit under the National Pollutant Discharge Elimination System (NPDES) program.<sup>55</sup> This effectively prohibits the direct dumping of wastes into surface waters and encompasses regulation of publicly owned treatment works (POTWs), thereby regulating the qualities of wastewater that operators can dispose of through these facilities.

### ***Safe Drinking Water Act***

The Safe Drinking Water Act (SDWA) was initially passed in 1974 to regulate public drinking water supplies but amendments in 1996 significantly enhanced the law’s protections for water sources.<sup>56</sup> A key mechanism employed by SDWA to protect underground drinking water supplies is requiring entities that inject substances underground to prevent contamination of groundwater sources.<sup>57</sup> The Environmental Protection Agency had long maintained that hydraulic fracturing was not included in the definition of “underground injection,” a position that was successfully challenged in a court case filed in 1994 by the Legal Environmental Assistance Foundation.<sup>58</sup> In the 2005 Energy Policy Act, however, Congress amended the Safe Drinking Water Act to reinforce the EPA’s traditional non-inclusion of hydraulic fracturing as a form of underground injection with the following language: “The term ‘underground

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<sup>53</sup> Wiseman and Gradijan, “Regulation of Shale Gas Development, Including Hydraulic Fracturing,” 26.

<sup>54</sup> *Ibid.*, 35.

<sup>55</sup> US EPA, “NPDES Permitting Program.”

<sup>56</sup> US EPA, “Safe Drinking Water Act (SDWA).”

<sup>57</sup> 42 U.S.C. § 300h(b)(1)(B).

<sup>58</sup> S. Marvin Rogers, *History of Litigation Concerning Hydraulic Fracturing to Produce Coalbed Methane*.

injection’... excludes... the underground injection of fluids or propping agents (other than diesel fuels) pursuant to hydraulic fracturing operations related to oil, gas, or geothermal production activities.”<sup>59</sup> As can be seen from this text, however, Congress kept hydraulic fracturing using diesel fuels under the purview of the Safe Drinking Water Act. The EPA is currently undergoing the public review process for draft guidance that it has released on the use of diesel in hydraulic fracturing.<sup>60</sup> Aside from hydraulic fracturing, the Safe Drinking Water Act does have jurisdiction over the injection of waste substances that are disposed of in underground injection control wells, which is the most common method of disposal, particularly of liquid wastes from shale gas extraction operations.<sup>61</sup>

To summarize, the Safe Drinking Water Act currently regulates two aspects of shale gas development: hydraulic fracturing *only when diesel fuels are used*, and disposal of wastes in underground injection control wells.

### ***Clean Air Act***

Until recently, the Clean Air Act has exercised minimal control over oil and gas drilling as most wells were categorized as “minor source” sites of emissions while the Clean Air Act focuses on limiting harmful emissions from “major source” sites of emissions. There are a number of recent changes in how the EPA is conceiving of its regulatory mandate in relation to air emissions from oil and gas sites, including hydraulic fracturing, that are changing how the agency enforces the Clean Air Act.

In September of 2009, an EPA official circulated a memorandum to the agency’s Regional Administrators withdrawing the agency’s standing guidance on source determinations for the oil and gas industry and encouraging EPA staff to:

...rely foremost on the three regulatory criteria for identifying emissions activities that belong to the same “building,” “structure,” “facility,” or “installation.” These are (1) whether the activities are under the control of the same person (or person under common control); (2) whether the activities are located on one or more contiguous or adjacent properties; and (3) whether the activities belong to the same industrial grouping.<sup>62</sup>

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<sup>59</sup> Pub. L. No. 109-58 § 322.

<sup>60</sup> US EPA, “Permitting Guidance for Oil and Gas Hydraulic Fracturing Activities Using Diesel Fuels – Draft: Underground Injection Control Program Guidance #84.”

<sup>61</sup> 42 U.S.C. § 300h (d)(1) (2011).

<sup>62</sup> “Memorandum from Gina McCarthy, Assistant Administrator to Regional Administrators, Withdrawal of Source Determinations for Oil and Gas Industries.”

This methodology could bring many more oil and gas sites, including shale gas sites, under purview of the Clean Air Act's "major source" regulations.<sup>63</sup> In addition, the EPA released new rules on April 17, 2012 that require shale gas operators to control emissions of volatile organic compounds (VOCs) resulting from flowback by using "green completions."<sup>64</sup> Gas compressor stations, whether newly built or those that increase their hourly emissions due to modification, are also subject to emissions controls for "Stationary Spark Ignition Internal Combustion Engines."<sup>65</sup>

To summarize, while the EPA has taken steps to expand regulation and controls over air emissions from shale gas development sites in recent years, including requiring green completions to limit VOC emissions, most emissions from the shale gas industry are not currently regulated. The EPA does seem to be taking steps to enhance regulation of air emissions, though, including of methane as a greenhouse gas.

### ***Resource Conservation and Recovery Act***

The Resource Conservation and Recovery Act (RCRA) of 1976 governs disposal of solid wastes and hazardous wastes. As explained by EPA, RCRA was designed to take a comprehensive approach to control of hazardous wastes: "The Resource Conservation and Recovery Act (RCRA) gives EPA the authority to control hazardous waste from the "cradle-to-grave." This includes the generation, transportation, treatment, storage, and disposal of hazardous waste."<sup>66</sup>

When RCRA was first enacted, the law was written to cover wastes resulting from the oil and gas development process.<sup>67</sup> In 1980, however, Congress granted a temporary exemption to "exploration and production" oil and gas wastes and directed the EPA to study whether these wastes should be regulated under Subtitle C of RCRA.<sup>68</sup> The EPA, in the late 1980s, determined that regulation of oil and gas wastes as hazardous wastes was "unwarranted" due to both the significant costs that would be imposed on oil and gas producers under Subtitle C regulation and the fact that state regulation of oil and gas wastes was generally adequate.<sup>69</sup>

A significant aspect of the EPA's findings, particularly for purposes of this paper, is that the agency did recognize that some oil and gas exploration and production wastes are hazardous

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<sup>63</sup> Wiseman and Gradijan, "Regulation of Shale Gas Development, Including Hydraulic Fracturing," 74.

<sup>64</sup> US EPA, "Oil and Natural Gas Air Pollution Standards."

<sup>65</sup> 40 CFR Part 63, Subpart ZZZZ.

<sup>66</sup> US EPA, "Summary of the Resource Conservation and Recovery Act."

<sup>67</sup> James R. Cox, "Revisiting RCRA's Oilfield Waste Exemption as to Certain Hazardous Oilfield Exploration and Production Wastes," 2.

<sup>68</sup> *Ibid.*, 3; 42 U.S.C. § 6921(b)(2)(B).

<sup>69</sup> Wiseman, "Regulatory Adaptation in Fractured Appalachia," 245–246.

and also found state regulations to be lacking in some respects with regards to oil and gas waste handling.<sup>70</sup> As the EPA decided not to regulate these wastes itself, however, it provided funding to the Interstate Oil and Gas Compact Commission (IOGCC) to review state regulations, and the IOGCC formed an organization called the State Review of Oil & Natural Gas Environmental Regulations, Inc., or "STRONGER."<sup>71</sup> STRONGER is a nonprofit, multi-stakeholder organization, composed of representatives of industry, environmental groups, and regulatory officials, that has developed guidelines for state regulations around waste handling and disposal and groundwater protection.<sup>72</sup> States can voluntarily submit their own regulatory programs for review to STRONGER and can then whether to implement the recommendations produced through the review process.<sup>73</sup>

To summarize, wastes resulting from the oil and gas production processes, including shale gas production, are exempt from federal regulation under the Resource Conservation and Recovery Act.

#### ***Comprehensive Environmental Response, Compensation, and Liability Act***

The Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) of 1980 was designed to clean up sites contaminated with hazardous substances.<sup>74</sup> It principally effects current and ongoing shale gas operations due to operators' reporting responsibilities for releases of hazardous chemicals of threshold quantities.<sup>75</sup> Operators may be liable for cleanup and remediation costs resulting from these releases.<sup>76</sup>

Congress exempted oil and natural gas, and the chemicals contained in these substances, from CERCLA reporting and liability provisions. The EPA notes that, in addition to petroleum and oil, the "definition of hazardous substance also excludes natural gas, natural gas liquids, liquefied natural gas, and synthetic gas usable for fuel."<sup>77</sup> Shale gas operators are still responsible for reporting, and may be liable for, spills of other hazardous substances used in the shale gas production process, including the chemicals used in fracturing fluids.

To summarize, shale gas operators are exempt from reporting and from potential liability for spills and contamination caused solely from natural gas and petroleum (which, in the case, of

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<sup>70</sup> Ibid., 246–248.

<sup>71</sup> STRONGER, Inc., "Formation of STRONGER."

<sup>72</sup> STRONGER, Inc., "Who We Are."

<sup>73</sup> STRONGER, Inc., "State Reviews - The Process."

<sup>74</sup> US EPA, "CERCLA Overview."

<sup>75</sup> 42 U.S.C. § 9603(a) (2011).

<sup>76</sup> 42 U.S.C. § 9607 (2011).

<sup>77</sup> US EPA, "Superfund - Reportable Quantities."

gas, is anyways airborne), but are not exempt from reporting of spills of the various other hazardous materials that are used in the extraction process and are covered by CERCLA.

### ***Reporting of Chemicals***

The Emergency Planning and Community Right-to-Know Act (EPCRA) and the Occupational Safety and Health Act (OSH Act) require operators to maintain material safety data sheets (MSDS) for certain chemicals that are stored at the drilling site above threshold quantities.<sup>78</sup> Under EPCRA, however, oil and gas operators are not required to prepare annual toxic chemical release forms, as the oil and gas industry is not one of the listed industries under the Act.<sup>79</sup> In addition, although EPCRA requires that operators must provide the MSDS to local emergency planning committees upon request, it allows operators to claim that certain chemical compositions are “trade secrets” and are therefore exempt from disclosure.<sup>80</sup>

### ***Federal Wildlife Protections***

Shale gas operators are required to comply with the provisions of both the Endangered Species Act and the Migratory Birds Treaty Act. Under the Endangered Species Act, operators are required to confer with the Fish and Wildlife Service about potential harm to listed species and must secure an incidental “take” permit if well development is likely to adversely impact endangered to threatened species.<sup>81</sup> Under the Migratory Birds Treaty Act, shale gas operators are held liable for any harm to protected species and therefore must ensure that gas development facilities, such as surface pits and drilling rigs, do not attract and harm members of protected species.<sup>82</sup>

### ***State Primacy***

As explored in the above review, federal laws, and rules and regulations promulgated by EPA and other federal agencies pursuant to federal laws, cover some, but not all, aspects of shale gas development. It is worth noting that, of the federal laws and regulations that apply to shale gas, many are actually administered and enforced by states.

For example, the Safe Drinking Water Act gives states and Native American tribes primary enforcement responsibility (known as “primacy”) if they can meet certain requirements.<sup>83</sup> Although the contours of primacy vary somewhat between the different laws covered here, the

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<sup>78</sup> 29 C.F.R. § 1910.1200(b) (2010); 42 U.S.C. § 11005 (2011).

<sup>79</sup> Wiseman, “Regulatory Adaptation in Fractured Appalachia,” note 125.

<sup>80</sup> Ibid.

<sup>81</sup> 16 U.S.C. § 1538 (a) (2011).

<sup>82</sup> 16 U.S.C. §§ 703, 707 (2011).

<sup>83</sup> See US EPA, “Safe Drinking Water Act - Primacy.” States must meet a dozen requirements to receive primacy under the Safe Drinking Water Act.

basic idea is that, once a state has been granted primacy it replaces the federal government in the various components of administering the law and its regulations. For example, in states that have primacy under the Clean Water Act, operators must apply to the state, not the federal government, for stormwater permitting and these states also take enforcement action in case of non-compliance. The National Pollutant Discharge Elimination System (NPDES), under which stormwater permitting is done, has five categories under which states and territories can receive primacy approval, including “State NPDES Permit Program,” “Regulate Federal Facilities,” and “State Pretreatment Program.”<sup>84</sup> All states, save for four, have obtained primacy under NPDES in most of the five categories.<sup>85</sup> Under state primacy, the federal Environmental Protection Agency exercises some degree of guidance and oversight over state administration of federal law, and can direct states to reexamine their application and enforcement of federal law, going so far as to revoke state primacy.<sup>86</sup> In the realm of shale gas regulation, the EPA critically questioned Pennsylvania’s enforcement of the Clean Water Act with regards to shale gas operators who were taking flowback water and produced water to publicly owned treatment works (wastewater treatment plants) for disposal.<sup>87</sup> The Pennsylvania Department of Environmental Protection consequently requested that operators no longer take their wastes to publicly owned treatment works for disposal.<sup>88</sup>

Of the federal laws reviewed here, many states have gained primacy in administration of the Clean Water Act, the Clean Air Act, and the Safe Drinking Water Act.

### Future Directions

The Environmental Protection Agency, in some cases under direction from Congress, is currently exploring the possibility of expanding the ambit of federal regulatory authority over select aspects of shale gas development.

*Clean Water Act:* The EPA is updating chloride water quality criteria which will provide an updated scientific basis on which to issue discharge permits. This will impact the handling of flowback and produced water by publicly owned treatment works. The EPA expects to release draft criteria in early 2013.<sup>89</sup> In addition, the EPA has initiated a rule-making process to create a pretreatment standard for wastewater from shale gas operations before the wastewater can be

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<sup>84</sup> US EPA, “National Pollutant Discharge Elimination System (NPDES).”

<sup>85</sup> Ibid.

<sup>86</sup> Spence, “Federalism, Regulatory Lags, and the Political Economy of Energy Production,” note 159.

<sup>87</sup> Wiseman and Gradijan, “Regulation of Shale Gas Development, Including Hydraulic Fracturing,” 127.

<sup>88</sup> Ibid.

<sup>89</sup> US EPA, Office of External Affairs, “Natural Gas Extraction - Hydraulic Fracturing.”

treated in publicly owned treatment works (POTWs). These regulations would take effect under the Clean Water Act and the EPA expects to propose rules by 2014.<sup>90</sup>

*Safe Drinking Water Act:* The EPA released draft guidance on the use of diesel fuels in hydraulic fracturing in May 2012.<sup>91</sup> At the time of writing, the draft guidance was open to public comment.<sup>92</sup>

*Clean Air Act:* As noted above, the EPA revised its guidelines for source determination in 2009. The impact of this revision is still playing out and could bring many more oil and gas sites, including shale gas sites, under purview of the Clean Air Act's "major source" regulations.<sup>93</sup>

*Resource Conservation and Recovery Act:* Although wastes generated during the exploration, development, and production of crude oil, natural gas, and geothermal energy are exempt from federal hazardous waste regulations the Resource Conservation and Recovery Act, the EPA is "currently evaluating industry practices and state requirements and is considering the need for technical guidance on the design, operation, maintenance, and closure of pits under the Resource Conservation and Recovery Act (RCRA) in order to minimize potential environmental impacts."<sup>94</sup>

*Bureau of Land Management Regulations:* In addition to the laws and attendant regulations described above, it should be noted that the federal government does directly regulate drilling and fracturing on federally-owned land, which is overseen by the Bureau of Land Management (BLM). The BLM released draft rules for hydraulic fracturing in early May of 2012.<sup>95</sup> At the time of writing, the draft rules have undergone public comment and are expected to be finalized by the end of the year. The three key components of this draft revision are: public disclosure of hydraulic fracturing chemicals, new guidelines for casing wells and conducting integrity-testing, and required submission of water management plans.<sup>96</sup> Although the BLM regulations only apply to drilling on federal lands (which is quite extensive), the regulations may have the effect

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<sup>90</sup> US EPA, "Shale Gas Extraction."

<sup>91</sup> US EPA, "Permitting Guidance for Oil and Gas Hydraulic Fracturing Activities Using Diesel Fuels – Draft: Underground Injection Control Program Guidance #84."

<sup>92</sup> US EPA, "Draft Guidance: Permitting Guidance for Oil and Gas Hydraulic Fracturing Activities Using Diesel Fuels."

<sup>93</sup> Wiseman and Gradijan, "Regulation of Shale Gas Development, Including Hydraulic Fracturing," 74.

<sup>94</sup> US EPA, Office of External Affairs, "Natural Gas Extraction - Hydraulic Fracturing."

<sup>95</sup> Dep't of the Interior, Bureau of Land Mgt., "Press Release: Interior Releases Draft Rule Requiring Public Disclosure of Chemicals Used in Hydraulic Fracturing on Public and Indian Lands."

<sup>96</sup> Dep't of the Interior, Bureau of Land Mgt., "43 C.F.R. Pt. 360, WO-300-L13100000.FJ0000, Proposed Rule for Oil and Gas; Well Stimulation, Including Hydraulic Fracturing, on Federal and Indian Lands."

of setting an effective “floor” for state regulations and encouraging states to bring their own regulations in line with the BLM rules.

*EPA Study on Potential Impacts of Hydraulic Fracturing on Drinking Water Resources:* Apart from its regulatory role, Congress directed EPA to undertake a study on potential impacts on drinking water of hydraulic fracturing. EPA has constructed the study to “includes the full lifespan of water in hydraulic fracturing, from acquisition of the water, through the mixing of chemicals and actual fracturing, to the post-fracturing stage, including the management of flowback and produced water and its ultimate treatment and disposal.”<sup>97</sup> The EPA expects to release a progress report in late 2012 and the full report for public comment and peer review in 2014.<sup>98</sup>

### **Conclusion**

Congress passed an array of environmental legislation in the 1970s and into the early 1980s, many of touch on an aspect of shale gas development one way or another. Over the years, however, Congress has carved out exemptions from this legislation for oil and gas development and, more recently, specifically for hydraulic fracturing, thereby significantly limiting the reach of federal regulation over shale gas development. In addition, most states have gained primacy status to apply and enforce federal regulations under three key laws that apply to shale gas development: the Clean Water Act, and Clean Air Act, and the Safe Drinking Water Act. Both the Environmental Protection Agency and the Bureau of Land Management are in various stages of conducting research, enacting new rules, and clarifying existing rules to respond to the risks presented by shale gas development.

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<sup>97</sup> US EPA, “EPA’s Study of Hydraulic Fracturing and Its Potential Impact on Drinking Water Resources.”

<sup>98</sup> Ibid.

## Chapter 3 – State Regulations

### Introduction

Regulation of drilling for oil and natural gas first emerged in the late 1800s and early 1900s in states, and in some cities, that were active in extraction at that time. New York enacted regulations requiring operators to plug abandoned wells in 1879 and various states, including Ohio, Pennsylvania, Oklahoma, and California adopted regulations for casing and plugging wells in subsequent years.<sup>99</sup> Intriguingly, a history of oil and gas regulation written by the Ground Water Protection Council notes that:

Most of these early regulations on well construction and plugging were not specifically designed to protect ground and surface water from the impacts of oil and natural gas production.... In these early years the principal focus was on protection of the petroleum resource from the effects of water incursion and not on protection of water resources themselves.<sup>100</sup>

The 1930s saw the beginning of oil (gas was a very secondary concern at the time) conservation efforts.<sup>101</sup> In contrast to common use of the word “conservation” today, these regulations strived to “promote conservation of oil resources through an orderly development of oil reservoirs.”<sup>102</sup> In other words, the goal was to maximize oil production and minimize the amount of oil left in the ground. A number of oil producing states created “conservation commissions” or “corporation commissions” during this era to oversee exploration and production, such as the Colorado Oil and Gas Conservation Commission, the Oklahoma Corporation Commission, and the Texas Railroad Commission (which was given authority over oil and gas along with its initial mandate over railroads). Generally beginning in the 1940s, state regulations began protecting against certain risks to public health and environmental damage, such as regulations on surface pits and requirements that operators clean up serious oil spills in surface waters.<sup>103</sup> In line with the passage of federal environmental regulations described in Chapter 2, state regulations expanded to protect environmental resources and public health in the 1960s and 1970s.<sup>104</sup>

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<sup>99</sup> Ground Water Protection Council, *State Oil and Natural Gas Regulations Designed to Protect Water Resources*, 13.

<sup>100</sup> *Ibid.*, 12.

<sup>101</sup> The Ground Water Protection Council history does note that the Interstate Oil Compact Commission did develop “model” gas regulations (that states could choose to emulate) in the early 1960s, similar to model oil regulations developed in 1935. See: *Ibid.*, 13.

<sup>102</sup> *Ibid.*

<sup>103</sup> *Ibid.*, 14.

<sup>104</sup> *Ibid.*, 14–15.

Today, many of the states that established specific agencies (such as conservation commissions) to oversee and promote oil and gas development have left primary or exclusive regulatory responsibility in the hands of that same agency.<sup>105</sup> These agencies had already been regulating the industry for many years and had technical expertise in areas such as well spacing and casing requirements.<sup>106</sup> As a result, in some states (such as Colorado), these conservation commissions also enforce environmental protections pertaining to oil and gas production. Some states have given primary regulatory authority to an environmental agency, such as Pennsylvania has with the Pennsylvania Department of Environmental Protection. And some states, such as Texas, take a hybrid approach, with the Railroad Commission exercising the bulk of regulatory authority but with the Texas Commission on Environmental Quality holding responsibility for administering air quality regulations.<sup>107</sup>

This chapter describes the diverse regulatory approaches that have been taken by a sample of states in which shale gas extraction is currently active or, in the case of New York State, has been heavily debated and may begin soon. The states covered in this review are: Arkansas, Colorado, Louisiana, New York, Oklahoma, Pennsylvania, and Texas. These states represent some of the most active shale gas extraction areas across the United States, including the Barnett Shale (Texas), Fayetteville Shale (Arkansas), Haynesville Shale (Louisiana), Marcellus Shale (New York and Pennsylvania), Niobrara Shale (Colorado), and Woodford Shale (Oklahoma). Production from these states accounted for 94.53 percent of shale gas production in the United States in 2010.<sup>108</sup>

These states also represent a cross-section of histories of oil and gas extraction, political climates, and regulatory approaches. Although the first oil well was drilled in Titusville, PA in 1859, in recent decades oil and gas drilling has been much more common in states such as Texas and Oklahoma.<sup>109</sup> With refinements in drilling technology that were first pioneered in Texas' Barnett Shale, however, the Marcellus formation underlying Pennsylvania and New York has become very attractive to drilling operators – it is the largest unconventional gas field in the

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<sup>105</sup> Wiseman, "Fracturing Regulation Applied," 370.

<sup>106</sup> Mike Soraghan, "Oil and Gas: Protecting Oil from Water -- the History of State Regulation."

<sup>107</sup> Wiseman, "Fracturing Regulation Applied," note 49.

<sup>108</sup> Data derived from: U.S. Energy Information Administration, "Shale Gas Production." Almost all of this production came from Texas, Louisiana, Arkansas, Oklahoma, and Pennsylvania (listed in descending order of production volumes). Although production in Colorado from the Niobrara Shale was minimal in 2010 and New York produced no shale gas due to its ongoing moratorium, these two states were included in this survey due to the innovative nature of their regulations.

<sup>109</sup> Ground Water Protection Council, *State Oil and Natural Gas Regulations Designed to Protect Water Resources*, 8.

United States and the second largest unconventional gas field in the world.<sup>110</sup> The states also represent a variety of political climates that are variously more or less inclined to the role of government vis-à-vis industry and environmental protections.

The states, as will be seen through the review, also represent a diversity of approaches to regulation of the oil and gas industry. Texas, for example, has a very active oil and gas industry and has traditionally employed a minimalist regulatory style with regards to oil and gas extraction.<sup>111</sup> Colorado updated many of its regulations after a wave of drilling in the early 2000s that led to an overhaul of the Colorado Oil and Gas Conservation Commission.<sup>112</sup> Pennsylvania, after encountering a shale gas drilling boom beginning in 2008, enacted a comprehensive update of its oil and gas laws in February 2012.<sup>113</sup> And New York has enacted an ongoing moratorium on shale gas drilling while it attempts to craft a policy that would allow for shale gas development while protecting the environment and public health.<sup>114</sup> It should be noted here that the regulations included in this review for New York are the draft regulations articulated in the NYS Department of Environmental Conservation's Revised Draft Supplemental Generic Environmental Impact Statement (Revised Draft SGEIS), which is expected to heavily influence the shape of final regulation.<sup>115</sup>

This review of state regulation is not intended to provide a comprehensive overview of regulation as applied to shale gas development in all states where the practice is taking place or is likely to occur in the future.<sup>116</sup> Rather it is meant to survey the variety of regulatory approaches that states have adopted for the purpose of comparing the nature and approach of state regulation to federal regulation.

This chapter will survey regulations pertaining to shale gas development across seven states. Developing a shale gas well requires multiple stages from initial testing to final well closure and

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<sup>110</sup> "Marcellus and Beyond — Natural Gas (Penn State Extension)."

<sup>111</sup> Rahm, "Regulating Hydraulic Fracturing in Shale Gas Plays."

<sup>112</sup> Mike Soraghan, "Oil and Gas: Protecting Oil from Water -- the History of State Regulation."

<sup>113</sup> Pa. Act 13 — Pa. HB 1950.

<sup>114</sup> Hakim, "Hydrofracking Under Cuomo Plan Would Be Restricted to a Few Counties."

<sup>115</sup> N.Y. Dept. of Environmental Conservation, "Revised Draft SGEIS on the Oil, Gas and Solution Mining Regulatory Program," Exec. Sum.—2. The Revised Draft SGEIS states that: "In reviewing and processing permit applications... the Department would apply the requirements contained within regulations, along with the final SGEIS and the findings drawn from it, including criteria and conditions for future approvals" and that, "The final SGEIS will apply statewide...."

<sup>116</sup> For a more comprehensive review of state regulations pertaining to shale gas development, see Wiseman and Gradijan, "Regulation of Shale Gas Development, Including Hydraulic Fracturing."

site remediation, and this chapter is organized to describe applicable state regulations at most of these stages.<sup>117</sup> The stages around which this review is organized are:

- Testing for gas,
- Constructing a well pad and access road,
- Locating the well pad,
- Drilling and casing a well,
- Controlling air emissions,
- Withdrawing water for hydraulic fracturing,
- Disclosure of hydraulic fracturing chemicals,
- Preventing and reporting spills,
- Testing and replacing water supplies,
- Storing wastes,
- Disposing of wastes.

### Testing for Gas Procedures

The first step of drilling for natural gas in shale is to locate the productive areas of natural gas such that production wells that are subsequently drilled will be able to successfully extract the resource. A common method of testing involves using seismic testing techniques that introduce energy into the ground by either detonating explosives or striking the ground with heavy equipment.<sup>118</sup> The reverberations resulting from these methods are measured and interpreted to identify the presence and depth of subsurface materials including, allowing drilling operators to locate promising locations in which to drill production wells.<sup>119</sup>

Most states covered in this review require that operators secure a permit and/or a blaster's license before conducting seismic testing.<sup>120</sup> Beyond this basic requirement, state regulations vary widely in terms of how they control activity related to testing for gas.

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<sup>117</sup> This organizational approach, as well as the documentation of regulations pertaining to shale gas extraction, draws on an analysis performed by Hannah Wiseman and Francis Gradijan in their white paper: "Regulation of Shale Gas Development, Including Hydraulic Fracturing." The white paper is part of a larger series published by the Energy Institute at the University of Texas at Austin titled *Fact-Based Regulation for Environmental Protection in Shale Gas Development*.

<sup>118</sup> N.Y. Dept. of Environmental Conservation, "Guidelines for Seismic Testing on DEC Administered State Land."

<sup>119</sup> *Ibid.*

<sup>120</sup> For example, Colorado requires that the operator secure a permit and Pennsylvania requires that the operator secure a blaster's license. See 7 COLO. CODE REGS. § 1101-9:3.1 and 25 PA. CODE § 210.13.

A number of states require that seismic activity be set back a certain distance from structures or set other regulations to minimize damage to property. For example, Arkansas mandates that the shot hole, into which explosives are placed, be located at least 200 feet away from structures and further specifies that this required set-back distance could be increased based on charge weight.<sup>121</sup> Oklahoma similarly requires a 200 feet setback from structures.<sup>122</sup> Pennsylvania defines its required setback not be a prescribed distance but rather by a limitation on the “maximum allowable peak particle velocity” as would be measured at the nearest building or other structure.<sup>123</sup> Pennsylvania also prohibits damage to real property due to blasting, save for damage to the property of the blasting permittee.<sup>124</sup> These sorts of regulation appears to be intended to minimize the probability of damage to buildings and other real property, particularly those that are owned by a party other than that which is conducting the seismic testing.

Similar to requiring setbacks from structures, a variety of states require that seismic activity be setback from water wells. For example, both Oklahoma and Arkansas require the same 200 feet setback for water wells that they do for structures.<sup>125</sup> Texas requires that operators secure drilling permits for seismic holes that penetrate to depths at which usable groundwater “must be protected or isolated.”<sup>126</sup> Another type of regulation that some states have implemented in order to protect groundwater supplies pertains to what happens to the shot hole once seismic testing is complete. Arkansas, Colorado, Louisiana, and Texas all require that shot holes be plugged at the conclusion of testing.<sup>127</sup> Colorado’s requirements are the most detailed in this regard, requiring that slurry, drilling fluids, and cuttings from the shot hole must be raked to within one inch of the surface before the shot hole is plugged and filled.<sup>128</sup> The logic behind these requirements to plug shot holes is to prevent against the entry of contaminants deep into the subsurface where they could leech into groundwater aquifers.<sup>129</sup> These different types of regulations, whether setbacks from water wells, requirements for permits when drilling into groundwater, and requirements to plug shot holes upon completion of seismic testing, are all designed to protect groundwater supplies.

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<sup>121</sup> AOGC, RULE B-42(k) (2011).

<sup>122</sup> 52 OKL. ST. ANN. § 318.23 (A).

<sup>123</sup> 25 PA. CODE § 211.151 (c).

<sup>124</sup> 25 PA. CODE § 211.151(a).

<sup>125</sup> See 52 OKL. ST. ANN. § 318.23 (A) and AOGC, RULE B-42(k) (2011).

<sup>126</sup> 16 TEX. ADMIN. CODE § 3.100 (a)(4), (d)(2).

<sup>127</sup> Wiseman and Gradjan, “Regulation of Shale Gas Development, Including Hydraulic Fracturing,” 34.

<sup>128</sup> 2 COLO. CODE REGS. § 404-1:333 (c)(4)(A)-(D).

<sup>129</sup> Wiseman and Gradjan, “Regulation of Shale Gas Development, Including Hydraulic Fracturing,” 31.

While some aspects of Louisiana's regulations mirror those of other states described here, the state places special protections on wildlife or waterfowl refuges and on scenic river areas. Operators are required to have a pre-project meeting and secure written permission from the Seismic Section of the Department of Wildlife and Fisheries before commencing geophysical exploration work. State regulations also specify that marsh buggies and other vehicles used should minimize damage to land, water bottoms, stream bottoms, etc.<sup>130</sup> It is noteworthy that, in contrast to the other states reviewed, which generally locate their regulations pertaining to seismic testing under oil and gas conservation or environmental protection agencies, Louisiana grants regulatory jurisdiction to its Department of Wildlife and Fisheries. Louisiana, perhaps due to the particular geography and habitats present in the bayou, places particular emphasis on protecting wildlife habitat in its regulations.

### **Constructing a Well Pad and Access Road**

After an operator has located a desired site for drilling extraction wells through seismic testing and has collected the necessary extraction rights through signing mineral rights leases with landowners, the operator must secure permits from state and/or federal agencies to construct a well pad and access roads to the well pad.<sup>131</sup> The well pad is platform, generally constructed of either concrete or gravel, upon which production activity, including drilling, storage of materials and wastes, etc. takes place.<sup>132</sup> A well pad typically covers between 2.2 and 5.7 acres, and coverage by access roads can range from very little additional coverage (if preexisting roads are used extensively) to 2.75 acres.<sup>133</sup> As a result, the footprint of well pads, particularly in areas where widespread drilling is occurring, can be extensive.

The federal Clean Water Act requires that shale gas operators obtain general stormwater permits. Federal regulations under the Clean Water Act are usually implemented by state agencies, and as part of the approvals process, operators must submit a notice of intent as well as a storm water pollution prevention plan to the appropriate state agency.<sup>134</sup> These pollution prevention plans are not site-specific and involve the implementation of Best Management

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<sup>130</sup> LA. ADMIN. CODE tit. 76: I., § 301 (B)(5), (E), (F), (Q).

<sup>131</sup> Wiseman and Gradijan, "Regulation of Shale Gas Development, Including Hydraulic Fracturing," 35.

<sup>132</sup> Schlumberger Oilfield Glossary, "Pad."

<sup>133</sup> N.Y. Dept. of Environmental Conservation, "Revised Draft SGEIS on the Oil, Gas and Solution Mining Regulatory Program," 5–10, 5–11.

<sup>134</sup> Wiseman and Gradijan, "Regulation of Shale Gas Development, Including Hydraulic Fracturing," 36. These pollution prevention plans are often known as "stormwater erosion and sediment control plans," "sediment and erosion control plans," "stormwater management plans," or something similar in different state regulations.

Practices, which means that they tend to be relatively consistent across the states included in this review.<sup>135</sup>

Of the states reviewed, some, such as Texas and Oklahoma, appear to follow EPA guidelines under the Clean Water Act and require that operators apply for stormwater permits as required under federal law.<sup>136</sup> The permits issued by these states, in line with Clean Water Act requirements, serve to control the sedimentation of waterways near well pads and limit the quantity of pollutants, such as diesel and other chemicals, that would enter waterways due to leakage from equipment and general industrial activity.<sup>137</sup>

Some states have regulations that go beyond the scope of the federal Clean Water Act. For example, New York requires operators to secure general stormwater permits that are specific to gas drilling operations (in contrast to the “general industrial” permits generally granted by states following EPA guidelines) and requires them to secure individual State Pollutant Discharge Elimination System permits for stormwater discharges that are located within 500 feet of principal aquifers.<sup>138</sup> Louisiana, in addition to requiring a Louisiana Water Discharge Permit System permit for stormwater runoff, places limits on the amount of chemical oxygen demand, organic carbon, chloride, oil, and grease that can enter waterways through stormwater flow.<sup>139</sup>

Pennsylvania differentiates between the different types of surface waterways that are likely to be affected by stormwater flow, with an erosion and sediment control plan required for disturbances to land surfaces of as little as 5,000 square feet if the runoff would flow into “High Quality” or “Exceptional Value” waters, as defined by state code, and a more general permit, called the “Erosion and Sediment Control and Stormwater Management for Oil and Gas Exploration, Production, Processing, Treatment Operations or Transmission Facilities General Permit,” required for any earth disturbance that is 5 acres or larger.<sup>140</sup>

New York, Louisiana, and Pennsylvania, which have regulations that go beyond the baselines requirements promulgated by EPA under the Clean Water Act, appear to be striving for similar

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<sup>135</sup> Ibid.

<sup>136</sup> Ibid., 42.

<sup>137</sup> Ibid., 35.

<sup>138</sup> N.Y. Dept. of Environmental Conservation, “Revised Draft SGEIS on the Oil, Gas and Solution Mining Regulatory Program,” 7–26–29.

<sup>139</sup> LA. Admin. Code tit. 33:IX, § 708(4).

<sup>140</sup> Governor’s Marcellus Shale Advisory Commission, *Governor’s Marcellus Shale Advisory Commission, Final Report*, 70.

goals as the EPA in terms of seeking to minimize sedimentation due to construction and erosion and limit harmful runoff of chemicals from well pads.

Colorado, along with concerns about sedimentation and contamination of waterways, also highlights concerns about adverse impacts on wildlife due to habitat loss and fragmentation in its regulations. If an operator applies to locate a well within a “sensitive wildlife habitat or a restricted surface occupancy area,” the operator is required to consult about impacts on wildlife with the Colorado Division of Wildlife, the Colorado Oil and Gas Conservation Commission, and the surface owner of the land under which drilling will occur.<sup>141</sup> Operators also have the option to submit a Comprehensive Drilling Plan to the Colorado Oil and Gas Conservation Commission, and the Colorado Department of Public Health and Environment, the Colorado Division of Wildlife, “local government designee(s),” and affected surface owners. All of these stakeholders are invited, under state regulations, to participate in developing the plan, which often leads to “identification of potential impacts and development of conditions of approval to minimize adverse impacts.”<sup>142</sup> Colorado also prescribes a number of other measures to both reduce impact on waterways and on habitat, such as requiring that, “[e]xisting roads shall be used to the greatest extent practicable to avoid erosion and minimize the land area devoted to oil and gas operations.”<sup>143</sup> State regulations also mandate that, “[w]here possible, operators shall provide for the development of multiple reservoirs by drilling on existing pads or by multiple completions or commingling in existing wellbores,”<sup>144</sup> and, “[w]here feasible, operators shall use directional drilling to reduce cumulative impacts and adverse impacts on wildlife resources.”<sup>145</sup>

### **Locating the Well Pad, Well, Pits, and Disposal Sites**

Once the operator has secured the required stormwater permits as required under federal and state laws, it will construct the well pad. The pad will contain other facilities necessary for gas development, including the well itself, storage facilities for materials and wastes in the form of pits and tanks, and on-site waste pits.

In addition to stormwater permits, all of the states covered in this review have additional regulations pertaining to where a well pad and/or its associated facilities can be placed. State regulations mandate that certain gas drilling facilities be set back from certain items, such as drinking water resources, wetlands, and structures in order to prevent damage to these

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<sup>141</sup> 2 COLO. CODE REGS. § 404-1:1202 (b)-(c).

<sup>142</sup> 2 COLO. CODE REGS. § 404-1:216(d).

<sup>143</sup> 2 COLO. CODE REGS. § 404-1:1002 (e)(4).

<sup>144</sup> 2 COLO. CODE REGS. § 404-1:603(d).

<sup>145</sup> 2 COLO. CODE REGS. § 404-1:1002(d).

domestic and natural resources and property. Different regulatory models for each of these protected items will be described in turn.

States have opted to pursue a variety of approaches in regulating the placement of gas extraction facilities in relation to drinking water resources such as public water supplies and private water wells. The most intricate, and incidentally, aggressive regulations have been adopted by Colorado and New York (in the case of New York, the regulations were written but had not been approved at the time of writing).<sup>146</sup> Both states have a detailed setback, or “buffer zone,” system to protect drinking water supplies. In this type of approach, regulations specify the distances between extraction equipment and drinking water resources as well as the types of gas extraction equipment that must be set back specific distances from drinking water resources.

Colorado, for example, has defined three “buffer zones” in which specific types of equipment, and therefore activities are restricted.<sup>147</sup> The internal buffer zone (0-300 feet from the water resource), nearest to public water facilities, prohibits any gas drilling and completion activity.<sup>148</sup> In the intermediate buffer zone (301-500 feet from the water resource), restrictions are placed on gas extraction activity; for example, operators are required to use “closed-loop” systems in which all chemicals and wastes are stored in steel tanks as opposed to pits and various other protections are implemented.<sup>149</sup> In the external buffer zone (501-2640 feet from the water resource), operators are also required to store material in tanks (although the system does not have to be a “closed-loop” system with the attendant protections required in the intermediate buffer zone) and are required to conduct pre-drilling and post-drilling groundwater testing for a set of defined chemicals.<sup>150</sup> The regulations are further differentiated in terms of requirements for extraction equipment that pre-dated the promulgation of the regulations and new equipment that is installed, with the regulations requiring stricter controls on new equipment.<sup>151</sup>

Some states follow a less aggressive approach than Colorado and New York by identifying specific high-risk activities on the well pad and specifying that these should be set back from drinking water resources. Some states also take into account particularly high-risk areas, such as 100-year floodplains, when determining setback requirements for specific facilities. In other

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<sup>146</sup> Wiseman and Gradjan, “Regulation of Shale Gas Development, Including Hydraulic Fracturing,” 45–46.

<sup>147</sup> 2 COLO. CODE REGS. § 404-1:317B.

<sup>148</sup> 2 COLO. CODE REGS. § 404-1:317B(c).

<sup>149</sup> 2 COLO. CODE REGS. § 404-1:317B(d).

<sup>150</sup> 2 COLO. CODE REGS. § 404-1:317B(e).

<sup>151</sup> 2 COLO. CODE REGS. § 404-1:317B.

words, the regulations take into account not only the likelihood and adverse consequences of human or mechanical error, but also on the likelihood of natural occurrences such as floods. Arkansas and Oklahoma both follow this approach.<sup>152</sup> For example, Arkansas' regulations read, in part: "Mud, Circulation, and Reserve Pits constructed within the 100 year flood plain must be in accordance with any county or other local ordinance or requirement pertaining to the 100-year flood plain."<sup>153</sup>

Finally, of the states reviewed, Texas has the most lenient approach to protecting water resources, as it appears not to require any sort of setback from public water supplies, private wells, or streams. The only setbacks that Texas regulations seem to require are setbacks from structures.<sup>154</sup>

In terms of setbacks from buildings and other structures, the regulatory approach among the reviewed states is relatively consistent, with required setbacks generally ranging from 150 feet to 500 feet, depending on the state and the circumstances of the situation. For example, Colorado and Louisiana both mandate that the required setback distance be greater in "high-density" or "urban" areas.<sup>155</sup> Arkansas and Colorado require greater setbacks from "public use buildings" and "group facilities" than from other types of buildings.<sup>156</sup> Some states, including Louisiana and Pennsylvania, specify minimum setbacks for gas production equipment but allow for the setback to be waived if the operator can secure written consent from the building owner.<sup>157</sup> Finally, Texas sets a state-wide minimum setback of 200 feet from private residences, and prohibits the drilling of a well "in the thickly settled part of the municipality," but allows local jurisdictions, such as municipalities and counties, to set stricter requirements, as needed.<sup>158</sup>

The final category of setbacks covered in this review is setbacks from wetlands. Similar to setbacks from water resources, states take a variety of approaches and evidence different motivations in creating their regulations. Colorado's regulations make clear that that state is

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<sup>152</sup> Wiseman and Gradjan, "Regulation of Shale Gas Development, Including Hydraulic Fracturing," 46.

<sup>153</sup> AOGC, RULE B-17(f) (2012).

<sup>154</sup> See 16 TEX. ADMIN. CODE § 3.8(d)(4) (providing pit requirements); 16 TEX. ADMIN. CODE § 3.37 (providing well spacing requirements but no setback requirements); TEX. LG. CODE ANN. § 253.005(c) (providing setbacks from structures).

<sup>155</sup> 2 COLO. CODE REGS. § 404-1:603, STATE OF LA. OFFICE OF CONSERVATION, ORDER NO. U-HS at 2(A) (2009), available at [http://dnr.louisiana.gov/assets/OC/eng\\_div/20090806-U-HS.pdf](http://dnr.louisiana.gov/assets/OC/eng_div/20090806-U-HS.pdf).

<sup>156</sup> AOGC Rule B-26 (c)(5)(A), (d)(4)(A) (2012), 2 COLO. CODE REGS. 404-1:603.

<sup>157</sup> STATE OF LA. OFFICE OF CONSERVATION, ORDER NO. U-HS at 2(A) (2009), available at [http://dnr.louisiana.gov/assets/OC/eng\\_div/20090806-U-HS.pdf](http://dnr.louisiana.gov/assets/OC/eng_div/20090806-U-HS.pdf), 58 PA. CONS. STAT. ANN. § 3215(a).

<sup>158</sup> TEX. LG. CODE ANN. § 253.005(c), Rahm, "Regulating Hydraulic Fracturing in Shale Gas Plays," 2978–2979.

seeking to protect habitat and minimize environmental harm in its directive to operators to “avoid or minimize impacts to wetlands and riparian habitats to the degree practicable,” by “incorporat[ing] adequate measures and controls to prevent significant adverse environmental impacts.”<sup>159</sup> Louisiana allows for the use of drilling equipment in wetlands, but requires sequestration of the drilling site through the use of either dikes or impervious decking with curbs, gutters, and/or sumps.<sup>160</sup> Louisiana’s intention seems to be to localize any adverse impact on wetland habitat and waters through containment measures. Various states reviewed (Arkansas, New York, Oklahoma, and Pennsylvania) require setbacks from wetlands for either the entire well site (Pennsylvania) or for specific equipment and practices (New York & Arkansas specify oil/fueling tanks and fluid storage tanks; Oklahoma specifies waste disposal of produced water, drill fluids, and drill cuttings).<sup>161</sup> Arkansas’ regulations cite the proximity of the water table to the surface in wetlands environments and, in situation “where [the] water table is 10 ft. or less below surfaces,” requires use of above-ground pits or closed loop systems.<sup>162</sup> In this case, Arkansas demonstrates a concern for contamination of underground water supplies. Finally, Texas, as noted above with regards to water supplies, similarly appears to have no mandated setbacks from wetland environments.<sup>163</sup>

### **Drilling and Casing a Well; Preventing Blowouts**

Once the well pad has been constructed, the next stage of the shale gas production process is to drill the production well. Securing the wellbore through adequate structural protections in the form of casing (steel pipes) and cement as well as mechanisms to control blowouts (uncontrolled fluid flows into the wellbore due to high pressures underground) is critical for preventing groundwater contamination due to leakages from the well.<sup>164</sup> States regulate both of these aspects, structural protection and blowout prevention, in significant detail, although there are some differences in the approach that states take. This review will cover a few key aspects of these structural and blowout regulations, namely the depth to which casing must be installed, the strength of casing used, requirements to test cement integrity and submit a log reporting on the testing, and blowout prevention regulations.

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<sup>159</sup> 2 COLO. CODE REGS. § 404-1:1002 (e)(2), 2 COLO. CODE REGS. § 404-1:901 (f).

<sup>160</sup> LA. ADMIN. CODE tit. 33:V, §.1121.

<sup>161</sup> AOGC, RULE B-17 (f)(1)(D) (2012), AOGC, RULE B-26 (c)(5)(C), (d)(4)(C) (2012), N.Y. Dept. of Environmental Conservation, “Revised Draft SGEIS on the Oil, Gas and Solution Mining Regulatory Program,” 7–34, OKLA. ADMIN. CODE §§ 165:10-7-17, 10-7-19 10-7-26, 58 PA. CONS. STAT. ANN. § 3215(b)(3).

<sup>162</sup> AOGC, RULE B-17 (f)(1)(D) (2012).

<sup>163</sup> See 16 TEX. ADMIN. CODE § 3.8(d)(4) (providing pit requirements); 16 TEX. ADMIN. CODE § 3.37 (providing well spacing requirements but no setback requirements).

<sup>164</sup> Ground Water Protection Council, *State Oil and Natural Gas Regulations Designed to Protect Water Resources*, 21.

It should be noted that most regulations in this area were written before the widespread use of high-volume hydraulic fracturing practices and most states have not updated their regulations since that time. The technical requirements for a conventional well and for a shale gas well are largely the same, although the practice of high-volume hydraulic fracturing does place greater pressure on the casing and other well components.<sup>165</sup> Some states, such as Pennsylvania and New York, have updated their regulations on well construction and blowout prevention to take into account the particular challenges presented by the use of hydraulic fracturing in shale gas extraction.

States generally take one of two approaches when it comes to regulating how deep casing must be installed. Some states prescribe a required length for the casing in all cases, while others have general requirements that casing be sufficient to protect groundwater (and may prescribe required lengths if groundwater is encountered while drilling). Oklahoma and New York are examples of the first type of approach, in which a required length is prescribed in all cases. Oklahoma require that casing be installed 50 feet below the lowest fresh groundwater or 90 feet below the surface, whichever is deeper.<sup>166</sup> Pennsylvania's regulations are similar, but slightly different, in requiring that casing be installed 50 feet below the lowest fresh groundwater or 50 feet into consolidated rock, whichever is deeper.<sup>167</sup> Note that there is a difference between the two states, in that Oklahoma measures depth from the surface whereas Pennsylvania requires that casing be installed into consolidated rock, no matter how far from the surface. The second type of approach, of having a generalized requirement to protect fresh water, can be seen in Texas' regulations, which reads in part: "set and cement sufficient surface casing to protect all usable-quality water strata."<sup>168</sup>

Similar to regulations on the depth to which casing must be installed, regulations on the required strength of casing can be grouped into two categories, the first prescribing a required strength (in some cases, linked to the specifics of that well) and the second category requiring a more general standard. The first, more specified, approach can be seen in New York, which requires that casing undergo a mill test of at least 1,000 psi, and in Texas, which requires that casing must be "hydrostatically pressure tested with an applied pressure at least equal to the maximum pressure to which the pipe will be subjected in the well."<sup>169</sup> The second, more

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<sup>165</sup> Lustgarten, "Why Gas Leaks Matter in the Hydraulic Fracturing Debate."

<sup>166</sup> OKLA. ADMIN. CODE § 165:10-3-4.

<sup>167</sup> 25 PA. CODE § 78.83 (2011).

<sup>168</sup> 16 TEX. ADMIN. CODE § 3.13.

<sup>169</sup> N.Y. Dept. of Environmental Conservation, "Revised Draft SGEIS on the Oil, Gas and Solution Mining Regulatory Program," 7–50, 16 TEX. ADMIN. CODE § 3.13.

general approach, can be seen in Oklahoma, which specifies only that “oil field grade steel casing” be used, and in Colorado, which mandates that casing “protect any potential oil or gas bearing horizons penetrated during drilling from infiltration of injurious waters from other sources, and to prevent the migration of oil, gas or water from one (1) horizon to another, that may result in the degradation of ground water.”<sup>170</sup>

The states reviewed generally require submissions of a log (variously called a bond log, a cement log, or similar) to demonstrate that the cement used to seal the gaps between the casing and well wall and between the layers of casing is structurally sound. Some states require that logs be submitted in all cases while other states only require submission of logs under specific circumstances. Colorado, New York, Pennsylvania, and Texas require submission of logs in all circumstances; for example, Colorado requires copies of “all logs run,” specifying that this includes “mechanical, mud, or other.”<sup>171</sup> In contrast, Arkansas and Oklahoma require that logs be submitted only under certain circumstances.<sup>172</sup> For example, Oklahoma requires submission of logs to the Oklahoma Corporation Commission, Oil and Gas Conservation Division if the agency does not witness the fracturing operation or in site-specific circumstances.<sup>173</sup>

In addition to the various regulations that states have in place to protect against well failure, states also regulate the blowout prevention equipment and procedures that operators must install in case a well does fail. Some states have prescriptive regulations, requiring that specific blowout prevention equipment be in place, whereas others have introduced performance-based regulation. In the prescriptive model, Colorado requires that, in high-density areas, rigs with Kelly must have: “double ram with blind ram and pipe ram; annular preventer or a rotating head,” while rigs without Kelly must have “double ram with blind ram and pipe ram.”<sup>174</sup> In contrast, Texas’ performance-based model requires that blowout prevention equipment must “satisfy any reasonable test which may be required by the commission or its duly accredited agent.”<sup>175</sup>

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<sup>170</sup> OKLA. ADMIN. CODE § 165:10-3-4, 2 COLO. CODE REGS. § 404- 1:317.

<sup>171</sup> 2 COLO. CODE REGS. § 404-1:308(a), N.Y. Dept. of Environmental Conservation, “Revised Draft SGEIS on the Oil, Gas and Solution Mining Regulatory Program,” 7–54, 25 PA. CODE § 78.74, 16 TEX. ADMIN. CODE § 3.16, (b),(c).

<sup>172</sup> AOGC, RULE B-19(f) (2011), STRONGER, Inc., *Oklahoma Hydraulic Fracturing State Review*.

<sup>173</sup> *Ibid.*

<sup>174</sup> 2 COLO. CODE REGS. § 404-1:603.

<sup>175</sup> 16 TEX. ADMIN. CODE § 3.13(b).

## Controlling Air Emissions

The process of drilling and hydraulically fracturing a well emits a variety of emissions into the air, including nitrogen oxides, carbon monoxide, sulfur dioxide, volatile organic compounds (VOCs), and hazardous air pollutants such as benzene.<sup>176</sup> While many of these substances are regulated under the Clean Air Act, most oil and gas production operations historically have not been subject to these controls because the Clean Air Act focuses on “major sources” (sources that emit a minimum number of tons per year of a given pollutant) whereas individual gas wells do not meet these minimums and are therefore “minor sources.”<sup>177</sup> The U.S. Environmental Protection Agency released new rules in April 2012 that enhance regulation of air pollution from the oil and natural gas industry at the federal level (much of which is delegated and carried out by individual states).<sup>178</sup> Beyond the baseline regulations laid out at the federal level, states have discretion to implement minor source control programs, and some have done so, although, at the time of writing, the majority of states covered in this review have taken very limited action in response to air emissions from natural gas production.

New York and Colorado have gone the furthest in regulating air emissions from natural gas production activities. New York has proposed a significant number of specific measures and controls on air emissions from shale gas operations. For example, New York has proposed regulations prohibiting the simultaneous operation of drilling and fracturing engines on one well pad and that the diesel used in engines be “limited to ULSD [ultra-low sulfur diesel] with a maximum sulfur content of 15 ppm.”<sup>179</sup> New York also has proposed limiting to four “[t]he maximum number of wells to be drilled and completed annually or during any consecutive 12-month period at a single pad.”<sup>180</sup> The state’s proposed regulations also require vapor recovery systems on condensate tanks to capture VOC emissions.<sup>181</sup> Gas also escapes during the flowback stage (when fluids flow back to the surface up the well after hydraulic fracturing), and New York has proposed limiting the venting of gas to “a maximum of 5 MMscf [million standard cubic feet] during any consecutive 12-month period.”<sup>182</sup> In addition, among other regulations, New York has proposed that the operator be required to “construct and operate the site in accordance with a greenhouse gas emissions impacts mitigation plan” that would involve, for

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<sup>176</sup> U.S. Environmental Protection Agency, “Overview of Final Amendments to Air Regulations for the Oil and Natural Gas Industry - Fact Sheet.”

<sup>177</sup> Wiseman and Gradijan, “Regulation of Shale Gas Development, Including Hydraulic Fracturing,” 73–74.

<sup>178</sup> US EPA, “Oil and Natural Gas Air Pollution Standards.”

<sup>179</sup> N.Y. Dept. of Environmental Conservation, “Revised Draft SGEIS on the Oil, Gas and Solution Mining Regulatory Program,” 7–108.

<sup>180</sup> Ibid.

<sup>181</sup> Ibid.

<sup>182</sup> Ibid.

example, implementation of EPA's Natural Gas STAR Best Management Practices, reduced-emission completions, creation of a leak detection and repair program, and on-demand reporting under the EPA's GHG reporting rule.<sup>183</sup>

Colorado regulations require that condensate tanks, crude oil tanks, and produced water tanks with the potential to emit at least five tons of VOCs per year must capture 95 percent of their VOCs when these tanks are located within a quarter mile of facilities such as schools, nursing homes, and jails within certain counties.<sup>184</sup> Glycol dehydrators and pits under similar conditions must capture 90 percent of their VOC emissions.<sup>185</sup> Colorado's regulations also require green completion practices (that capture methane and other air emissions) be implemented for wells that are likely to emit 500,000 cubic feet per day (500 MCFD); specific green completion practices that are required are specified in the regulations.<sup>186</sup>

Besides New York and Colorado, most states reviewed here have taken minimal action to limit air emissions from shale gas development sites. Texas and Pennsylvania have implemented monitoring programs. The Texas Commission on Environmental Quality has implemented an extensive emissions monitoring program in the Barnett Shale and Pennsylvania conducted a more limited monitoring program over three months in 2010.<sup>187</sup> Oklahoma requires that rigs have a "suitable" stack height for flaring in order to "prevent a hazard to people or property."<sup>188</sup>

### **Withdrawing Water for Hydraulic Fracturing**

High-volume hydraulic fracturing requires significant quantities of water be injected underground to fracture the shale and release the trapped natural gas, allowing it to flow up the well to the surface. The water is mixed with fracturing fluids and proppants, but the vast majority of the solution that is injected underground is water. Each fracturing treatment typically requires between 2.4 and 7.8 million gallons of water, varying due to differences in geology between different shales.<sup>189</sup> Although this volume of water per fracturing treatment, even when multiplied across the many wells that may be dug in a given area, represents only a

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<sup>183</sup> Ibid., 7–116–117.

<sup>184</sup> 2 COLO. CODE REGS. § 404-1:805(b)(2).

<sup>185</sup> Ibid.

<sup>186</sup> 2 COLO. CODE REGS. § 404-1:805(b)(3).

<sup>187</sup> Texas Commission on Environmental Quality, "Barnett Shale Emissions"; Pennsylvania Department of Environmental Protection, *Northcentral Pennsylvania Marcellus Shale Short-Term Ambient Air Sampling Report*.

<sup>188</sup> OKLA. ADMIN. CODE § 165:10-3-15.

<sup>189</sup> N.Y. Dept. of Environmental Conservation, "Revised Draft SGEIS on the Oil, Gas and Solution Mining Regulatory Program," 8.

tiny fraction of annual use for all other water uses across a state, the impact on specific water sources that become overburdened, especially in arid regions, can be significant.<sup>190</sup>

Laws controlling water use vary significantly from state to state. In all of the states covered in this review, though, a shale gas operator must either secure water rights before withdrawing water or must purchase water from someone with water rights and the authorization to sell water under those rights.<sup>191</sup> Water rights in these states are structured in diverse ways. In most eastern states, water rights have traditionally been allocated under a riparian regime in which those whose land abuts the water source have usage rights to the water.<sup>192</sup> In most western states, water rights have traditionally allocated under a prior appropriation regime under which users who put water to beneficial use have the right to continued use of the water.<sup>193</sup> Today, most states have supplemented, or even supplanted, these common law underpinnings with statutes and regulations that control water withdrawal and usage, and shale gas operators seeking to withdraw water are subject to these various rules.<sup>194</sup> Some states covered in this review require operators to secure both water rights and a permit to withdraw a limited quantity of water. Other states require operators to secure a permit only under specific circumstances, while some require reporting of quantities of water used. Finally, a few states have implemented regulations encouraging or requiring reuse of flowback water (injected water that flows back to the surface) in multiple fracture treatments.

Pennsylvania and New York have relatively strict water withdrawal regimes, underpinned by the use of permits to regulate fresh water use by shale gas operators. Both of these states require that operators obtain permits before withdrawing water either from ground or surface sources.<sup>195</sup> In these permit applications, operators are required to designate the sources from which they will withdraw water and the quantity that will be withdrawn from those sources. Operators are required to conduct analysis of the impacts of their proposed withdrawals and demonstrate that their actions will not cause, for example in New York, a degradation of the

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<sup>190</sup> Rahm and Riha, "Toward Strategic Management of Shale Gas Development," 15; Rahm, "Regulating Hydraulic Fracturing in Shale Gas Plays," 2976.

<sup>191</sup> Weston, "Water and Wastewater Issues in Conducting Operations in a Shale Play – The Appalachian Basin Experience," 9.

<sup>192</sup> *Ibid.*, 10.

<sup>193</sup> Smith, "Governing Water," 445.

<sup>194</sup> Wiseman and Gradijan, "Regulation of Shale Gas Development, Including Hydraulic Fracturing," 83–84.

<sup>195</sup> 58 PENN. STAT. § 3211; 6 NYCRR § 601.3 (2011).

quality of the water source such that it no longer accords with the guidelines of its “designated best use.”<sup>196</sup>

Pennsylvania’s regulations, for example, require operators to submit a “water management plan” to the state’s Department of Environmental Protection (DEP), which the agency must approve before the operator is permitted to begin drawing water.<sup>197</sup> The operator must describe the water source, its location, the average daily quantity that it proposes to withdraw, and the maximum withdrawal rate.<sup>198</sup> The water management plan also requires that operators conduct a low-flow analysis of surface waterways from which they propose to withdraw water, a withdrawal-impacts analysis describing how the withdrawal will be designed to minimize adverse impact on aquatic life and habitat, and a natural diversity inventory.<sup>199</sup> Pennsylvania law requires that the DEP only approve a water management plan if the operator demonstrates that withdrawal will not adversely impact the quantity or quality of water in the source, will not adversely impact water quality in the watershed, and will meet passby flow conditions.<sup>200</sup>

Some states require permitting for withdrawals in limited circumstances or have enacted regulations granting state authorities jurisdiction to protect the health of waterways and the rights of riparian rights holders. Colorado requires that parties seeking to withdraw groundwater outside of designated groundwater basins secure a permit from the state engineer before doing so.<sup>201</sup> Opinions by Louisiana’s Attorney General have established that River Waterway Districts possess authority to “maintain proper” water depths and regulate water use and that running water may not be “taken out of a channel in a volume that would impair the rights of riparian owners.”<sup>202</sup>

Texas does not require any sort of prior permit for water withdrawal, but does require reporting of the total volume of water used.<sup>203</sup> Colorado similarly requires reporting of total

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<sup>196</sup> N.Y. Dept. of Environmental Conservation, “Revised Draft SGEIS on the Oil, Gas and Solution Mining Regulatory Program,” 7–3.

<sup>197</sup> Weston, “Water and Wastewater Issues in Conducting Operations in a Shale Play – The Appalachian Basin Experience,” 18.

<sup>198</sup> PA Department of Environmental Protection, “Water Management Plan Example Format Instructions for Marcellus Shale Gas Well Development.”

<sup>199</sup> Ibid.

<sup>200</sup> 58 PENN. STAT. § 3211(m)(2).

<sup>201</sup> COL. STAT. REV. § 37-90-137 (2011).

<sup>202</sup> State of La., Atty. Gen. Op. 10-0289 at 3 (Feb. 22, 2011); State of La., Atty. Gen. Op. 08-0176 at 3 (Mar. 17, 2010).

<sup>203</sup> 16 TEX. ADMIN. CODE § 3.29 (c)(2)(A)(viii).

volume of water used and Louisiana requires reporting of both the volume and the source of water.<sup>204</sup>

Apart from permitting and reporting on water usage, a few states have enacted regulations to either require or encourage the reuse of flowback water in multiple fracture treatments. Pennsylvania requires operators to develop a “wastewater source reduction strategy” (which simultaneously reduces both new water withdrawn and wastewater produced) to “maximize the recycling and reuse of flow back or production fluid either to fracture other natural gas wells, or for other beneficial uses.”<sup>205</sup> Arkansas and Oklahoma amended their regulations to allow for reuse of flowback water.<sup>206</sup>

### Disclosure of Hydraulic Fracturing Chemicals

The chemicals that are mixed with water in order to fracture shale and release gas deposits have received a tremendous amount of press and have caused widespread public concern about contamination of groundwater.<sup>207</sup> Accentuating this public concern was the fact that, until recently, operators were not required to disclose the chemicals they were injecting into the ground as part of the fracturing process, thereby driving anxiety about all the chemicals that *could* be in use.

The federal Emergency Planning and Community-Right-To-Know Act (EPCRA) and the Occupational Safety and Health Act (OSHAct) have required that operators keep material safety data sheets (MSDS) for certain chemicals stored above threshold quantities.<sup>208</sup> These rules have only covered some of the chemicals used in the fracturing process, however, thereby failing to alleviate public concerns. All of the states covered in this review have taken steps to supplement basic MSDS disclosure although they have done so in somewhat different ways.

All seven states reviewed have either passed regulations, or propose to put in place regulations, that would require information to be disclosed about all chemicals used in the fracturing process, specifically the trade name of the chemicals, their Chemical Abstracts Service (CAS)

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<sup>204</sup> 2 COLO. CODE REGS. § 404-1:205A; Louisiana Department of Natural Resources, “State Office of Conservation Requiring Reporting of Water Source in Hydraulic Fracturing Operations.”

<sup>205</sup> 25 PA. CODE § 95.10.

<sup>206</sup> AOGC, RULE B-19(j) (2012), OKLA. ADMIN. CODE 165:10- 7-24 (b)(3), (c)(1).

<sup>207</sup> Groat and Grimshaw, *Fact-Based Regulation for Environmental Protection in Shale Gas Development*, 9–13.

<sup>208</sup> US EPA, “Emergency Planning and Community Right-To-Know Act (EPCRA)”; US EPA, “Summary of the Occupational Safety and Health Act.”

numbers, and maximum concentration. Some states also require information about the supplier of and purpose of each chemical as relates to the fracturing process.<sup>209</sup>

Although most of the reviewed states require reporting of chemicals used only after fracturing has been completed, Arkansas requires operators to report on which chemicals they anticipate using, and New York has proposed to do the same.<sup>210</sup> Wiseman and Gradijan note that, although prior disclosure “likely would better protect human health and the environment, [it] may be difficult in light of the fact that operators often change fluids and concentrations used in fracturing as they learn more about the formation into which they have drilled.”<sup>211</sup>

All of the states reviewed allow for operators to declare that certain additives are “trade secrets” and are thereby exempt from disclosure. All reviewed states also create an exception from this trade secrets provision if needed by healthcare professionals or in the event of an emergency.<sup>212</sup>

### Preventing and Reporting Spills

Spills of hazardous substances, such as diesel fuel, fracturing fluids, and wastes, can occur in a variety of ways, posing public health and environmental hazards. For example, spills could occur during transport of equipment, during the hydraulic fracturing injection process, due to leakage from storage pits, or during transfer from the well to a storage pit or tank, among other possibilities.<sup>213</sup>

The Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) requires operators to report spills of hazardous substances over a threshold level and can require operators to pay cleanup costs.<sup>214</sup> States have implemented various regulations to supplement CERCLA in those areas that CERCLA covers, such as reporting requirements and

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<sup>209</sup> AOGC Rule 19(k) (2012); 2 COLO. CODE REGS. 404-1:205; 2 COLO. CODE REGS. 404-1:100; 2 COLO. CODE REGS. § 404-1:205A; LA. ADMIN. CODE tit. 33:IX, § 708 (2011); LA. ADMIN. CODE tit. 43:XIX, § 118 (C)(1); N.Y. Dept. of Environmental Conservation, “Revised Draft SGEIS on the Oil, Gas and Solution Mining Regulatory Program,” 8–30–31; OKLA. ADMIN. CODE § 165:10-3-10(b); 58 PA. STAT. § 3222(b.1)(1)(i); 16 TEX. ADMIN. CODE § 3.29 (c)(2)(A)(ix),(x),(xi).

<sup>210</sup> Ibid.

<sup>211</sup> Wiseman and Gradijan, “Regulation of Shale Gas Development, Including Hydraulic Fracturing,” 98–99.

<sup>212</sup> AOGC Rule 19(k) (2012); 2 COLO. CODE REGS. § 404-1:205A; LA. ADMIN. CODE tit. 43:XIX, § 118 (C)(2); N.Y. Dept. of Environmental Conservation, “Revised Draft SGEIS on the Oil, Gas and Solution Mining Regulatory Program,” 8–31; OKLA. ADMIN. CODE § 165:10-3-10(b); 58 PA. STAT. § 3222.1(d2); 16 TEX. ADMIN. CODE § 3.29 (c)(4), (f)(1).

<sup>213</sup> Wiseman and Gradijan, “Regulation of Shale Gas Development, Including Hydraulic Fracturing,” 106.

<sup>214</sup> US EPA, “CERCLA Overview | Superfund | US EPA.”

cleanup of spills, and also in areas that CERCLA does not cover, such as implementing spill-prevention measures.

States have implemented varying regulations about how quickly operators must report spills. For example, at least under certain circumstances, Colorado and New York require reporting of spills immediately. Colorado requires immediate notification of the nearby public water system if any spill occurs within a buffer-zone area.<sup>215</sup> New York has proposed that operators be required to notify authorities verbally within two hours of the discovery of the spill.<sup>216</sup> In contrast, some states allow for passage of significantly more time before a spill must be reported. For example, Arkansas requires that any spill be reported within 24 hours and Oklahoma requires only that all discharges to water and spills on land of greater volume than 10 barrels be reported within 24 hours.<sup>217</sup>

States also take different approaches to what quantity of material spilled triggers reporting. New York has proposed that “any spill” be reported within two hours.<sup>218</sup> Colorado and Oklahoma both differentiate between spills affecting water sources and those not affecting water sources. Both states require that any spill impacting water sources be reported; Colorado requires that a release of over 5 barrels of hazardous material to land be reported while Oklahoma requires that a release of over 10 barrels of hazardous material to land be reported.<sup>219</sup>

Most of the states reviewed supplement CERCLA with mandated spill prevention measures required for shale gas operators (as well as other oil and gas operators). Louisiana, New York, and Pennsylvania all require operators to develop spill prevention and control programs involving both preventative measures and containment plans in the event of a spill.<sup>220</sup> Some states direct operators to implement specific controls to prevent and contain spills and specify required upkeep and maintenance of these mechanisms to ensure that they are functional in

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<sup>215</sup> 2 COLO. CODE REGS. § 404-1:317B.

<sup>216</sup> N.Y. Dept. of Environmental Conservation, “Revised Draft SGEIS on the Oil, Gas and Solution Mining Regulatory Program,” 7–57.

<sup>217</sup> AOGC, RULE B-19 (i) (2012); OKLA. ADMIN. CODE 165: 10-7-5.

<sup>218</sup> N.Y. Dept. of Environmental Conservation, “Revised Draft SGEIS on the Oil, Gas and Solution Mining Regulatory Program,” 7–57.

<sup>219</sup> 2 COLO. CODE REGS. 404-1:337, 906(b); COLO. REV. STAT. § 25-8-601(2); OKLA. ADMIN. CODE 165: 10-7-5.

<sup>220</sup> LA. ADMIN. CODE tit. 33:IX, § 905; N.Y. Dept. of Environmental Conservation, “Revised Draft SGEIS on the Oil, Gas and Solution Mining Regulatory Program,” 7–27–29; PA. Dept. of Environmental Protection, “Oil and Gas Management Practices Guidelines for a Preparedness, Prevention, and Contingency (PPC) Plan for Oil and Gas Development” at 3 (2001), available at <http://www.elibrary.dep.state.pa.us/dsweb/Get/Version-48243/chap4.pdf>.

the event of a spill. For example, Arkansas specifies that certain types of equipment be surrounded by containment dikes or other containment structures and that the reservoir in the dike must be kept free of excessive vegetation, stormwater, etc.<sup>221</sup> Texas appears to be the only state, of those reviewed, that does not specify spill prevention and control measures at the state level, as the section of its regulations titled “Spill Prevention and Control” focus on reporting and cleanup of spills and do not include prevention measures.<sup>222</sup>

### Testing and Replacing Water Supplies

Concerns about groundwater contamination are central to public apprehension about shale gas extraction. In particular, there has been significant controversy about the source and cause of methane or chemical contaminants that have been detected in water supplies near shale gas drilling sites.<sup>223</sup> In some cases, testing by state authorities has indicated that the methane or chemical contaminants pre-dated the beginning of local shale gas drilling or comes from another source, but local residents doubt these findings for myriad reasons.<sup>224</sup>

Of the states covered in this review, Colorado, Louisiana, New York, and Pennsylvania have all implemented regulations requiring or incentivizing baseline testing of groundwater before drilling begins, at least under some circumstances.<sup>225</sup> Baseline testing can serve to establish the contaminants in the water that pre-date drilling, provide residents with proof when contamination is caused by local shale gas development, and provide data for research on contamination pathways.<sup>226</sup>

Colorado requires baseline testing as well as data collection for up to three months after local shale gas production operations conclude for surface water sources located within the buffer zones near public water systems.<sup>227</sup> Pennsylvania does not require baseline testing but, through statute and regulation, incentivizes drilling operators and homeowners to have baseline testing conducted. The state does so by establishing a rebuttable presumption that

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<sup>221</sup> AOGC, RULE B-6 (2012).

<sup>222</sup> TX. ADMIN. CODE, 30 TAC 327.

<sup>223</sup> For example, the film “Gasland” documented a number of families and households that attributed contamination of their drinking water source to nearby shale gas production.

<sup>224</sup> For example, the Colorado Oil & Gas Conservation Commission released a statement rebutting some of the claims made in the film “Gasland” about sources of groundwater contamination in Colorado. See Colorado Oil & Gas Conservation Commission, “COGCC Gasland Correction Document.”

<sup>225</sup> 2 COLO. CODE REGS. 404-1:317(b); 43 LA. ADMIN. CODE tit. 43:XIX, § 309; N.Y. Dept. of Environmental Conservation, “Revised Draft SGEIS on the Oil, Gas and Solution Mining Regulatory Program,” 1–10; 58 PA. CONS. STAT. ANN. § 3218; 25 PA. CODE § 78.52.

<sup>226</sup> Wiseman and Gradijan, “Regulation of Shale Gas Development, Including Hydraulic Fracturing,” 114.

<sup>227</sup> 2 COLO. CODE REGS. 404-1:317(b).

any contamination of groundwater that occurs within 2,500 feet of the well and is discovered and reported within 12 months of the completion of unconventional gas development activities (which includes shale gas development) is due to the actions of the shale gas operation.<sup>228</sup> As a result, drilling operators, at risk of being held responsible, face a significant incentive to conduct baseline testing before they begin operations.

Pennsylvania also requires that, in case contamination as a result of the shale gas operation is found, the operator provide a replacement water supply. State regulations articulate a number of criteria by which the replacement supply must be equivalent to the previous supply, including reliability, cost, maintenance, control, quality, quantity, and serviceability.<sup>229</sup>

Besides Pennsylvania, the other states covered in this review do not appear to have regulations in place concerning provision of replacement water if contamination occurs.

### **Storing Wastes**

The drilling and fracturing processes create various types of waste, including drill cuttings, drilling fluids (also known as drilling muds), flowback water, and produced water. Before permanent disposal, these waste products are generally stored on site at the well pad or nearby, either in pits or in steel tanks. States regulate the storage of waste because these waste products can contaminate soil and water, thereby causing harm to humans, wildlife, and livestock.<sup>230</sup>

States take a wide variety of approaches to regulating the storage of waste at the production site. Most states reviewed allow for the storage of waste in pits, imposing regulations on how these pits must be structured in order to ensure integrity of the storage and prevent leakage. A couple of states prohibit the use of pits in favor of steel tanks, at least under certain circumstances. All of the states reviewed have similar requirements about the required height of freeboard—the distance between the normal storage level and the top of the pit.

Pits are a common method of storing waste from the drilling and fracturing processes. All of the states reviewed regulate or provide some guidelines for how the pits must be constructed or how they must perform in terms of holding waste products. These performance requirements are expressed in the form of requirements for the pit liners. Some states have established performance standards in terms of the hydraulic conductivity that is permissible in

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<sup>228</sup> 58 PA. CONS. STAT. ANN. § 3218; 25 PA. CODE § 78.52.

<sup>229</sup> 25 PA. CODE § 78.51.

<sup>230</sup> Wiseman and Gradjan, “Regulation of Shale Gas Development, Including Hydraulic Fracturing,” 120.

pit lining. For example, Louisiana and Pennsylvania both specify that the pit liner must have a hydraulic conductivity of no more than  $1 \times 10^{-7}$  cm/sec.<sup>231</sup> Louisiana allows for the pit lining to be made of diverse materials, such as natural soil (i.e. clay), a soil mixture, or synthetic materials, while Pennsylvania specifies that a “synthetic flexible liner” should be used.<sup>232</sup> Other states seek to limit seepage from the pit by specifying a required minimum thickness of the liner. For example, Arkansas requires that pits have a liner composed of compacted clay and a 40-mil synthetic liner.<sup>233</sup> Colorado requires that, within the intermediate and external buffer zones, pits have a synthetic liner of 24-mil thickness and a soil foundation compacted 12 inches.<sup>234</sup> As can be seen from Colorado’s example, some states require different standards in different areas. Oklahoma, similarly, requires the use of synthetic liners in wellhead protection areas and within 1 mile of active municipal water wells.<sup>235</sup> All of the reviewed states require that, when pits are used to store waste, that 2 feet of freeboard be present in case of extra unanticipated wastes, heavy precipitation, etc.<sup>236</sup>

New York and Colorado have both enacted measures (or proposed measures, in the case of New York) to prohibit the use of pits under certain circumstances. Colorado requires the use of pits within some portions of the buffer zones surrounding public water systems.<sup>237</sup> New York has proposed that only water-tight steel tanks be allowed for any extraction activity in the Marcellus shale that use high volumes of water, which would encompass high-volume hydraulic fracturing.<sup>238</sup> While steel tanks and closed-loop systems diminish the likelihood of seepages and spills of hazardous materials as compared with pits, they increase costs for operators.<sup>239</sup>

### Disposing of Wastes

One of the final parts of the shale gas extraction process involves disposing of the waste products produced during drilling and hydraulic fracturing of the well. As noted in the previous section, the key waste products are drill cuttings, drilling fluids, flowback water, and produced

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<sup>231</sup> LA. ADMIN. CODE tit. 43:XIX, § 307; 25 PA. CODE § 78.56.

<sup>232</sup> Ibid.

<sup>233</sup> AOGC, RULE B-17 (g)(2)(A) (2012).

<sup>234</sup> 2 COLO. CODE REGS. § 404-1:904 Rule 317B.

<sup>235</sup> OKLA. ADMIN. CODE § 165:10-7-16.

<sup>236</sup> AOGC, Rule B-17 (f)(2)(A), (g)(2)(A) (2012); 2 COLO. CODE REGS. § 404-1:902(b); LA. ADMIN. CODE tit. 33:IX, § 708(C)(1); N.Y. Dept. of Environmental Conservation, “Revised Draft SGEIS on the Oil, Gas and Solution Mining Regulatory Program,” Appendix 10; OKLA. ADMIN. CODE § 165:10-7-16; 25 PA. CODE § 78.56(a); 30 TEX. ADMIN. CODE § 218.20(c).

<sup>237</sup> 2 COLO. CODE REGS. 404-1:904.

<sup>238</sup> N.Y. Dept. of Environmental Conservation, “Revised Draft SGEIS on the Oil, Gas and Solution Mining Regulatory Program,” 7–39.

<sup>239</sup> Railroad Commission of Texas, “Waste Minimization in Drilling Operations.”

water. The shale gas development process, in its use of high-volume hydraulic fracturing, has caused a significant uptick in the volume of flowback water and produced water that is produced and must be disposed of. While states have established procedures and regulations in place for managing the disposal of drill cuttings and drilling fluids (generally through land-spreading, the use of landfills, or at the drilling site itself), many states have struggled to adapt to the high volumes of flowback water and produced water produced as a side-effect of shale gas development.<sup>240</sup>

Although disposal practices vary from state to state and even region to region in larger states, generally operators in the northeast dispose of liquid wastes through publicly owned treatment works (POTWs) while operators in southern and western states tend to use underground injection control (UIC) wells for disposal of liquid wastes.<sup>241</sup> Both of these disposal mechanisms present environmental and health risks, however, if not controlled adequately. POTWs are typically designed to treat domestic sewage waste and not to treat industrial wastewater. As a result, if flowback water and produced water from shale gas wells are not adequately pre-treated before being treated at a POTW, levels of total dissolved solids, naturally-occurring radioactive substances, and other contaminants can remain in the water despite the treatment process and enter the environment when the POTW releases the water after treatment.<sup>242</sup> UIC wells can cause contamination of groundwater sources and localized seismic activity if they are not properly constructed and operated.<sup>243</sup>

The U.S. Environmental Protection Agency regulates POTWs under the Clean Water Act and regulates UIC wells under the Safe Drinking Water Act.<sup>244</sup> Some states have also supplemented federal regulations with their own regulations and restrictions on disposal. A few states have introduced regulations requiring operators to create a plan for water management and waste disposal prior to drilling a well as well as reporting on actual disposal volumes and practices. For example, Colorado requires that operators develop a “plan for the management of exploration and production wastes.”<sup>245</sup> As described in the section on water withdrawal, above, Pennsylvania requires that operators create a “wastewater source reduction strategy” to maximize reuse of flowback and produced waters.<sup>246</sup>

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<sup>240</sup> Wiseman and Gradijan, “Regulation of Shale Gas Development, Including Hydraulic Fracturing,” 126.

<sup>241</sup> *Ibid.*

<sup>242</sup> *Ibid.*, 131.

<sup>243</sup> *Ibid.*

<sup>244</sup> US EPA, “Publicly Owned Treatment Works (POTW) General Permit”; US EPA, “Regulations - Underground Injection Control.”

<sup>245</sup> 2 COLO. CODE REGS. § 404-1: 216(e).

<sup>246</sup> 25 PA. CODE § 95.10.

Although some states continue to use POTWs for processing and disposal of wastewater from shale gas development, the U.S. Environmental Protection Agency has expressed concern about the capacity and adequacy of these facilities to properly treat these wastes.<sup>247</sup> In April 2011, the Pennsylvania Department of Environmental Protection “requested” that operators no longer send their waste to POTWs; since that time, it appears that most operators are either reusing wastewater or sending it out of state for disposal.<sup>248</sup>

## Conclusion

The seven states covered in this survey of state regulations are located in different parts of the country and have different histories of oil and gas development, diverse geological and environmental conditions, and varying attitudes about the appropriate role for government in regulating economic activity.

Table 1, below, summarizes which states have enacted regulations for each stage of the shale gas development process. In situations where a federal standards exists, such as for stormwater permitting under the Clean Water Act when constructing a well pad and access roads, states only receive a check mark if they have regulations that go beyond the required baseline federal regulations.

Table 1: Regulations for each stage of shale gas development, by state.

|                            | Arkansas | Colorado | Louisiana | New York | Oklahoma | Pennsylvania | Texas |
|----------------------------|----------|----------|-----------|----------|----------|--------------|-------|
| Testing for gas            | ✓        | ✓        | ✓         | ✓        | ✓        | ✓            | ✓     |
| Constructing pad and roads | ✓        | ✓        | ✓         | ✓        |          | ✓            |       |
| Locating well pad          | ✓        | ✓        | ✓         | ✓        | ✓        | ✓            | ✓     |
| Drilling and casing well   | ✓        | ✓        | ✓         | ✓        | ✓        | ✓            | ✓     |
| Controlling air emissions  | ✓        | ✓        | ✓         | ✓        | ✓        | ✓            |       |

<sup>247</sup> U.S. Environmental Protection Agency, “EPA Seeks More Information from Natural Gas Drilling Operations to Ensure Safety of Wastewater Disposal (05/12/2011)”;

Urbina, “Regulation Lax as Gas Wells’ Tainted Water Hits Rivers.”  
<sup>248</sup> Don Hopey and Sean D. Hamill, “Pa.: Marcellus Wastewater Shouldn’t Go to Treatment Plants”; Wiseman and Gradijan, “Regulation of Shale Gas Development, Including Hydraulic Fracturing,” 127–128.

|                                      |   |   |   |   |   |   |   |
|--------------------------------------|---|---|---|---|---|---|---|
| Withdrawing water                    |   | ✓ | ✓ | ✓ |   | ✓ | ✓ |
| Disclosure of chemicals              | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Preventing and reporting spills      | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |   |
| Testing and replacing water supplies |   | ✓ | ✓ | ✓ | ✓ | ✓ |   |
| Storing wastes                       | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Disposing of wastes                  | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |

There are clearly many types of regulations that fall into each of these categories. For example, in the category “locating well pad” the primary regulatory response across the different states is a required setback. However, as described in the textual section on this stage earlier in the chapter (called “Locating the Well Pad, Well, Pits, and Disposal Sites”), some states require setbacks from drinking water resources, some from wetlands, and some from physical structures. Most require setbacks from more than one of these (many require setbacks from all three). Texas, however, only requires setbacks from physical structures. Yet all states receive a checkmark in the relevant row in Table 1. In addition, some states specify which types of drilling equipment, such as storage pits, pose especially high risks of contamination, and require setbacks only for those features, or extra setbacks for those features. Setbacks can also be specified in different types of schema; for example, Colorado and New York both employ a graduated system of “buffer zones” in which various types of equipment are prohibited within concentric radii from certain resources, such as public water supplies.

All of this is intended to highlight the point that states have an incredible diversity of approaches when it comes to regulating shale gas development, and that diversity is not reflected in Table 1. Table 1 does, however, illustrate that most states have at least some sort of regulation on the books for most aspects of the shale gas development process.

## Chapter 4 – Enforcement of State Regulations

### Introduction

Previous chapters described the wide array of federal and state regulations of shale gas development that are currently in place. In order to develop a fuller understanding of how these regulations impact the everyday business of shale gas operators, however, it is not enough to simply look at the regulations that are on the books. Regulatory agencies and other authorities have significant discretion regarding the application and enforcement of regulations and it is only by analyzing enforcement practices that we can understand how regulations influence and impact the practice of shale gas development. Regulations that appear to be robust could have little impact on the ground if they are ignored by operators and regulators while other regulations that may seem minor could shape development practices if they are interpreted broadly and enforced robustly.<sup>249</sup>

As noted in previous chapters, shale gas development is primarily regulated at the state level. Accordingly, this chapter will focus on developing a better understanding of how regulations are implemented by the states. The chapter will focus on three key elements of regulatory implementation: the capacity of states to enforce oil and gas regulations, data from the states on violations they have detected and recorded, and information from the states about how they have responded to these violations in terms of enforcement actions.<sup>250</sup>

### Enforcement Capacity

Perhaps the first step in a state's ability to enforce regulations governing shale gas development is the capacity that it has to enforce the regulations on its books. "Capacity," as defined here, consists of the number of field inspectors that a state regulatory agency has on staff. Field inspectors are critical for an agency's ability to inspect sites, identify regulatory violations, implement enforcement actions, and verify that the violation has been satisfactorily addressed.<sup>251</sup>

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<sup>249</sup> Wiseman, "Fracturing Regulation Applied," 369.

<sup>250</sup> This organizational approach, as well as documentation of regulatory enforcement practices pertaining to shale gas extraction, draws on an analysis performed by Hannah Wiseman in her white paper: "State Enforcement of Shale Gas Development Regulations, Including Hydraulic Fracturing." The white paper is part of a larger series published by the Energy Institute at the University of Texas at Austin titled *Fact-Based Regulation for Environmental Protection in Shale Gas Development*.

<sup>251</sup> Wiseman, "State Enforcement of Shale Gas Development Regulations, Including Hydraulic Fracturing," 11.

Table 2, shown below, summarizes the numbers of field inspectors employed by oil and gas development regulatory agencies in a selection of states.<sup>252</sup>

Table 2: Numbers of Field Inspectors, Agency-Wide and Assigned to Shale Gas Wells, 2008-2011

|                                                                                               | CO | LA               | MD  | MI | MT | NM | ND | OH                  | OK               | PA               | TX                | WY                            |
|-----------------------------------------------------------------------------------------------|----|------------------|-----|----|----|----|----|---------------------|------------------|------------------|-------------------|-------------------------------|
| Total number of field inspectors in agency 2008                                               | NA | 64 <sup>34</sup> | NA  | 27 | 6  | 16 | NA | 17-22 <sup>35</sup> |                  |                  | 125 <sup>36</sup> | NA                            |
| 2009                                                                                          | NA | 62               | NA  | 25 | 7  | 16 | NA | 17-22               | NA               | 35 <sup>37</sup> |                   | NA                            |
| 2010                                                                                          | NA | 61               | 4   | 24 | 7  | 16 | NA | 17-22               | 48 <sup>38</sup> | 76 <sup>39</sup> |                   | NA                            |
| 2011                                                                                          | 12 | 59               | 4   | 22 | 7  | 16 | 11 | 28                  | NA               | NA               |                   | 12 O&G<br>7 DEQ <sup>40</sup> |
| Of total inspectors listed above, total number of inspectors assigned to shale gas wells 2008 |    |                  |     | 27 |    | 16 | NA | NA                  |                  |                  |                   | NA                            |
|                                                                                               |    | 43 <sup>41</sup> | NA  |    |    |    |    |                     |                  |                  |                   |                               |
| 2009                                                                                          |    | 41 <sup>42</sup> | NA  | 25 |    | 16 | NA | NA                  |                  |                  |                   | NA                            |
| 2010                                                                                          |    | 40 <sup>43</sup> | 444 |    |    |    | NA | NA                  |                  |                  |                   | NA                            |
| 2011                                                                                          |    | 38 <sup>45</sup> | 446 |    |    |    | NA | NA                  |                  |                  |                   | 12 <sup>47</sup>              |

Source: Wiseman, "State Enforcement of Shale Gas Development Regulations, Including Hydraulic Fracturing," 13.

As can be seen from the data in Table 2, regulatory capacity across the states varies significantly, from four in Maryland to 125 in Texas. This variance can be attributed to a variety of factors, including differences in how states report data,<sup>253</sup> state budgets, agency priorities, and political direction from policy makers.<sup>254</sup> In addition to each of these factors, however, Wiseman asserts that, "the number of staff employed [by regulatory agencies] is largely influenced by the number of wells."<sup>255</sup> At the extremes, Maryland, with only four field inspectors in 2011, had no hydraulically fractured wells as of July 2011 whereas Texas had almost 16,000 wells in the Barnett Shale.<sup>256</sup> This general correlation also applies to states between these two extremes, and Pennsylvania, for example, has increased the number of field inspectors employed as the number of wells drilled in the state has grown exponentially since

<sup>252</sup> The data in the table are drawn from a variety of sources, including reports published by the agencies themselves and by third parties, and from data obtained by Wiseman directly from agency representatives.

<sup>253</sup> For example, some states reported data for field inspectors across the agency while other reported numbers for field inspectors dedicated to oil and gas operations. See Wiseman, "State Enforcement of Shale Gas Development Regulations, Including Hydraulic Fracturing," notes 40, 41, 44.

<sup>254</sup> Wiseman, "Fracturing Regulation Applied," 371.

<sup>255</sup> Ibid.

<sup>256</sup> Ibid.; Railroad Commission of Texas, *Newark, East (Barnett Shale) Well Count 1993 Through July 19, 2012*.

shale gas development first began in 2008.<sup>257</sup> Of course, in addition to looking at the raw numbers of inspectors in different states, it can be valuable to look at the ratio of inspectors to the number of wells and also to the number of inspections that have been carried out. Table 3 provides data on the number of wells drilled in selected states and Table 4 provides data on the number of field inspections carried out.

Table 3: Numbers of Wells Drilled, 2008-2011

|      | CO <sup>16</sup> | LA <sup>17</sup> | MD <sup>18</sup> | MI <sup>19</sup> | MT <sup>20</sup> | NM <sup>21</sup> | ND <sup>21</sup> | OH <sup>22</sup> | OK | PA <sup>23</sup>                            | TX                                 | WY <sup>24</sup>                                   |
|------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|----|---------------------------------------------|------------------------------------|----------------------------------------------------|
|      |                  |                  | 0                | 308              |                  |                  |                  |                  |    | 195 <sup>25</sup> wells drilled             | 10,146 <sup>26</sup> Barnett Shale |                                                    |
| 2009 |                  |                  | 0                | 153              |                  |                  |                  |                  |    | 768 <sup>27</sup> wells drilled             | 13,740 <sup>28</sup> Barnett Shale | 25 wells completed in 2009-11 period <sup>29</sup> |
| 2010 |                  |                  | 0                | 120              |                  |                  |                  |                  |    | 1,386 <sup>30</sup> wells drilled           | 14,886 <sup>31</sup> Barnett Shale |                                                    |
| 2011 |                  |                  | 0                | 72               |                  |                  |                  |                  |    | 1,751 <sup>32</sup> wells drilled thr. Nov. | 15,870 <sup>33</sup> Barnett Shale |                                                    |

Source: Wiseman, "State Enforcement of Shale Gas Development Regulations, Including Hydraulic Fracturing," 12-13.

Table 4: Numbers of Field Inspections Conducted, 2008-2011

|                                  | CO | LA  | MD | MI                                                     | MT | NM | ND | OH | OK | PA  | TX                                                     | WY |
|----------------------------------|----|-----|----|--------------------------------------------------------|----|----|----|----|----|-----|--------------------------------------------------------|----|
| Number of field inspections 2008 |    | 13  |    | 11,013 <sup>48</sup><br>(Not specific to shale wells.) |    | 16 |    |    |    | 144 | 120,866<br>(all oil and gas facilities <sup>49</sup> ) | 3  |
| 2009                             |    | 186 |    | 13,459                                                 |    | 16 |    |    |    | 323 |                                                        | 2  |
| 2010                             |    | 374 | 22 | 16,850                                                 |    | 16 |    |    |    | 643 |                                                        | 2  |
| 2011                             |    | 363 | 0  | 4,396                                                  |    | 16 |    |    |    | 298 |                                                        | 2  |

Source: Wiseman, "State Enforcement of Shale Gas Development Regulations, Including Hydraulic Fracturing," 14.

The ratio of field inspectors to the number of wells drilled varies widely. For example, in 2008 Michigan had a ratio of 308 shale gas wells drilled to a staff of 27 field inspectors, meaning that the state had a ratio of approximately 11 wells drilled for each field inspector on staff. In contrast, in 2008 Texas had a ratio of 10,146 shale gas wells drilled to a staff of 125 field inspectors, meaning that the state had a ratio of approximately 81 wells drilled for each field inspector on staff. Differences in capacity, and how that capacity is utilized (and variances in how data are reported) can also be seen in the number of field inspections that were conducted in different states, in Table 4.

<sup>257</sup> Wiseman, "Fracturing Regulation Applied," 371.

Some commentators have documented the struggles that regulatory agencies face in keeping up with the surge in drilling in recent years.<sup>258</sup> Pro Publica conducted a review of 32 oil and gas producing states in 2009, documenting the number of wells drilled, the total number of wells, the number of enforcement staff, and the number of enforcement actions in each state for each year between 2003 and 2009.<sup>259</sup> Although the early part of this time period predates the spread of shale gas development beyond Texas, it is worth noting that, in most states, the rate of well development far outpaced the number of enforcement staff added (if any were added at all). In more recent years, Pennsylvania has significantly increased the number of staff employed by the Department of Environmental Protection, including field staff dedicated to inspections, while the Railroad Commission of Texas underwent a hiring freeze in 2009 and lost both field personnel and attorneys to pursue legal enforcement actions for regulatory violations.<sup>260</sup>

### Regulatory Violations

As described in previous chapters, shale gas development is a very complex process and is governed by myriad regulations. As a result, violations of regulations can occur at many different stages of the site development, drilling, and fracturing processes. This section will provide an overview of findings on regulatory violations from various states where shale gas development is proceeding.<sup>261</sup>

The most commonly recorded regulatory violations include a variety of actions by well operators, some of which seem to present immediate risks to public safety and the environment and some of which do not. In a review of data from Louisiana, Michigan, New Mexico, and Texas, the most common violations involved: “failures to obtain permits or submit reports, failures to mow weeds around wellheads or post proper signs, improper construction or maintenance of surface pits, and surface spills of various drilling materials.”<sup>262</sup> Table 5 provides an overview of these results.

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<sup>258</sup> Abrahm Lustgarten, “State Oil and Gas Regulators Are Spread Too Thin to Do Their Jobs”; Mike Soraghan, “Oil and Gas: Puny Fines, Scant Enforcement Leave Drilling Violators with Little to Fear.”

<sup>259</sup> Pro Publica, “How Big Is the Gas Drilling Regulatory Staff in Your State?”.

<sup>260</sup> Governor’s Marcellus Shale Advisory Commission, *Governor’s Marcellus Shale Advisory Commission, Final Report*, 65–66; Wiseman, “State Enforcement of Shale Gas Development Regulations, Including Hydraulic Fracturing,” 6.

<sup>261</sup> This section also includes information on New Mexico, where natural gas development is focused on tight sands gas as opposed to shale gas. Although the exploration process is different for the two sources of natural gas, the development process is very similar. See Shell, “Understanding Tight and Shale Gas”; Matt Hall, “Shale vs Tight - Journal.”

<sup>262</sup> Wiseman, “Fracturing Regulation Applied,” 373.

Table 5: Most Common Violations at Shale Gas and Tight Sands Sites by Percent of Total Violations

|                                                             | Louisiana <sup>67</sup><br>2009–2011 | Michigan <sup>68</sup><br>1999–2011 | New Mexico <sup>69</sup><br>2000–2011 | Texas <sup>70</sup><br>2008–2011 |
|-------------------------------------------------------------|--------------------------------------|-------------------------------------|---------------------------------------|----------------------------------|
| Permitting & reporting                                      | 9.5%                                 | 0%                                  | 7.8%                                  | 32.3%                            |
| Pit construction & maintenance                              | 33.2                                 | 0.2                                 | 1.3                                   | 4.8                              |
| Signs & labeling                                            | 23.7                                 | 32.5                                | 18.2                                  | 1.6                              |
| Site maintenance                                            | 0.9                                  | 22.4                                | 0                                     | 0                                |
| Surface spill: produced water                               | 0.5                                  | 0.2                                 | 33.8                                  | 0                                |
| Surface spill: non-produced water or unidentified substance | 3.3                                  | 24.5                                | 5.2                                   | 0                                |

Source: Wiseman, "Fracturing Regulation Applied," 374.

As can be seen from Table 5, pit construction and maintenance and surface spills (of either produced water or of other substances) are violations of potentially serious environmental effects that were commonly reported in Louisiana, Michigan, and New Mexico. In Louisiana, the most common pit- and storage-related violation documented was "failing to cover [the] reserve pit."<sup>263</sup> Other common pit- and storage-related violations were for oil tank seal valves that "are not equipped with the proper locking or sealing device" and for having storage units for crude oil and produced water that are not properly segregated and could therefore pass contents from one to the other.<sup>264</sup>

Surface spills of produced water and of other substances can also be a cause for significant concern. Incidents in Michigan all involved spills of unknown fluids that contaminated soil, usually at the wellhead.<sup>265</sup> Records document that spills in New Mexico are due to a variety of reasons, including frozen valves, overflowing tanks, and "human error."<sup>266</sup> Intriguingly, New Mexico's records often document how much fluid is released in a spill and how much is

<sup>263</sup> Hannah Wiseman and Molly Wurzer, "Louisiana Violations and Enforcements." See, e.g., Permit no. 239471.

<sup>264</sup> Ibid at Permit Nos. 238345, 240287.

<sup>265</sup> Hannah Wiseman and Jeremy Schepers, "Michigan, New Mexico, and Wyoming Violations and Enforcements."

<sup>266</sup> Ibid at Permit no. 30-039-25478, Incident no. nBP0918932635; Permit no. 30-039-25947, Incident no. nDGF0100955815; Permit no. 30-039-25430; nDGF0605554027.

recovered; for example, in one case a freeze led to the spill of 120 barrels of produced water, of which only 10 barrels were recovered.<sup>267</sup>

Michigan's many "site maintenance" violations almost all are for uncleared "vegetation" and "objects on site" within 75 feet of the wellhead, or wellhead and tanks, or other equipment.<sup>268</sup>

Violations for assorted signs and labeling-related violations are very common in Louisiana, Michigan, and New Mexico. Across all three states, these violations were generally for either improper identification or no identification at the well site and tank battery or a lack of warning signs, among other assorted causes.<sup>269</sup>

The bulk of documented violations in Texas pertain to "permitting and reporting." The violations consisted of failures to secure required permits before drilling or fracturing wells, failure to obtain approval of surface casing programs, and "failures to submit completion reports—which provide data about how the well was drilled and fractured and the formations encountered during the process—within ninety days of completing a well."<sup>270</sup>

Finally, Pennsylvania deserves special focus as the state has produced the most violations of state oil and gas laws at shale gas sites. Between March 1, 2012 and July 31, 2012 (a five-month period after Pennsylvania passed Act 13),<sup>271</sup> the Department of Environmental Protection conducted 5,170 inspections of 2,744 unconventional well sites (including routine inspections, drilling/alteration inspections, complaint inspections, incident inspections (responding to an accident or event), and follow-up inspections).<sup>272</sup> One hundred forty-nine of these inspections found a total of 315 violations (many incidents violated multiple of the Commonwealth's regulations). Records cite a wide variety of actions that violated regulations, including:

- failure to tag a well,<sup>273</sup>

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<sup>267</sup> Ibid, at Permit no. 30-039-25435, Incident no. nBP0701751207.

<sup>268</sup> Ibid, see, for example, Permit no. 46116.

<sup>269</sup> Hannah Wiseman and Molly Wurzer, "Louisiana Violations and Enforcements"; Hannah Wiseman and Jeremy Schepers, "Michigan, New Mexico, and Wyoming Violations and Enforcements."

<sup>270</sup> Hannah Wiseman, "Texas Violations and Enforcements"; Wiseman, "Fracturing Regulation Applied," 375.

<sup>271</sup> Some provisions of the Act went into effect upon signing on February 14, 2012 while others went into effect two months later on April 14, 2012. See Pennsylvania Public Utility Commission, "Act 13 of 2012."

<sup>272</sup> PA Department of Environmental Protection, "Office of Oil and Gas Management Compliance Report (Query Range: 03/01/2012 to 07/31/12)."

<sup>273</sup> Ibid, Well permit 115-20637, violation #641247, June 7, 2012.

- release of 4 to 6 barrels of synthetic oil-based muds (drilling fluids) due to operator negligence,<sup>274</sup>
- unsafe venting of gas,<sup>275</sup>
- leaking of hazardous materials from a surface pit,<sup>276</sup>
- failure to follow proper procedures during construction of well pad and access roads, including erosion-control procedures,<sup>277</sup>
- failure to report a spill,<sup>278</sup>
- spillage of brine that evaded containment structures, flowed off the well pad, and entered surface waters,<sup>279</sup>
- contamination of groundwater resulting in a groundwater sample with elevated concentrations of barium, iron, manganese, chloride and bromide,<sup>280</sup>
- spillage of an oil-based emulsifier resulting from a puncture from a forklift; this site also had holes in the secondary containment structure,<sup>281</sup>
- failure to report defective, insufficient, or improperly cemented casing within 24 hours or to submit a plan to correct the problem within 30 days,<sup>282</sup>
- discharge of 25 gallons of drilling mud into a landowner's field,<sup>283</sup>
- spillage of production fluids into a creek and wetlands,<sup>284</sup>
- spillage of 20 gallons of flowback fluids due to a disconnected hose as the fluids were being transferred into a truck for transport to a disposal site,<sup>285</sup>
- failure to plug a well upon abandonment.<sup>286</sup>

It should be noted that most, but not all, of the incidents summarized here received a formal Notice of Violation from the Department of Environmental Protection, particularly in cases where the violation was immediately remediated.

Stepping back from individual regulatory violations, there is significant variance among states around what types of violations most commonly are reported in state records, as can be

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<sup>274</sup> Ibid, Well permit 115-20802, violation #637616, April 19, 2012.

<sup>275</sup> Ibid, Well permit 115-20873, violation #644586, July 12, 2012.

<sup>276</sup> Ibid, Well permit 117-21148, violation #642082, June 11, 2012.

<sup>277</sup> Ibid, Well permit 081-20877, violation #636054, April 2, 2012.

<sup>278</sup> Ibid, Well permit 105-21722, violation #636634, April 9, 2012.

<sup>279</sup> Ibid, Well permit 081-20763, violation #644956, July 24, 2012.

<sup>280</sup> Ibid, Well permit 015-20081, violation #640800, June 4, 2012.

<sup>281</sup> Ibid, Well permit 115-20805, violation #642641, June 21, 2012.

<sup>282</sup> Ibid, Well permit 031-25404, violation #638187, April 19, 2012.

<sup>283</sup> Ibid, Well permit 015-22058, violation #636663, April 10, 2012.

<sup>284</sup> Ibid, Well permit 115-20191, violation #642390, June 19, 2012.

<sup>285</sup> Ibid, Well permit 115-20568, violation #644426, July 19, 2012.

<sup>286</sup> Ibid, Well permit 047-24478, violation #637149, April 9, 2012.

observed in Table 5. Wiseman suggests a number of possible reasons for this sort of variance, including the types of operators that are active in a given state (assuming, for example, that larger operators with more experience cause fewer violations), climate and other local factors (assuming, for example, that wetter states have more surface water to contaminate and more precipitation that can cause pits to overflow), and different areas of focus and enforcement capabilities among agencies, skewed date (in this case, many of the records for New Mexico were drawn from the state's "Spills" database and Texas only reports violations that lead to enforcement actions).<sup>287</sup> It should be noted here that, both in the four states included in Table 5, and also in sample of violations from Pennsylvania, the violations were largely "easy to detect."<sup>288</sup> That is, violations like spills, overgrowth of vegetation, and signage errors are all readily detectable from a quick visit to a site. The documented violations do not contain many mentions of regulatory violations that are more difficult to detect, such as air contamination and groundwater contamination. This may be because these sorts of violation occur less frequently, or it may be that regulatory agencies are not detecting these violations at present.<sup>289</sup>

### Enforcement Actions

After regulatory agencies find an operator in violation of regulations, they can choose what sort of enforcement mechanism to pursue in order to promote compliance. As in the recording of violations noted in the previous section, states display a significant diversity of approaches towards enforcing regulations that are on their books.

To provide a brief illustration of the divergent approaches that states take to enforcing their oil and gas regulations, Table 6 provides data on the number of recorded violations, enforcement actions, fines/penalties, and the amount fined, for a sample of seven states.<sup>290</sup> This data is for all oil and gas drilling in these states during 2009 and therefore provides a broader perspective on variance in oil and gas enforcement that is not restricted to shale gas.

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<sup>287</sup> Wiseman, "Fracturing Regulation Applied," 377; Wiseman, "State Enforcement of Shale Gas Development Regulations, Including Hydraulic Fracturing," 25.

<sup>288</sup> Wiseman, "Fracturing Regulation Applied," 377, 378.

<sup>289</sup> *Ibid.*, 377.

<sup>290</sup> Although *Greenwire* does not cite data sources for its violation and enforcement data, as noted in previous sections of this chapter, states record and report data in diverse formats with definitions that may not align. For example, the data sources for the number of violations in Oklahoma and Texas may define "violations" differently, which may explain why the number of violations in Texas is an order of magnitude larger than the number in Oklahoma. Similar caveats apply to other data points in this table.

Table 6: Oil and Gas Drilling Enforcement Data, 2009

|                                                                    | Colorado  | Louisiana | New York | Oklahoma  | Pennsylvania | Texas       |
|--------------------------------------------------------------------|-----------|-----------|----------|-----------|--------------|-------------|
| <b>Violations</b>                                                  | --        | 984       | --       | 8,475     | 3,361        | 80,000      |
| <b>Enforcement Actions</b>                                         | 260       | 922       | 51       | 176       | 678          | 3,200       |
| <b>Fines / Penalties</b>                                           | 9         | 213       | 6        | 81        | 122          | 379         |
| <b>Amount Fined</b>                                                | \$168,000 | \$170,000 | \$45,000 | \$451,977 | \$1,683,054  | \$2,273,825 |
| <b>Percent of violations that receive enforcement actions</b>      | --        | 94%       | --       | 2%        | 20%          | 4%          |
| <b>Percent of violations that receive fines or other penalties</b> | --        | 22%       | --       | 1%        | 4%           | 0%          |
| <b>Average amount of fine</b>                                      | \$18,667  | \$798     | \$7,500  | \$5,580   | \$13,796     | \$6,000     |

*Data Source: Greenwire, "Oil and Gas Drilling Enforcement Data, by State."*

As can be seen from the data in Table 6, states take very different approaches to dealing with violations of their own oil and gas regulations. For example, in 2009 Louisiana pursued almost all of the documented violations with some sort of enforcement action and meted fines for over 20 percent of violations. In contrast, Oklahoma and Texas pursued enforcement actions and fines against a very small number of violations (in all cases, less than 5 percent of violations). For violations that received fines, the average dollar amount of the fine also varied dramatically, from less than \$1,000 in Louisiana to over \$18,000 in Colorado.

Another image of enforcement behavior is provided by Table 7, which shows a sampling of the violations identified for each regulatory category in each of the four sample states as well as the most severe penalty meted out for each category of violation.

Table 7: Enforcement Actions: Examples of Violations and Penalties

|                                       | Louisiana                                                                                                                            | Michigan                                                         | New Mexico                                                                          | Texas                                                                                                                 |
|---------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------|-------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------|
| Permitting & reporting                | Failure to obtain work permit before completing well, file completion report, etc.<br><br>Agreed order, \$1000 <sup>104</sup>        | Violations noted<br><br>No known enforcement from data provided  | Failure to obtain permit to produce and transport gas<br><br>Agreed order, \$23,500 | Failure to obtain permit before drilling well<br><br>Agreed order, \$14,500 <sup>105</sup>                            |
| Pit construction & maintenance        | High levels of arsenic, selenium, etc. at reserve pit closure<br><br>Admin. order to take appropriate remedial action <sup>106</sup> | Violations noted<br><br>No known enforcement from data provided  | Water above liner in pit<br><br>Agreed order, \$5000 <sup>107</sup>                 | Apparent failure to properly de-water, backfill reserve pit<br><br>Agreed order, \$1000 <sup>108</sup>                |
| Signs & labeling                      | Improper I.D. of well site and tank battery<br><br>Admin. order to post correct sign <sup>109</sup>                                  | Violations noted<br><br>No known enforcement from data provided  | Failure to display well sign<br><br>Agreed order, \$1000 <sup>110</sup>             | No violations identified                                                                                              |
| Site maintenance                      | No violations identified                                                                                                             | Violations noted<br><br>No known enforcement from data provided  | No violations identified                                                            | No violations identified                                                                                              |
| Surface spill: produced water         | Salt water load line from production facility left open<br><br>Admin. order to report clean-up methods <sup>111</sup>                | Violations noted<br><br>No known enforcement from data provided. | Spills of 15, 30, 60 barrels<br><br>e.g. notices of violation <sup>112</sup>        | No violations identified                                                                                              |
| Surface spill: unidentified substance | No violations identified                                                                                                             | Violations noted<br><br>No known enforcement from data provided. | Small leak of unidentified substance<br><br>e.g. phone call <sup>113</sup>          | Improper disposal violation that required spill clean-up<br><br>Agreed order, remediation and \$15,000 <sup>114</sup> |

Source: Wiseman, "Fracturing Regulations Applied," 379-380.

Table 7 illustrates that, generally, the states took minimal enforcement action in response to the most common types of violations (the categories here are the same categories as in Table 5, above), save for violations of permitting and reporting regulations.

Returning to the same data set for Pennsylvania discussed in the Regulatory Violations section, above, 5,170 well inspections over a five-month period in 2012 yielded 315 violations.<sup>291</sup> Of these 315 violations, the state took enforcement actions against 80 of them. Of these 80 enforcement actions, in all except for 4 cases the Department of Environmental Protection issued a Notice of Violation. A Notice of Violation creates a formal record that an operator has been cited for violating one or more of the Commonwealth's laws or regulations, but comes with no additional consequences. These 4 remaining cases all received a Consent Assessment of Civil Penalty (CACP). Under a CACP, the operator and the Department of Environmental Protection enter into an agreement by which the operator agrees to wrongdoing and to pay the agreed-upon restitution amount. Three of these four penalties were for \$500 and the fourth was for \$1,500.<sup>292</sup> Three of the four CACP enforcement actions were for operators failing to submit well records within 30 days of the completion of drilling (yielding \$500 CACPs) and the fourth was for the operator's failure to have a drillers log on site at the time of inspection (yielding the \$1,500 CACP).

It should be noted that, aside from the five-month period from March to July, 2012, Pennsylvania has instituted fines against operators for larger amounts of money in some high-profile cases. For example, the Department of Environmental Protection reached an agreement with Cabot Oil and Gas Corp. by which the company paid \$4.1 million to residents in Dimock, PA whose water supplies were contaminated by natural gas.<sup>293</sup> In this case, the settlement specified that the \$4.1 million be paid directly to 19 affected families while the Department of Environmental Protection received \$500,000 to offset the costs of its investigation into the situation.<sup>294</sup> Other notable penalties include a combined fine of over \$1 million levied against Chesapeake Energy in May 2011 for contamination of well water for 16 families due to improper well casing and cementing (resulting in a \$900,000 fine) and an incident in which three condensate separator tanks caught fire due to improper handling and management of condensate (resulting in a fine of \$188,000).<sup>295</sup> In addition to the monetary penalties levied,

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<sup>291</sup> PA Department of Environmental Protection, "Office of Oil and Gas Management Compliance Report (Query Range: 03/01/2012 to 07/31/12)."

<sup>292</sup> Ibid, Well permit 005-30826, violation #636225, April 6, 2012; Well permit 105-21728, violation #635038, March 19, 2012; Well permit 105-21728, violation #635039, March 19, 2012; Well permit 003-22197, violation #636224, April 6, 2012.

<sup>293</sup> Laura Legere, "DEP Drops Dimock Waterline Plans; Cabot Agrees to Pay \$4.1M to Residents."

<sup>294</sup> Ibid.

<sup>295</sup> PA Department of Environmental Protection, "DEP Fines Chesapeake Energy More Than \$1 Million."

the Department of Environmental Protection also reached agreements with the operator by which the latter would have to remediate damage done and change its operating procedures in the future in order to avoid similar incidents. As part of the Consent Order and Agreement for the well contamination case, Chesapeake agreed to, “take multiple measures to prevent future shallow formation gas migration, including creating a plan to be approved by DEP that outlines corrective actions for the wells in question; remediating the contaminated water supplies; installing necessary equipment; and reporting water supply complaints to DEP.”<sup>296</sup> The Consent Order and Agreement for the tank fires, “Chesapeake must submit for approval to the department a Condensate Management Plan for each well site that may produce condensate.”<sup>297</sup> In February of 2012, Chesapeake Energy was fined \$565,000 by the Department of Environmental Protection for multiple violations, including release of flowback water and other fluids into a stream, damage to wetlands, and erosion into a stream classified as “high-quality.”<sup>298</sup>

Overall, the data indicate that regulatory agencies in the states reviewed generally take enforcement actions for detected violations in a minority of cases (often a small minority of cases) and, of these enforcement actions, most are similar to Pennsylvania’s Notices of Violation—the violation is officially recorded and the operator is required to remedy the violation. Only a very small number of violations receive more significant enforcement responses, whether fines, mandatory remediation, a temporary cease-work order, suspension of general operations within a limited geographic area, revocation of operating license, or requirements to adopt different operating procedures in the future. Another conclusion that can be drawn from the information in Table 7 is that regulatory authorities in the four states generally meted out larger fines for violations of permitting and reporting regulations than for the other categories of common violations, including pit construction and maintenance and spills. This finding aligns with the regulatory information available from Pennsylvania for the period March 1, 2012 to July 31, 2012, when the four fines imposed by the Department of Environmental Protection were for failures to submit well records and to have a drillers log on site at the time of inspection.

The approach to enforcement taken by the states can be explained by a number of possible factors. To begin, it seems that many states employ a graduated enforcement system for violations of oil and gas regulations. In this kind of system, detected violations are generally handled first through “informal” enforcement mechanisms, and in case these procedures do not work, authorities will progress to “formal” enforcement mechanisms. For example,

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<sup>296</sup> Ibid.

<sup>297</sup> Ibid.

<sup>298</sup> Scott Detrow, “Chesapeake Fined \$565,000 For Violations.”

Michigan has a “standardized compliance and enforcement program” that is designed to “ensure predictable, reliable, and efficient escalated enforcement actions.”<sup>299</sup> Michigan’s program generally, but not in all cases, proceeds through the following stages:

1. Issuance of a Notice of Noncompliance (NONC), which allows the permittee 30 days to voluntarily resolve the violation;
2. Issuance of second Notice of Noncompliance (NONC);
3. Issuance of a Notice of Referral, informing the permittee that the violations have been referred to the Compliance and Enforcement Unit;
4. The Compliance and Enforcement Unit issues a Notice of Violation (NOV), which must be resolved through a formal administrative, civil, or criminal process;
  - a. The Administrative Process can either be resolved through voluntary compliance by the permittee (e.g. through a voluntary consent agreement) or through an Administrative Hearings Process;
  - b. The Civil Process often includes violations “that involve permittees that are located outside Michigan, those that involve cost recovery, or those that involve failure to comply with administrative orders or agreements” and cases are heard in circuit court before a judge;
  - c. The Criminal Process is for cases that appear to involve criminal intent and may be heard before a judge or a jury.<sup>300</sup>

Similarly, both Colorado and Florida have graduated compliance and enforcement programs in which regulatory agencies afford the operator the opportunity (and perhaps multiple opportunities, as in Michigan) to voluntarily bring their operation into compliance with regulations before proceeding with formal enforcement mechanisms.<sup>301</sup> The Florida Department of Environmental Protection explains that the preference for compliance through informal mechanisms is mutually beneficial for the operator and for the agency:

Compliance without enforcement benefits both the Department and the violator. Effective compliance assistance is less costly for the Department than legal proceedings, and the violator typically spends more of its resources towards resolving or preventing environmental damage rather than defending itself in a legal action.<sup>302</sup>

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<sup>299</sup> Michigan Dept of Environmental Quality, Office of Oil, Gas, and Minerals, “Compliance and Enforcement Fact Sheet.”

<sup>300</sup> Ibid.

<sup>301</sup> Colorado Oil & Gas Conservation Commission, “General Users Guide to the COGCC Hearing Process”; Florida Department of Environmental Protection, “Enforcement Manual 12 (Revised Dec. 2004).”

<sup>302</sup> Florida Department of Environmental Protection, “Enforcement Manual 12 (Revised Dec. 2004).”

Given the data described above, it seems possible that many other states take this sort of compliance-oriented approach in which operators are given the opportunity to voluntarily rectify a noncompliant situation and bring their operations into compliance.

Different states and political administrations may also have varying political motivations for identifying violations and taking enforcement action. Shale gas development has created jobs and economic development, including in parts of the country, such as Appalachia, where these resources are particularly wanting. Regulatory agencies, which sit in the executive branch of state government, may receive instructions from the governor of the state to follow a particular regulatory approach. For example, the percentage of violations that received enforcement actions were significantly lower during the first few months of the Corbett administration in Pennsylvania than they were than during an equivalent period of time one year earlier, under the previous administration. A study by a group called Citizens for Pennsylvania's Future analyzed Department of Environmental Protection data and found that, during the first quarter of 2011, once Governor Corbett came to power, there was one enforcement action for every 8.69 violations, whereas one year earlier, under Governor Rendell, there was one enforcement action for every 1.7 violations.<sup>303</sup> The Corbett administration also released a directive – which was subsequently rescinded – requiring field inspectors to get approval from department administrators before issuing Notices of Violation to Marcellus Shale drilling operations.<sup>304</sup> On the other hand, state officials in Pennsylvania have noted that PA Act 13, passed in February 2012, gives the Department of Environmental Protection greater enforcement powers than it previously had, including a tripling of the maximum civil penalties that the agency can impose and giving the agency the ability to revoke permits of drillers with repeat violations.<sup>305</sup> In addition, in the press release from the Department of Environmental Protection announcing the \$1.9 million fine of Chesapeake Energy for the water well contamination and the tank fire, described above, Secretary Krancer is quoted as saying: “The water well contamination fine is the largest single penalty DEP has ever assessed against an oil and gas operator, and the Avella tank fire penalty is the highest we could assess under the Oil and Gas Act. Our message to drillers and to the public is clear.”<sup>306</sup> Overall, it seems clear that a regulatory agency, either independently or under political direction, can strategically decide how it will pursue its responsibilities to enforce state regulations.

As noted above, violations and enforcement data indicate that states may be more aggressive in applying and enforcing regulations requiring operators to secure permits and report on their

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<sup>303</sup> Don Hopey, “Shale Drilling Fines Drop Under Corbett.”

<sup>304</sup> Ibid.

<sup>305</sup> Timothy Puko, “Fines Against Drillers in Pa. down 70 Percent.”

<sup>306</sup> PA Department of Environmental Protection, “DEP Fines Chesapeake Energy More Than \$1 Million.”

activities than they are around other types of regulations, such as pit construction and maintenance and spill prevention and remediation. There are a couple of possible reasons why some states may be more commonly and aggressively enforcing permitting and reporting regulations than other types of regulations. One factor may be that, if an operator does not secure a permit for a well, a regulatory agency cannot perform its other responsibilities with regards to that well. That is, when an operator applies for permits and submits reports about the various stages of development, the regulatory agency is put on notice about the well's existence and what actions the operator is taking (for example, a well completion report informs the agency that the operator has finished the completion process and is moving on to extraction).<sup>307</sup> This information allows the regulator to perform both its environmental and health protection duties and also its oil and gas conservation duties.<sup>308</sup> As such, regulators may enforce permitting and reporting regulations more aggressively than many other types of regulations because the former are prerequisites for carrying out the agency's mandate. A second possible factor may be that some agencies place a higher priority on carrying out their oil and gas conservation mandates than they do on carrying out their environmental and public safety mandates.<sup>309</sup> While the permitting and reporting regulations are critical for both conservation and environmental protections purposes, most of the other regulations (e.g. air pollution, pit integrity, spill control, etc.) serve only the latter of these two purposes. As such, some agencies may be focusing on enforcing the permitting and reporting regulations because these are the only ones that are critical for conservation purposes.

Another set of factors that could influence state agency's enforcement efforts have to do with staffing. Particularly as state budgets have come under increasing pressure in recent years, just as the shale gas boom has taken off, agencies may not have the resources to hire sufficient numbers of field inspectors and other officials (such as lawyers) to pursue enforcement actions. Wiseman goes so far as to postulate that, "inadequate staffing [may be] the primary reason for low levels of enforcement."<sup>310</sup> One striking example is Texas, where even as conventional and shale drilling have boomed in recent years, the Railroad Commission of Texas underwent a hiring freeze in 2009 and lost personnel. The agency's chief geologist reported that "Legal

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<sup>307</sup> Wiseman, "Fracturing Regulation Applied," note 119.

<sup>308</sup> As described in Chapter 2, due to the history of oil and gas regulation in which regulation was initially intended to "conserve" oil and gas resources and regulations for environmental protection were added in the second half of the twentieth century, many regulatory agencies (often known as "conservation commissions" or "corporation commissions") play a dual role of promoting oil and gas development and protecting environmental resources and human health.

<sup>309</sup> Wiseman, "Fracturing Regulation Applied," 382.

<sup>310</sup> Hannah Wiseman, "Questions Re: Shale Gas Regulation (personal correspondence with author)."

Enforcement was down to attorneys and field operations was also short of personnel.”<sup>311</sup> With a smaller staff, Texas pursued only 5 enforcement actions at fractured well sites in 2010.<sup>312</sup> As noted above, a study by Pro Publica found that the growth in wells significantly outpaced the growth in inspection capacity between 2003 and 2009 in most states, and the study also found that this led to a decrease in the percentage of wells inspected in most states and a drop in enforcement actions in some states.<sup>313</sup> A second staffing issue agencies that could impact on enforcement activity is the question of whether field staff, in particular, are adequately trained. Wiseman suggests that, in some cases, “inspectors may be inadequately trained to detect certain environmental violations... specific training regarding oil and gas inspections and the potential effects to look for likely... is necessary.”<sup>314</sup> West Virginia and Pennsylvania both have some sort of requirement in place by which (some) inspectors must have experience in the industry.<sup>315</sup> State geologists in Pennsylvania testified that they “are not familiar with requirements to look at how the operation might affect nearby streams.”<sup>316</sup> Both staffing levels and lack of proper expertise among staff may be contributing factors to the low enforcement levels seen in many states.

Finally, there are a number of other factors that could also influence enforcement levels. A 2009 legal judgment in New Mexico, for example, found that the state’s regulatory agency, the Oil Conservation Commission, does not have the authority to issue civil penalties for environmental violations and must ask the Attorney General’s Office to do so.<sup>317</sup> As this case illustrates, some regulatory agencies may be limited in the enforcement tools that they have at their disposal (the New Mexico Oil Conservation Commission can still issue notices of violation and enter into compliance orders with operators) and which could influence the types of enforcement actions that agencies pursue. Other factors that could influence enforcement levels and outcomes include: “whether site visits are conducted routinely or primarily in response to complaints; whether advance warning of inspections is provided... and whether industry best practices tend to vary between regions.”<sup>318</sup>

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<sup>311</sup> Wiseman, “State Enforcement of Shale Gas Development Regulations, Including Hydraulic Fracturing,” note 7.

<sup>312</sup> Wiseman, “Fracturing Regulation Applied,” 372.

<sup>313</sup> Abrahm Lustgarten, “State Oil and Gas Regulators Are Spread Too Thin to Do Their Jobs.”

<sup>314</sup> Hannah Wiseman, “Questions Re: Shale Gas Regulation (personal Correspondence with Author).”

<sup>315</sup> Mike Soraghan, “Oil and Gas: Drilling Regulators Pull Double Duty as Industry Promoters.” Soraghan actually cites the requirement not as a positive attribute but rather as a factor that promotes regulatory capture.

<sup>316</sup> Mike Soraghan, “Oil and Gas: Protecting Oil from Water -- the History of State Regulation.”

<sup>317</sup> Wiseman, “Fracturing Regulation Applied,” 378–379.

<sup>318</sup> *Ibid.*, 373.

## Conclusion

Written regulations provide only a partial image of regulatory practice; in order to see the whole picture, it is necessary to look at how regulations are applied and enforced. This chapter reviews regulatory enforcement data to understand how state regulators interpret the law and apply the enforcement tools at their disposal for purposes of protecting public health, safety, and environmental quality. The data that are available are limited. Nevertheless, the composite picture that begins to emerge is that most state regulatory agencies are struggling to catch up with the drilling and production boom, and this is occurring in an era of fiscal austerity and lean government budgets. The types of violations that are detected, as reflected in state records, vary from state to state and most would be observable from a visual site inspection or a review of paperwork (as opposed to regulatory violations that occur underground or involve air emissions, which are more difficult to observe). Most states employ what might be called a “cooperative regulatory model” in which regulators work closely with shale gas operators to bring them into compliance with the law. Most violations initially receive no formal sanction; instead, operators are given a chance to remedy the violation and bring their operation into compliance without incurring any sort of penalty. In most states, a very small percentage of recorded violations receive a fine or involve some other enforcement action beyond a basic citation of noncompliance. Regulatory authorities are far more likely to issue a fine for violations of permitting and reporting requirements than for spills or blowouts – events that present a more immediate threat to public safety and health and to environmental quality.

## Chapter 5 – Regulatory Federalism

### Introduction

Previous chapters have documented both federal and state regulation of shale gas development as well as how states, which exercise the vast majority of regulatory authority at present, apply and enforce regulations. As shale gas development – with “fracking” often used as shorthand – has gained public prominence in recent years, a number of commentators have raised questions about the adequacy of current regulations and whether the current regulatory structure is robust enough to safeguard public health and safety and protect the environment. In particular, some commentators have called for the federal government to take the lead and set a baseline level of regulation to provide minimal protections in all jurisdictions.<sup>319</sup>

The National Institute of Standards and Technology, a Federal agency located within the U.S. Department of Commerce, articulates the purpose of government regulations as follows:

The U.S. Federal regulatory system is designed to protect and improve the health, safety, and well being of U.S. citizens and to protect the environment. It seeks to improve the performance of the economy without imposing unacceptable or unreasonable costs on society.<sup>320</sup>

In other words, the government (although this quotation is specific to the federal government, the principles apply equally to the states) regulates certain activities in order to protect public and environmental wellbeing but seeks to do so in a way that does not impose unnecessary costs. That is, regulators seek to strike a balance between the public benefits derived from regulation and the public costs imposed by regulation.<sup>321</sup> Efficient regulations are generally those in which the benefits derived from the regulation meet or exceed the costs imposed by the regulation.

The purpose of this chapter is to define and apply a set of evaluative criteria to determine which level of government – the states or the federal government – is better able to protect the public welfare in a way that does not impose unnecessary costs. This analysis is driven by an attempt to identify which level of government, state or federal, is best suited to regulate, not by what the regulations should be. That is, it is presumed that once the level of government that is best suited to create and enforce regulations is identified, the appropriate government

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<sup>319</sup> See, for example, Freeman, “The Wise Way to Regulate Hydraulic Fracturing.”

<sup>320</sup> National Institute of Standards and Technology, “Regulations.”

<sup>321</sup> It should be noted that while this approach of balancing costs and benefits applies to most regulatory activities, policy makers have specifically exempted some regulations, such as the federal Resource Conservation and Recovery Act (RCRA), from evaluation under a benefit-cost test. See W. E. Oates, “A Reconsideration of Environmental Federalism,” 15.

bodies will then decide how to strike an optimal balance between the benefits and costs of regulation.

The evaluative criteria that will guide this analysis are of two kinds: the first set are “level-neutral” in the sense that they will be applied to evaluate whether both state and federal governments would be capable of evaluating shale gas development and whether one entity or the other would be better to undertake such regulation. This first set of criteria consists of:

- Geographic distribution of costs and benefits,
- Regulatory capacity,
- Innovation, flexibility, and adaptability in regulation,
- Efficiency, certainty, and stability in regulation.

Application of this first set of criteria will find that states are better suited to regulate most, although not all, aspects of shale gas development (as the states already do).

In addition to this first set of criteria, a second set will analyze two specific questions that would indicate “regulatory failure” on the part of state regulators and would consequently compel the federal government to step in and assume regulatory authority from the states (as described in previous chapters, states currently hold the vast majority of regulatory authority as pertains to shale gas development). If either of these two latter criteria are found to be “true” or in effect, then at least some portions of regulatory authority currently held by states should be taken over by the federal government. This second set of criteria consists of:

- Is competition among the states to attract capital investment for economic growth causing downward pressure on regulations such that federal intervention is required to set a national regulatory floor?
- Is regulatory capture of state agencies occurring such that federal intervention is required to set a national regulatory floor?

Although answers to these questions cannot be definitively given, the affirmative evidence for both of these questions is not compelling enough to necessitate federal assumption of regulatory authority from the states.

After defining each of the criteria, this chapter will examine each of these six criteria in turn and will reach the conclusion that regulatory authority over shale gas development is, in most cases, best left with the states.

#### **Definition of the Criteria**

The evaluative criteria will be briefly explained here before exploring how they apply to the current practice of shale gas development in the United States.

### *Geographic distribution of costs and benefits*

The applicable principle is that regulation should be conducted by the lowest level of government that geographically encompasses the costs and benefits associated with the regulated activity. The reasoning behind this principle is that the jurisdiction of government that best matches the geographic distribution of costs and benefits will be best able to decide on the appropriate balance between the costs and benefits. Under this criterion, federal regulation would be needed when the costs or benefits of the regulated activity are felt largely across state lines.<sup>322</sup>

### *Regulatory capacity*

The regulatory entity should possess the capacity to regulate the activity in question. While capacity consists of various components, including financial and human resources, management capacity, and organizational infrastructure, among others, the critical consideration here pertains to technical know-how. While a regulatory agency may require additional financial resources to carry out its mandate, for example, or may require some time to build out its management capacity, responsible agencies should already possess technical know-how and expertise in regulating areas that are similar to shale gas in terms of the types of technical capacities (e.g. risk analysis, modeling, geologic expertise, etc.) that are required.

### *Innovation, flexibility, and adaptability in regulation*

This criterion seeks to assess how well a regulatory entity or entities would experiment with new regulatory approaches, or allow for such experimentation, in order to yield enhanced policy and regulation. A key component of this criterion is the regulatory entity's ability to be flexible and adaptable to changing circumstances as shale gas development continues to evolve in practice and as science and public opinion about shale gas continue to evolve.

### *Efficiency, certainty, and stability in regulation*

As noted in the introduction to this chapter, regulatory action by state and federal governments generally seeks to balance the benefits derived from regulation against the costs imposed by regulation and to make sure that the associated benefits are greater than equal to the costs. A key cost of regulation is the burden that it imposes on business, particularly business actors associated with the regulated industry. This criterion seeks to assess how well a regulatory entity or entities would be able to create and enforce regulations efficiently, in order to minimize the burden on the regulated entities, and how effectively the regulatory entity could create regulatory stability and certainty (as uncertainty and changing regulations can impose

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<sup>322</sup> Wallace E. Oates, "Industrial Ecology," 14.

significant costs on businesses as they are forced to hedge against potential changes as well as invest resources in changing their operations in response to regulatory changes).

*Competition among the states causing downward pressure on regulations?*

Some commentators have argued that states that are competing against each other to attract a limited pool of capital investment may weaken regulations in an effort to reduce the cost of doing business in order to attract business investment and thereby foster economic growth.<sup>323</sup> This phenomenon, in which each state is seeking to lower imposed regulatory costs to a lower level than businesses encounter in other states, is commonly known as a “race to the bottom.” Under this criterion, federal regulation would be needed if multiple states are weakening their regulations in order to compete with each other to attract business investment.

*Regulatory capture of state agencies?*

Some commentators have also argued that the risk of regulatory capture is greater at the state level than at the federal level because there is typically less policy transparency and less press attention to policy at the state level and it can be more difficult for pro-regulatory interests to achieve the critical mass necessary to successfully advocate for stronger regulations at the state level.<sup>324</sup> Under this criterion, federal regulation would be needed when there is a high risk of regulatory capture at the state level, or when regulatory capture of state regulators has already occurred.

**Primary Criteria Applied to Shale Gas Development**

This section will take the four primary criteria introduced in the previous section and apply them to the contemporary practice of shale gas development in order to determine whether states or the federal government is better suited to regulate this industry.

***Geographic Distribution of Costs and Benefits***

The first criterion pertains to the geographic scope of benefits and costs resulting from the regulated activity. In a system in which voters elect representatives to create policy on their behalf, such as exists in the United States, the level of government whose jurisdiction best corresponds to the geographic spread of benefits and costs will have the greatest incentive and ability to strike a balance between those benefits and costs that reflects the preferences of the people who experience the benefits and costs – the voters. This principle is known as subsidiarity. As will be described here, most of the costs and benefits of shale gas development

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<sup>323</sup> See, for example, Stewart, “Pyramids of Sacrifice?”, and Engel, “State Environmental Standard-Setting.”

<sup>324</sup> See, for example, Stewart, “Pyramids of Sacrifice?”, and Caminker, “State Sovereignty and Subordinacy.”

are experienced at the local level, thereby indicating that state governments would more faithfully represent the regulatory preferences of the affected populations than would the federal government.<sup>325</sup> In addition, those costs that cross state lines, such as air pollution and contamination of navigable waterways, are already regulated by existing federal authority.

Oates presents a typology of three cases, which are defined by the geographic distribution of externalities created by the regulated activity.<sup>326</sup> In Oates' model, the appropriate regulatory authority – national government or sub-national government – is the one that can best balance the costs and benefits associated with the regulated activity.

Oates' first case is one in which the environmental impact is felt at a national, or even global, scale with no impacts that are direct or exclusive to the local area in which the externality-causing activity is taking place.<sup>327</sup> Examples of this sort of "pure public" impact are greenhouse gas emissions that contribute to climate change and chlorofluorocarbons that contribute to ozone depletion. Neither of these examples involves an immediate impact on the area from which the emission occurs (although an indirect impact due to global warming or ozone depletion may clearly impact the local area), and the impact is encountered globally.<sup>328</sup> Local governments are ill-equipped to balance the costs and benefits of the regulated activity because the benefits are (likely) garnered locally while the costs are spread globally. Indeed, even national governments are not ideally equipped to deal with these sort of global impacts for similar reasons, which would be best handled with a truly global solution.

Oates' second case is one in which the environmental impact is felt exclusively at a local scale with no impacts that spread beyond a defined sub-national boundary.<sup>329</sup> Examples of this sort of "pure local" impact are contamination of local drinking water and the local disposal of waste

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<sup>325</sup> If the costs (including groundwater contamination, traffic, noise and light pollution, habitat, etc.) and the benefits (including revenues from mineral leases, employment, etc.) of shale gas development are largely experienced at the local level, it could be argued that local regulation would be better than state regulation. Indeed, one could imagine a scenario in which a state's electorate under-regulated shale gas development because the costs were borne disproportionately by a small portion of the state's population while the statewide population benefitted from secondary economic effects and a healthier state budget. While some states (particularly Texas) allow for local regulation, states have traditionally held regulatory authority over oil and gas development and questions would need to be resolved about whether all but the largest municipalities (such as Fort Worth, Texas) would have the technical, managerial, and financial wherewithal to regulate the oil and gas industry.

<sup>326</sup> W. E. Oates, "A Reconsideration of Environmental Federalism," 2–5.

<sup>327</sup> *Ibid.*, 2–3.

<sup>328</sup> *Ibid.*, 3.

<sup>329</sup> *Ibid.*, 3–4.

that was created locally.<sup>330</sup> The smallest jurisdiction of government that best aligns with the geographic distribution of costs and benefits associated with the regulated activity would be best able to balance the relevant costs and benefits, and therefore would be best able to set its appropriate standard for environmental quality.<sup>331</sup>

Oates' third case involves a pollutant that has both local effects in the jurisdiction in question as well as effects that spill over the jurisdictional boundary into neighboring (or, perhaps farther away) jurisdictions.<sup>332</sup> Examples of this sort of "local with spillover" impact are air or water pollution that flows out of the jurisdiction in which it was created and into other jurisdictions.<sup>333</sup> In these sorts of situations, local regulation is unlikely to take into account the externalities that flow beyond the local jurisdiction's boundaries (because the decision-makers are not directly accountable to the people who bear those impacts), thereby suggesting that regulation by a larger (perhaps national) jurisdiction would lead to better outcomes.<sup>334</sup>

Turning to shale gas development, most of the benefits and costs of the practice are experienced at the local, or perhaps regional, level. On the benefits side, revenues from mineral leases, jobs that are created, and economic development that results from the shale gas industry all largely accrue to the local area where extraction is occurring. On the costs side, most of the concerns that are raised by shale gas development also largely impact the local population. For example, most issues concerning water supply impact local aquifers or surface water sources, and water supply issues have traditionally been a state concern.<sup>335</sup> Conflicts around access to water are typically between local users and even interstate conflicts (for example, in the Southwest) have generally been handled by interstate compacts.<sup>336</sup> Adverse impacts from construction of well pads and access roads as well as drilling and extraction activity, including noise, traffic, lighting, impacts on habitat, and visual impact, are all local impacts. Contamination, whether of land, surface water, or groundwater, due to spills, leakages, or blowouts is generally localized in area and falls under the jurisdiction of state governments.<sup>337</sup>

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<sup>330</sup> Ibid., 4.

<sup>331</sup> Ibid.

<sup>332</sup> Ibid., 4–5.

<sup>333</sup> Ibid.

<sup>334</sup> Ibid., 5. Oates notes that the ideal intervention in these situations is not self-evident and that the first-best outcome is unlikely to be a uniform national standard for environmental quality.

<sup>335</sup> Spence, "Federalism, Regulatory Lags, and the Political Economy of Energy Production," 33.

<sup>336</sup> Ibid.

<sup>337</sup> For example, the jurisdiction of the Clean Water Act over stormwater flows and discharges to surface waters is limited to "navigable" waterways and adjacent wetlands. The focus of the Safe Drinking Water Act is on public water systems with only a "community information" approach offered for source water protection (such as groundwater sources). On the other hand, under RCRA and CERCLA, the handling,

There are some externalities imposed by shale gas development that clearly have impacts beyond state borders, and there are areas of shale gas development that the federal government already regulates. For example, air emissions, including methane and volatile organic compounds most notably, are not a local concern. Rather, because gases can easily travel beyond the local area and across state boundaries, air emissions are a cause for national concern (and even international concern, due to methane's contribution to climate change). The Clean Air Act gives the federal government jurisdiction to regulate air emissions, as described in Chapter 2. A second area of federal involvement in shale gas development is in wastewater disposal. Particularly the two most common methods of disposal, via publicly-owned treatment works (POTWs) and underground injection control wells, wastewater disposal is regulated under the Clean Water Act and the Safe Drinking Water Act.

Beyond the geographic distribution of costs and benefits, shale gas development does work differently in different states. States have enacted regulations that reflect these differences in geology and environmental conditions, which themselves create different cost and benefit structures in different states. For example, the development process in any two shales (for example, Michigan's Antrim Shale compared to Texas' Barnett Shale) differs significantly.<sup>338</sup> To take just one example, during the fracturing process, all shales return both flowback and produced water, but quantities returned differ significantly. In some shales, the combined flowback-plus-produced-water quantity returned is significantly less than the amount of water inserted, and in some shales, the amount returned is *more* than the amount inserted. Furthermore, the composition of the water returned to the surface in terms of the naturally-occurring chemicals contained therein and the quantities of the chemicals will differ significantly from one shale to another, and therefore, from one state to another.<sup>339</sup> These differences create significantly different operating conditions for shale gas companies in terms of their considerations around reuse and disposal of wastewaters and creates significantly different risk factors for the states that regulate operations.

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disposal, and remediation of hazardous substances and spills of hazardous substances has been defined as a federal responsibility, perhaps due to the exceptional nature of the handling and remediation procedures that are required for hazardous waste sites, and the significant resources that are required, but as described in Chapter 2, oil and natural gas have largely been exempted from these two pieces of legislation, putting regulatory responsibility back on the states.

<sup>338</sup> Wiseman, "State Enforcement of Shale Gas Development Regulations, Including Hydraulic Fracturing," note 52.

<sup>339</sup> Tom Hayes, "Characterization of Marcellus and Barnett Shale Flowback Waters and Technology Development for Water Reuse."

Different environmental conditions in the different states where shale gas development is occurring also create different risk structures and thereby change the nature of the costs and benefits that state regulators face. For example, while operators in states such as Texas and Oklahoma have typically stored various materials (such as fracturing fluids, drilling fluids, waste waters, etc.) in surface pits, these same pits present different risks for operators and communities in states such as Pennsylvania, West Virginia, and New York due to the higher precipitation levels in the Marcellus states.<sup>340</sup> Greater rainfall can make surface pits more susceptible to overflowing, thereby necessitating different operating procedures and regulations. New York, for example, has proposed only allowing storage tanks, not pits, in its proposed regulations.<sup>341</sup> Another example of local environmental conditions influencing operating conditions, risk factors, and therefore regulations can be seen in Louisiana, which specifies a number of regulations governing how pits must be constructed in wetland areas, regulations on the use of marsh buggies to protect stream bottoms and water bottoms, and sequestration of wetland drilling sites using either dikes or impervious decking with curbs, gutters, and/or sumps.<sup>342</sup> All of these regulations seem to be driven by a need to tailor operating procedures to the unique environment of the bayou. These examples demonstrate that environmental conditions shape the practice of shale gas development in different states, thereby also impacting the costs and benefits attendant to shale gas that states must take into consideration as they create and enforce regulations.

It is worth noting here that, in the areas where the federal government does have regulatory authority, it has been active in trying to diagnose and understand the evolving risks presented by shale gas development and respond accordingly. For example, as described in Chapter 2, the EPA has expanded regulations under the Clean Air Act to capture emissions of volatile organic compounds and is actively considering how to best regulate the disposal of diesel fuels in underground injection control wells.<sup>343</sup> The EPA is also studying the risks presented to drinking water and groundwater by hydraulic fracturing over the full lifespan of the process, from initial acquisition of water to final disposal.<sup>344</sup> The Environmental Protection Agency has also been active in encouraging compliance to federal regulations by states that have gained primacy to enforce those regulations. A particularly high profile example was the public back-and-forth

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<sup>340</sup> Weston, "Water and Wastewater Issues in Conducting Operations in a Shale Play – The Appalachian Basin Experience," 59.

<sup>341</sup> N.Y. Dept. of Environmental Conservation, "Revised Draft SGEIS on the Oil, Gas and Solution Mining Regulatory Program," 7–34.

<sup>342</sup> LA. ADMIN. CODE tit. 76: I., § 301 (B)(5), (E), (F), (Q); LA. ADMIN. CODE tit. 33:V, §.1121.

<sup>343</sup> US EPA, "Oil and Natural Gas Air Pollution Standards"; US EPA, "Permitting Guidance for Oil and Gas Hydraulic Fracturing Activities Using Diesel Fuels – Draft: Underground Injection Control Program Guidance #84."

<sup>344</sup> US EPA, "EPA's Study of Hydraulic Fracturing and Its Potential Impact on Drinking Water Resources."

between the EPA and the Pennsylvania Department of Environmental Protection (PA DEP) in which the EPA questioned PA DEP on whether operators were adequately pre-treating wastewater before sending it to publicly owned treatment works (POTWs) for final disposal and whether the state was adequately monitoring discharges from the POTWs into waterways.<sup>345</sup> This is an example of EPA ensuring that Pennsylvania, which has primacy to enforce Clean Water Act regulations, enforces those regulations adequately. Wiseman reports that, although a public exchange of this nature between the EPA and a state administration is rare, it is not unusual for the agency to provide direction to states that have primacy in their enforcement efforts.<sup>346</sup>

In summary, the majority of costs and benefits associated with shale gas development are contained within the boundaries of the states where shale gas development is occurring. Furthermore, each state confronts a unique set of costs and benefits because the nature of shale gas development differs somewhat from state to state, as highlighted above by examples stemming from geology and the local environment. According to the subsidiarity principle, the nature of the geographic distribution of costs and benefits argues in favor of allowing states to regulate most negative externalities of shale gas development because they are better able to strike a balance between costs and benefits that represents the interests of their constituents. Finally, those aspects of shale gas development that do involve spillover effects into other states are already regulated by the federal government.

### ***Regulatory Capacity***

The second criterion requires that the regulatory entity possess the capacity needed to regulate the activity in question. Capacity can be of various sorts, of course. A primary concern relates to the possession of technical know-how and expertise in regulating areas that are similar to shale gas in terms of the types of technical capacities (e.g. risk analysis, modeling, geologic expertise, etc.) that are required. Other types of capacity that are important include knowledge about local conditions and financial and human resource capacity.

The federal government, particularly in the form of the Environmental Protection Agency (EPA), and state regulatory agencies both possess the requisite technical capacities to regulate shale gas development. EPA has extensive experience regulating a wide variety of activity that require similar types of technical know-how as regulation of shale gas development requires,

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<sup>345</sup> Wiseman and Gradijan, "Regulation of Shale Gas Development, Including Hydraulic Fracturing," 127.

<sup>346</sup> Hannah Wiseman, "Questions Re: Shale Gas Regulation (personal Correspondence with Author)."

including mining and drilling, activities that create air emissions and that can contaminate surface water and groundwater, and handling and disposal of hazardous wastes.<sup>347</sup>

State regulatory agencies also possess the technical capacity required to regulate shale gas development. Rabe, for example, describes the significant expansion of regulatory capacity that states have undertaken since the 1970s.<sup>348</sup> For example, Rabe details the reforms in governance that state governments have undergone, including enacting new constitutions, expanded taxing powers, expanding and professionalizing state bureaucracies and political staffs, and becoming more democratic and responsive to citizen concerns.<sup>349</sup> Today, the states exercise significant authority and autonomy in environmental regulation, issuing the vast majority of permits and carrying out most enforcement actions.<sup>350</sup> States' responsibilities include, in the vast majority of states, responsibility for implementation of federal environmental regulations under the primacy doctrine.<sup>351</sup> States have been regulating the oil and gas industries for over a hundred years and the responsible agencies have developed expertise in this highly technical area during that time.<sup>352</sup>

Both the federal government and state regulatory agencies have also demonstrated their regulatory capabilities in their ongoing responsiveness and adaptation to shale gas development in recent years. The federal EPA has, among other actions, promulgated new regulations limiting release of volatile organic compounds from shale gas wells and pushed Pennsylvania to enforce compliance with Clean Water Act regulations pertaining to water that is discharged from wastewater treatment plants.<sup>353</sup> State regulatory agencies have responded to the particular risks presented by shale gas development, enacting new regulations that require disclosure of the chemicals constituents of fracturing fluids, strengthening well casing requirements to accommodate the high pressure associated with high-volume hydraulic fracturing, and increasing required setbacks from domestic and natural resources, among other innovations. On the enforcement side, states are inspecting well sites, noting violations, requiring that operators bring operations into compliance, and, in some cases, taking

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<sup>347</sup> See, for example, US EPA, "Water: Pollution Prevention & Control"; US EPA, "Air Pollutants | Air and Radiation"; US EPA, "Superfund | US EPA."

<sup>348</sup> Barry G. Rabe, "Power to the States: The Promise and Pitfalls of Decentralization," 34–42.

<sup>349</sup> *Ibid.*, 34.

<sup>350</sup> *Ibid.*, 34–35.

<sup>351</sup> *Ibid.*, 35.

<sup>352</sup> Ground Water Protection Council, *State Oil and Natural Gas Regulations Designed to Protect Water Resources*, 13–15.

<sup>353</sup> Wiseman and Gradijan, "Regulation of Shale Gas Development, Including Hydraulic Fracturing," 127; US EPA, "Oil and Natural Gas Air Pollution Standards."

enforcement actions such as issuing administrative orders, entering into consent orders, and imposing penalties.

Beyond technical know-how, there are a couple of other areas of capacity that are worth noting. One area in which states trump federal regulators is knowledge of local conditions. As described in section above on the geographic distribution of costs and benefits, local geology and the environment shape both the practice of shale gas development and the necessary regulatory response. State regulatory agencies have a better understanding of the local conditions in which shale gas development occurs and can therefore better adapt regulations to fit these conditions. A second capacity issue relates to financial and human resources. The section on regulatory capacity in Chapter 4 references the struggle that most state regulatory agencies have had in keeping pace with the explosive growth in drilling in recent years.<sup>354</sup> Although some states, particularly Pennsylvania, have taken steps to increase staffing levels, most states continue to grapple with a significant shortfall in regulatory staff, perhaps partially attributable to the lean budgets that states have been working with in recent years. Finally a third capacity issue pertains to research and development. State governments and their regulatory agencies generally make scant investment in research and development, and Rabe reports that, “each year the federal government outspends the states in environmental research and development by more than twenty to one, and states have shown little inclination to assume this burden by funding research programs tailored to their particular technological and research needs.”<sup>355</sup> While states have conducted, and are conducting, some research focused on shale gas, such as the Texas Commission on Environmental Quality’s air emissions monitoring study in the Barnett Shale, the bulk of research is being conducted at the federal level (such as the EPA’s study on groundwater impacts).<sup>356</sup>

Both the federal government and state regulatory agencies possess the core technical capacities that are required to regulate shale gas development. The states, however, have much more extensive experience regulating oil and gas development and understand the local conditions in which drilling is taking place better than the federal government is likely able to. While there are a couple of areas in which state agencies are lagging, particularly staffing capacity and research capacity, the policy recommendations in Chapter 6 suggest strategies to

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<sup>354</sup> Abrahm Lustgarten, “State Oil and Gas Regulators Are Spread Too Thin to Do Their Jobs”; Mike Soraghan, “Oil and Gas: Puny Fines, Scant Enforcement Leave Drilling Violators with Little to Fear”; Pro Publica, “How Big Is the Gas Drilling Regulatory Staff in Your State?”.

<sup>355</sup> Barry G. Rabe, “Power to the States: The Promise and Pitfalls of Decentralization,” 45.

<sup>356</sup> Texas Commission on Environmental Quality, “Barnett Shale Emissions”; US EPA, “EPA’s Study of Hydraulic Fracturing and Its Potential Impact on Drinking Water Resources.”

address these issues. Overall, the states possess more of the needed capacities to regulate shale gas development.

### ***Innovation, Flexibility, and Adaptability of Regulations***

The third criteria seeks to assess how effectively regulatory agencies have and continue to adapt to the evolving circumstances around shale gas development through innovative policies and flexible approaches that meet the diverse needs of concerned populations. A key element of shale gas development today is that widespread development of this resource is still relatively novel. The development process itself continues to evolve and, as described above, is often tailored to local geography and environmental conditions. In addition, much about the process remains unknown. Particularly relevant to this paper is that both the nature and magnitude of the risks associated with shale gas are still being explored and studied by science. The ability for regulatory approaches to evolve in concert with the evolving practice of, and scientific knowledge about, is critical for the effectiveness of regulatory practice.

The federal environmental laws of the 1970s broke new ground for government regulation in many respects, although they also built on top of and succeeded some state and local laws that were already in effect and regulated, for example, local air pollution.<sup>357</sup> Since this time, as states have enhanced their capacity for governance, generally, and regulation, specifically, some (and definitely not all) states have taken a leadership role in creating new approaches to improve environmental outcomes. Rabe describes the significant initiative that some states have shown in pioneering creative new approaches to environmental regulation. For example, he describes how some states are shifting their regulatory strategy from one of pollution control to one of pollution prevention.<sup>358</sup> Minnesota, for example, employs a performance-based approach in which emitting firms are required to submit annual toxic pollution prevention plans in contrast to the technology-mandate approach of much federal regulation.<sup>359</sup> Rabe also describes how some states have taken steps to reconceptualize how they approach the classification of environmental problems and seek a more integrative approach that minimizes leakages of pollution across mediums (e.g. air quality, water quality, waste management, etc.) as well as cutting down on net environmental damage.<sup>360</sup> States have also pioneered the use of economic incentives to meet environmental goals with, for example, the experiments in a number of states with emissions trading programs laying the groundwork for the federal government to adopt a national trading program in sulfur allowances as part of the 1990 Clean Air Act Amendments.<sup>361</sup>

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<sup>357</sup> W. E. Oates, "A Reconsideration of Environmental Federalism," 12–13.

<sup>358</sup> Barry G. Rabe, "Power to the States: The Promise and Pitfalls of Decentralization," 37–38.

<sup>359</sup> *Ibid.*, 38.

<sup>360</sup> *Ibid.*, 38–39.

<sup>361</sup> Oates, "An Essay on Fiscal Federalism," 1132.

The virtues of a federalist system in promoting innovation and experimentation were famously articulated by Justice Louis Brandeis in 1932:

There must be power in the States and the Nation to remould, through experimentation, our economic practices and institutions to meet changing social and economic needs.... It is one of the happy incidents of the federal system that a single courageous State may, if its citizens choose, serve as a laboratory; and try novel social and economic experiments without risk to the rest of the country.”<sup>362</sup>

In the shale gas arena, there is some evidence that states, and even the federal government, are already drawing from one another’s experiences and drawing on regulatory best practices. For example, Chapter 10 of New York State’s Revised Draft SGEIS (which articulates a framework for draft regulations) is titled “Review of Selected Non-Routine Incidents in Pennsylvania” and is a review of a number of accidents, spills, and regulatory failures that Pennsylvania has encountered with shale gas development and a description of mitigation measures that are contained in New York’s draft regulations that would address similar occurrences in New York.<sup>363</sup> In another example, the Environmental Protection Agency modeled its regulations controlling emissions of volatile organic compounds partially on regulations in place in Colorado and Wyoming.<sup>364</sup> Many states have also voluntarily submitted their regulatory programs (either their oil and gas programs in their entirety, a more limited review of provisions directly applicable to hydraulic fracturing, or both) for review by an organization called the State Review of Oil & Natural Gas Environmental Regulations, Inc., or “STRONGER.”<sup>365</sup> STRONGER is a nonprofit, multi-stakeholder organization, composed of representatives of industry, environmental groups, and regulatory officials, that has developed guidelines for state regulations around waste handling and disposal and groundwater protection.<sup>366</sup> Both submission of one’s regulatory program, and implementation of STRONGER’s recommendations, is voluntary. As illustrated here, dissemination of regulatory approaches and best practices can occur both horizontally (i.e. between states) and vertically (between states and the federal government).

Regulation by the states of shale gas development has yielded varying approaches to both written regulations and enforcement approaches. As described here, states are experimenting

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<sup>362</sup> Ibid.

<sup>363</sup> N.Y. Dept. of Environmental Conservation, “Revised Draft SGEIS on the Oil, Gas and Solution Mining Regulatory Program,” chap. 10.

<sup>364</sup> Wiseman and Gradijan, “Regulation of Shale Gas Development, Including Hydraulic Fracturing,” 75.

<sup>365</sup> STRONGER, Inc., “Formation of STRONGER.”

<sup>366</sup> STRONGER, Inc., “Who We Are.”

with new approaches and are learning from each other, and as described above, states have adapted to their local geological and environmental conditions to create different, individually appropriate, balances between the benefits and costs of regulation. These considerations regarding innovation, flexibility, and adaptability of regulations argues in favor of allowing states to maintain primary regulatory authority.

### ***Efficiency, Certainty, and Stability of Regulations***

A key cost imposed by regulatory action is the burden that it imposes on business, particularly business actors associated with the regulated industry. This fourth criterion seeks to assess two, related issue. First, it seeks to assess how well a regulatory entity or entities would be able to create and enforce regulations efficiently, in order to minimize the regulatory burden on the regulated entities. Second, it seeks to assess, how effectively the regulatory entity or entities could create regulatory stability and certainty. These qualities of regulatory stability and certainty are important for many actors associated with the regulated activity, but are particularly important for businesses that are engaged in the activity because changing regulations and uncertainty about the nature of future regulations can impose significant costs on businesses as they are forced to hedge against potential changes as well as invest resources in changing their operations in response to regulatory changes. This section will first address regulatory efficiency and will then address regulatory stability and certainty.

Most, though not all, regulations will impose a cost on business activity and, generally, policy makers and regulators attempt to balance the benefits derived from regulating an economic activity against the costs imposed by that regulation such that the costs do not exceed the benefits. Regulatory efficiency helps to keep down the costs imposed by regulation. Latin explains that, in the realm of environmental regulation, an example of a measure that strives for greater efficiency while maintaining identical environmental outcomes is the setting of a performance standard to meet a specified emissions-reduction target and allowing the regulated entities to determine the least-cost strategy to meet that target.<sup>367</sup> In contrast to a regulatory requirement that operators use a specific emissions-control technology, allowing operators to choose their preferred strategies and technologies to meet emissions-reductions targets will allow them to decide if the technology that would otherwise be mandated is the lowest-cost option to meet the emissions-reduction requirement or if there are lower-cost options available.

As described in the section on innovation, above, Rabe recounts how states have been at the forefront of measures to incorporate economic incentives into environmental regulation and to integrate regulatory efforts across media (which can greatly increase efficiency by, for example,

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<sup>367</sup> Latin, "Ideal Versus Real Regulatory Efficiency," 1268–1270.

asking businesses to comply with one set of factory-wide standards or requirements as opposed to complying with multiple and possibly overlapping requirements for water emissions, air emissions, solid waste disposal, etc.).<sup>368</sup> Anderson describes how state governments are able to manage forestlands more efficiently than the federal government and Schoenbrod argues that state governments are able to clean up contaminated waste sites far more cheaply and efficiently than can the federal government.<sup>369</sup> It should be recognized, of course, that more efficient (and less costly) regulation can be achieved not only by finding better, less onerous ways to meet standards but also by lowering standards.

When it comes to shale gas regulation, the states reviewed have taken a variety of approaches to promoting regulatory efficiency. Texas, for example, keeps an updated record of how long it takes to process and receive a drilling permit; at the time of writing, the state would grant an expedited permit in 7 business days and a standard permit in 14 business days.<sup>370</sup> The faster that permits are granted, the less time that companies have to keep resources idle, thereby saving money. All of the states that require disclosure of hydraulic fracturing chemicals, although only after fracturing has been completed, are acknowledging that requiring disclosure of chemicals that will be used prior to fracturing would impose regulatory inefficiency on shale gas operators since they often change the composition of the fluid as they learn more about the geology of the well while the drilling and fracturing process is occurring.<sup>371</sup>

It should be noted here that one argument that is sometimes made for regulatory efficiency calls for the federal government to implement uniform national standards in order to preempt the varied standards that can be set by the fifty states. Klass explains that this regulatory approach is usually applied to “nationwide products” (such as energy efficiency standards for appliances, or other types of regulations for automobiles, drugs, medical devices, etc.) so that manufacturers are not forced to choose between customizing products for each state or choosing only a subset of states for which to manufacture products.<sup>372</sup> Klass also notes that the approach taken by the federal government in these types of situations is not one of “regulatory federalism” in which the federal government sets either a regulatory floor or ceiling and allows states to enact stricter (in case of a floor) or more lenient standards (in case of a ceiling).<sup>373</sup>

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<sup>368</sup> Barry G. Rabe, “Power to the States: The Promise and Pitfalls of Decentralization,” 38–40.

<sup>369</sup> Anderson and Hill, “Environmental Federalism: Thinking Smaller,” xiv; Schoenbrod, “Why States, Not EPA, Should Set Pollution Standards,” 262.

<sup>370</sup> Railroad Commission of Texas, “Data and Statistics, Drilling.”

<sup>371</sup> Wiseman and Gradijan, “Regulation of Shale Gas Development, Including Hydraulic Fracturing,” 98–99.

<sup>372</sup> Klass, “State Standards for Nationwide Products Revisited,” 338.

<sup>373</sup> *Ibid.*

Rather, federal regulation preempts state and local regulations in these circumstances.<sup>374</sup> This type of approach is not required for regulation of shale gas development, however, because although operators do encounter different regulatory regimes in different states, the operators are not selling an otherwise standardized product to customers in different states and, even if regulations were to be standardized across the states, operators would still need to adapt operations in different states to differences in geology and local environment. Furthermore, the author is not aware of any calls for national regulation made by operators, indicating that operators likely do not perceive regulatory heterogeneity to be a significant cause of inefficiency and costs.

Another key concern for business is that they operate under a regime that offers regulatory certainty and stability. These qualities are important for businesses because changing regulations and uncertainty about the nature of future regulations can impose significant costs on businesses as they are forced to hedge against potential changes as well as invest resources in adapting their operations in response to regulatory changes. Although this author did not locate literature that spoke directly to the question of whether federal or state regulatory agencies provide greater regulatory stability and certainty, some inferences drawn from the literatures on federal bureaucracy and regulatory capture may assist in answering this question.

Wilson makes the case that federal government agencies function more effectively when they are given more autonomy by policy makers and when they face less public scrutiny and pressure to conform to public expectations.<sup>375</sup> Although Wilson does not contrast performance or behavior of federal and state agencies, Caminker and Spence argue that state agencies generally face lower levels of public scrutiny and public pressure due to lesser media attention and lower levels of political organizing at the state level to push policy priorities.<sup>376</sup> As a result, it could be argued that, all else being equal, state regulatory agencies do enjoy comparatively more autonomy than do federal regulatory agencies. With this greater level of autonomy, it can be inferred that state agencies would be subject to fewer of the external pressures that limit autonomy and that cause significant shifts in regulatory policy and would thereby be more likely to offer greater regulatory stability and certainty than do federal regulatory agencies.

Turning to regulation of shale gas development, examples of the pressure exerted on federal regulatory agencies, such as the EPA, can be seen in the many exemptions that have been granted to oil and gas development and to hydraulic fracturing from federal statutes such as

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<sup>374</sup> Ibid.

<sup>375</sup> Wilson, *Bureaucracy*.

<sup>376</sup> Caminker, "State Sovereignty and Subordinacy," note 44; Spence, "Federalism, Regulatory Lags, and the Political Economy of Energy Production," 25.

the Clean Water Act and the Resource Conservation and Recovery Act (RCRA). As was described in Chapter 2, Congress first directed the Environmental Protection Agency to study whether oil and gas wastes should be covered under RCRA in 1980. After almost a decade of foot-dragging, the EPA finally adopted Congress' position and declared RCRA regulation of oil and gas wastes to be "unwarranted" in 1988.<sup>377</sup> At the state level, the transition from the Rendell to the Corbett gubernatorial administrations provides an example of an apparent shift in regulatory policy, with a significantly smaller proportion of violations resulting in enforcement actions under the new administration than under the old one.<sup>378</sup> While there are likely numerous examples of shifts in regulatory policy and strategy that could be cited at both the federal and the state levels, the reasoning articulated above regarding the lower levels of interest-group pressure and public scrutiny that apply to state regulatory activities creates a presumption in favor of greater autonomy and therefore greater regulatory stability and certainty at the state level than at the federal level.

Although a more complete analysis would need to be conducted, particularly in the area of regulatory stability at the state level, it generally seems to be the case that states offer both greater regulatory efficiency and probably offer greater regulatory stability than does the federal government. This, then, is another argument for giving primary regulatory authority over shale gas development to the states.

### **Secondary Criteria Applied to Shale Gas Development**

In addition to the four criteria explored above – geographic distribution of costs and benefits; regulatory capacity; innovation, flexibility, and adaptability; and efficiency, certainty, and stability – there are two questions that would indicate regulatory failure on the part of the states and would thereby compel the federal government to step in and assume regulatory authority. If either of these two latter criteria – competitive downward pressure on regulations and regulatory capture – are found to be "true" or in effect, then at least some portions of regulatory authority currently held by states should be taken over by the federal government.

#### ***Competition among the states causing downward pressure on regulations?***

Some commentators have argued that states that are competing against each other to attract a limited pool of capital investment may weaken regulations and lower taxes in an effort to reduce the cost of doing business in order to attract business investment and thereby foster

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<sup>377</sup> Wiseman, "Regulatory Adaptation in Fractured Appalachia," 245–246. While this particular change in regulatory behavior is "industry-friendly" in that it exempts the oil and gas industry from a class of federal regulation, there can also be regulatory changes that impose greater regulatory burdens on industry and the general principle, of changeability in regulations, nevertheless applies.

<sup>378</sup> Don Hopey, "Shale Drilling Fines Drop Under Corbett."

economic growth. In this type of scenario, commonly known as a “race to the bottom,” states would fail to regulate an activity sufficiently and/or to lower taxes not because each would independently choose not to, but rather that, faced with the threat of some states lowering their regulatory standards or taxes in order to attract a limited pool of investment capital that would lead to jobs and economic growth, other states are compelled to lower their own standards and taxes in order to compete effectively for that same capital investment.<sup>379</sup> In this sort of scenario, the federal government would step in to resolve the “prisoner’s dilemma” of state competition by imposing an optimal level of regulation itself.

A vigorous debate about whether a “race to the bottom” exists, and the magnitude of its effects if it does exist, has raged for over thirty years. On one hand, Stewart has argued, as early as 1977, that the mobility of industry presents a risk to any individual state or community that seeks to adopt high environmental standards because the resultant flight of capital to other jurisdictions with lower standards can lead to a loss of welfare that outweighs the gains from the higher standards.<sup>380</sup> According to this logic, then, even if policy makers are assumed to act perfectly rationally (and are not myopic in discounting the welfare loss caused by environmental pollution that will be felt in the future, for example), they still have an incentive to lower their regulations to match those in the jurisdiction that regulates least stringently. On the other hand, Revesz has countered the “race to the bottom” argument by positing that states likely relax environmental standards not because they are caught in a “prisoner’s dilemma” that compels them to relax their standards to compete for investment, but rather because they are expressing a policy preference to weight economic development more heavily when striking a balance between the costs and benefits of regulation.<sup>381</sup> That is, these states (and their voting public) place a comparatively higher priority on economic development than they do on environmental protection than do more heavily-regulated states and, furthermore, this choice is a legitimate policy preference that should be respected.<sup>382</sup>

In addition the theoretical argument about whether competition among states causes downward pressure on regulations, some scholars have studied the issue empirically. For example, Goklany documents that municipalities and states around the country enacted regulations that led to real, measurable improvements in air quality even before the passage of federal regulation controlling air emissions in the 1960s and culminating in the passage of the Clean Air Act Amendments of 1970.<sup>383</sup> Goklany asserts that, contrary to the logic of the race to

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<sup>379</sup> Spence, “Federalism, Regulatory Lags, and the Political Economy of Energy Production,” 22.

<sup>380</sup> Stewart, “Pyramids of Sacrifice?”.

<sup>381</sup> Revesz, “Rehabilitating Interstate Competition.”

<sup>382</sup> Ibid.

<sup>383</sup> Goklany, *Clearing the Air*.

the bottom, local jurisdictions were tackling the problem of air pollution well before the federal government decided to act.<sup>384</sup> Grossman has documented that some states have enacted more stringent regulations on pesticide use than required under the Federal Insecticide, Fungicide, and Rodenticide Act and Lennett and Greer have shown that states have introduced tighter regulations on the disposal of hazardous wastes than required under the federal Resource Conservation and Recovery Act.<sup>385</sup> In both cases, the fact that states have sought to enact stricter regulations than required by the federal government would seem to argue against the existence of a race to the bottom, at least as applies to the circumstances particular to these states and their regulations. Another historically-focused approach employed by three different studies analyzed agency behavior and environmental performance by state regulatory agencies after the Reagan Administration implemented a wide-ranging decentralization of environmental decision making; none of these three studies found that states engaged in behavior that would accord with there being a race to the bottom.<sup>386</sup> Shifting from direct study of regulatory agency behavior to an analysis of the behavior of private firms, a meta-analysis by Jeppeson, et. al. of eleven studies that analyzed the location decisions of manufacturing plants and other pollution-intensive industries found mixed results, with some studies finding that firms tend to locate in areas with laxer air quality regulations while other studies found no such correlation.<sup>387</sup> Finally, and perhaps critically, one study found that 88 percent of state environmental officials attested that concerns about industry location and siting affects environmental decision-making in their state.”<sup>388</sup> Summarizing this extensive body of empirical research, the upshot seems to be that, while there is not much evidence to support idea that states have lowered regulations in order to compete to attract industry and other capital investment, the vast majority of state environmental officials attest that concern about driving away industry does impact their state’s own policies and regulations.

It is improbable that competition amongst the states to attract shale gas development is creating downward pressure on state regulations, although the evidence does seem to support the idea that state decision-makers, both political and regulatory, may be moderating the severity of environmental and public health regulations and other costs that are imposed on the gas industry. As argued by Revesz, this behavior seems to accord with a policy choice that (most) states are making to strike a balance between shale gas development and

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<sup>384</sup> Ibid.

<sup>385</sup> Grossman, “Environmental Federalism in Agriculture: The Case of Pesticide Regulation in the United States”; Lennett, “State regulation of hazardous waste.”

<sup>386</sup> List and Gerking, “Regulatory Federalism and Environmental Protection in the United States”; Fredriksson and Millimet, “Strategic Interaction and the Determination of Environmental Policy Across U.S. States”; Millimet, “Assessing the Empirical Impact of Environmental Federalism.”

<sup>387</sup> Jeppesen, List, and Folmer, “Environmental Regulations and New Plant Location Decisions.”

<sup>388</sup> Engel, “State Environmental Standard-Setting.”

environmental and health protection that ensures that gas development occurs. This behavior does not appear to indicate that there is a regulatory “race to the bottom” occurring between shale gas producing states. The regulatory approaches employed by Pennsylvania and New York will be used as examples to support this interpretation.

Some states, such as Pennsylvania, clearly have concerns about implementing a regulatory standard that would make it cost-prohibitive for shale gas companies to operate in the state and thereby lose the jobs and economic development associated with shale gas development. Governor Tom Corbett’s administration has taken a number of steps to keep the cost of operating in Pennsylvania low and thereby attract shale gas companies. For example, instead of a severance tax, which most other states impose on operators, Pennsylvania opted to introduce an impact fee in February 2012, as part of Act 13.<sup>389</sup> While the mechanics of how the tax and the fee are calculated differ somewhat, the relevant point here is that some analyses have indicated that Pennsylvania will be charging the industry significantly less money than many other states do.<sup>390</sup> Another aspect of Act 13 designed to hold down costs for operators limits the ability of municipalities to control shale gas development through land use controls such as zoning.<sup>391</sup> Act 13 also introduced many of the more innovative and aggressive environmental and health protections that can be seen across the current regulatory spectrum, as noted in Chapter 3.

These aspects of Pennsylvania’s legislative and regulatory approach as embodied in Act 13 highlight a couple of points with regards to the race to the bottom theory. First, from a business perspective, regulations are significant not in and of themselves, but rather because they increase the cost of operation. Taxes levied on companies also increase the cost of operation. Although the focus of this paper is on regulation, Pennsylvania seems to be looking at regulations and taxes/fees imposed on industry in tandem and seems to have struck an implicit balance between implementing stronger environmental and health protections and charging operators less than many other states in the form of fees and taxes. A second point is that, although the Corbett Administration and its allies in the Pennsylvania General Assembly that supported Act 13 are concerned about keeping costs imposed on operators in check, the innovative and aggressive environmental and health protections introduced in Act 13 respond to the concerns that many Pennsylvanians have about shale gas development. Act 13 represents Pennsylvania’s attempt at balancing costs and benefits in a way that promotes the economic benefits of shale gas development while mitigating some of the associated environmental, health, and social costs. A third point is that Pennsylvania’s actions likely do not

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<sup>389</sup> “What The New Impact Fee Law, Act 13, Means For Pennsylvania.”

<sup>390</sup> Tavernise, “Pennsylvania Senate Passes Bill on Marcellus Shale Gas Drilling.”

<sup>391</sup> “What The New Impact Fee Law, Act 13, Means For Pennsylvania.”

represent a step towards a regulatory race to the bottom. The cost of development in Pennsylvania, after the passage of Act 13, may be higher or lower than in Arkansas, or any other state, but this does not impact the amount of development that occurs in Pennsylvania since shale gas operators possess sufficient capital to invest in development in both Arkansas and Pennsylvania. In addition to the regulatory costs and taxes or fees that are imposed by the government, development costs for shale gas (whether in Pennsylvania or any other state) are also influenced by factors such as operational costs related to local geology and environmental conditions, land and mineral lease costs, the presence and location of infrastructure such as gas pipelines and roads, and local labor costs. Operators' decisions about whether to drill for shale gas in Pennsylvania (or any other state) is primarily driven by how the cost of development (due to the various factors cited here) compares to gas companies' expectations of profit from the gas that they develop, not by whether regulatory costs are higher in one state than another.

Similarly, New York has not "lost out" on the opportunity to enjoy the economic benefits of shale gas development due to its long-running moratorium on development. If, and when, New York allows shale gas development to proceed, companies will evaluate the expected cost of development in the state and determine whether it makes economic sense for them to proceed. Like Pennsylvania, New York is seeking to balance the costs and benefits of shale gas development in a way that will win the support of the majority of New York State's voters and, based on New York's draft regulations, it appears that New York will enact stronger regulations than Pennsylvania has done. This, too, will not necessarily preclude development of shale gas resources in New York State. If operators determine that New York's regulations make development there unaffordable at present, they will refrain from drilling now but will likely move forward with drilling in the likely event that the market price for natural gas increases to a point that covers the cost of operating in New York at some point in the future. All of this is to say that the structure of natural gas development belies the race to the bottom rationale for federal regulation.

With ample capital available for shale gas development and the costs imposed by regulatory action comprising only one of myriad costs that operators face as they consider whether to drill in any given state, the nature of shale gas development does not seem to accord with the theory that states are competing with each other to attract finite capital investment by reducing regulatory standards and taxes. Each state does strive to strike a balance between reaping the benefits of shale gas development and mitigating its costs and so may decide on a regulatory posture that is more or less stringent than other states. This decision-making process seems to be more akin to the policy preference that Revesz describes than the race to the bottom that Stewart describes. As a result, without compelling evidence that competition

is driving down regulatory standards among the states, then, this criterion does not require that the federal government step in to assume regulatory authority over shale gas from the states.

### ***Regulatory Capture***

The second criterion that would require federal regulation, if it were to be found true, is one in which state regulatory mechanisms are “captured” by the regulated industry and therefore do not carry out regulatory responsibilities adequately. In a situation of this nature, federal regulation would either supplant or place a floor below state regulation, thereby ensuring that minimum regulatory standards are being met.

While capture could afflict regulatory agencies at the state or federal level, some commentators have argued that regulatory capture is more likely to occur at the state level than the federal level. Caminker posits that, while a concentrated industry interest clearly has an interest in ensuring that a state has lax regulations, free rides and other collective action obstacles can preclude a forceful and effective articulation of the public interest to argue for a stronger regulatory approach.<sup>392</sup> In these sorts of situations, when resources available to pro-regulation interest groups at the state level may be limited, “diffuse pro-regulation interests may be able to organize more easily at the national level, and hence national deliberations may reflect a more “balanced” consideration of competing interests regarding a regulatory regime.”<sup>393</sup> Another argument for greater susceptibility to regulatory capture at the state level is summarized by Spence. In this second argument, state regulators are more susceptible to political capture by the regulated industry than are federal regulators due to a lower level of public scrutiny that is generally applied to decisions made at the state level than to decisions made at the national level due to lower levels of media attention and lesser transparency of the policy-making process at the state level.<sup>394</sup>

Some commentators have noted, and sharply criticized, the degree of overlap that exists between state regulators of the oil and gas industries and members of those industries: “*Greenwire* reviewed the backgrounds of 95 oil and gas commissioners, board members and agency heads in the top 27 oil and gas states. Of those, 39 had an oil and gas background, or 41 percent.”<sup>395</sup> The same article proceeds to assert that this overlap between regulators and those they regulate is a “problematic “revolving door”” that presents conflicts of interests – in other words, symbolizes regulators that have been captured by the regulated industry.<sup>396</sup> Some commentators have similarly criticized the relatively small percentage of regulatory violations

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<sup>392</sup> Caminker, “State Sovereignty and Subordinacy,” note 44.

<sup>393</sup> *Ibid.*

<sup>394</sup> Spence, “Federalism, Regulatory Lags, and the Political Economy of Energy Production,” 24–25.

<sup>395</sup> Mike Soraghan, “Oil and Gas: 40% of State Drilling Regulators Have Industry Ties.”

<sup>396</sup> *Ibid.*

that prompt enforcement actions in most states and the small sizes of most of the fines that are levied.<sup>397</sup>

These characteristics of regulatory practice in many states could be evidence of regulatory capture – or it could be due to more legitimate reasons such as the necessity of having industry insiders represented among regulatory officials due to the technical expertise that they contribute and a regulatory strategy of working collaboratively, rather than confrontationally, with industry. Enforcement data too could be a reflection of the cooperative regulatory strategy that states generally employ and it could also be an artifact of the sharp increase in drilling activity in recent years combined with budgetary constraints that state governments face.

Ultimately, the author is unable to determine whether regulatory capture has occurred in some, all, or none of the states. As is illustrated in Table 1, in Chapter 3, which summarizes the presence of state regulation at each stage of the shale gas development process, almost all of states reviewed in this paper have promulgated regulations covering almost all of the stages of the shale gas development process. As noted, while some commentators have raised questions about the presence of industry representatives amongst regulatory officials and have argued that current enforcement practices are inadequate to protect public and environmental wellbeing, these practices could be in place because of the regulatory strategy that states employ – ultimately, a result of policy preference as opposed to regulatory capture.

Further research needs to be conducted on the question of capture, particularly when it comes to regulatory enforcement by the states. The divergence between regulations, as they are written, and regulations, as they are enforced, is striking and the causes of this divergence merit investigation. Until such research is conducted, however, and the findings indicate that industry has captured state regulatory agencies, the federal government should err on the side of allowing the states to continue exercising primary regulatory authority, not least because of the various arguments in favor of state regulation articulated above.

## Conclusion

In the American federalist system, regulatory authority over shale gas development could be exercised by either the federal government or the states. This analysis took a level-neutral approach to ask whether, considering the particular characteristics of shale gas development and the capacities and capabilities of federal environmental regulators and state environmental

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<sup>397</sup> Mike Soraghan, “Oil and Gas: Puny Fines, Scant Enforcement Leave Drilling Violators with Little to Fear.”

regulators, the states or the federal government is better suited to exercise primary authority over shale gas development.

This analysis finds that the states are better suited than is the federal government to regulate shale gas development and that, consequently, primary regulatory authority should remain with the states. In comparison to the federal government, the states are better suited to strike a balance between the costs and benefits of shale gas development, the majority of which occur within states borders; have greater technical capacity to regulate shale gas development; are better at innovating and tailoring regulations to suit local circumstances and conditions; and are most likely better at creating efficient regulations that also offer regulatory stability and certainty.

In addition to this primary test, a secondary analysis was also conducted to assess whether two common types of regulatory failure – a race to the bottom and regulatory capture – have compromised state regulation of shale gas development and concluded that there is no compelling evidence that either of these types of failure is occurring. As a result, the primary analysis stands and the states should continue to exercise primary regulatory authority.

## Chapter 6 – Conclusion and Policy Recommendations

### Introduction

This thesis has made the case that primary responsibility for regulating shale gas development should be left in the hands of the states, as opposed to being transferred to the federal government. Applying criteria derived from theories of regulatory federalism to the contemporary practice and regulatory structure of shale gas development, this thesis has argued that the states are better positioned than the federal government to serve as primary regulators of shale gas. The states have a better understanding of the local context in which the majority of costs and benefits of shale gas development are experienced, they have superior capacity to regulate the industry, they are more likely to pursue innovative regulatory approaches that better fit local contexts, and they are more likely to regulate efficiently and to provide greater regulatory stability.

While primary regulatory authority should remain with the states, that is not equivalent to arguing that the regulation of shale gas development should remain just as it is. The public controversy about shale gas development highlights the many concerns that people have with the process, and this thesis has touched upon a number of ongoing challenges that shale gas development is creating for public and environmental wellbeing that are not fully addressed by the current regulatory structure and approach. This chapter will introduce policy proposals that both states and the federal government could adopt to better protect public health, safety, and the environment.

### Policy Recommendations for States

State policy-makers and regulators can take a couple of relatively simple steps, focusing on building enforcement capacity and incentivizing shale gas operators to take greater responsibility for potential negative externalities caused by their operations, to significantly improve regulatory outcomes.

#### *Use a portion of oil and gas revenues to support needed personnel expansion*

Chapter 4 presented information about the gap that has opened in recent years between the number of new wells that are drilled every year and the number of personnel that enforcement agencies have on hand. Many agencies appear to be stretched to the limit in their efforts to conduct field inspections of both existing and new wells. Texas, for one, has attributed a decrease in enforcement actions starting in 2009 to a hiring freeze at the Railroad Commission

that took effect in 2008.<sup>398</sup> State budgets have been constrained across the country due to ongoing fiscal austerity.

Pennsylvania significantly increased the number of its field inspectors by using increased revenues from permit fees. While some states rely on severance taxes and other revenue streams from gas drilling to support general state expenses, some states might consider instituting a small surcharge on current taxes and fees relating to oil and gas development to support enhanced inspection and build their enforcement capacity. As presented in Chapter 5, there does not appear to be a race to the bottom among states, so a marginal increase in fees to support the hiring of needed personnel should not adversely impact gas industry operations.

***Incentivize regulatory compliance by shifting greater liability onto industry***

Chapter 4 also documented how many states seem to take a “compliance-oriented” approach to regulatory enforcement in which operators that are found to be in violation are usually given a chance, often multiple chances, to rectify the violation before penalties are imposed. The exception to this general practice appears to involve violations of reporting and permit requirements, where, sanctions are imposed much more readily. While there are a couple of possible explanations for this practice (permitting and reporting being a prerequisite for other regulation, a regulatory prioritization of conservation over environmental protection), from a risk management perspective it seems counterintuitive. Actions and violations that endanger environmental and public wellbeing, such as spills of hazardous materials, ought to result in fines even if minor administrative violations do not. The lack of sanctions for serious violations prompts the question of what incentive operators have to comply with environmental and health regulations. As noted, inspection capacity in most states has not kept pace with booming drilling and development activity. States cannot possibly inspect every well site under their purview even once a year at current staffing levels. If operators know that inspections are few and far between and that punishment is unlikely, it is worth inquiring how frequently operators might be intentionally or unintentionally violating regulations.

Policy makers and regulators could consider shifting some of the liability associated with the negative externalities of shale gas development, currently borne by society, back onto shale gas operators. Pennsylvania’s rebuttable presumption of operator responsibility for groundwater contamination has served as an incentive for operators to conduct testing prior to drilling.<sup>399</sup> Texas has increased penalties for operators that are cited for repeated violations.<sup>400</sup> States

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<sup>398</sup> Wiseman, “State Enforcement of Shale Gas Development Regulations, Including Hydraulic Fracturing,” note 7.

<sup>399</sup> 58 PA. CONS. STAT. ANN. § 3218; 25 PA. CODE § 78.52.

<sup>400</sup> Hannah Wiseman, “Questions Re: Shale Gas Regulation (personal Correspondence with Author).”

could consider emulating these measures from Pennsylvania and Texas, and adopting others, that shift some of the liability and responsibility for safe and responsible behavior onto operators and enhance the incentives facing them to comply with the law. For example, Fred Krupp, of the Environmental Defense Fund, has suggested that states should implement “compliance schemes where companies certify they have done it right and there are severe penalties if they perjure.”<sup>401</sup>

### **Policy Recommendations for the Federal Government**

While this thesis argues against a significantly enhanced federal regulatory role given the superior suitability of the states for primary regulatory authority, the federal government should focus on those areas where it has a comparative advantage and can add significant value. For example, the federal government can support more basic research, make sure that the states share information and research results are widely disseminated, and support disclosure services. The federal government should also consider strengthening its enforcement of existing federal laws that regulate interstate environmental and health effects.

#### ***Provide Research, Guidance, and Disclosure Services to the States***

Chapter 1 noted the significant uncertainty that exists today regarding the nature and magnitude of the risks presented by shale gas development. Scientists, policy-makers, and regulators know that risks of various kinds exist, but are still struggling to understand their severity and how to prioritize between them. In the meantime, contention and controversy have arisen in ways that are making the public uncomfortable. Chapters 3 and 4 highlighted the notable diversity of approaches that states are taking to regulate shale gas development and enforce regulations. While this diversity can be a source of strength, in terms of fostering policy innovation, and may also reflect legitimate variation in policy choices in different states, it is also possible that this diversity reflects a lack of accurate information among the states regarding the true nature of the risks they face or the regulatory options available to address them.

A robust effort by the federal government to provide research, guidance, and disclosure services to the states could go a long way towards remedying both of these situations. As noted in Chapter 2, the Environmental Protection Agency is conducting a two-year study on the threats posed to drinking water and groundwater by hydraulic fracturing. This study includes not just the fracturing stage, in which water mixed with chemicals and proppants is injected into a shale gas well, but also looks at the full lifespan of water in hydraulic fracturing, from acquisition of the water, through the mixing of chemicals and actual fracturing, to the post-

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<sup>401</sup> Friedman, “Get It Right on Gas.”

fracturing stage, including the management of flowback and produced water and its ultimate treatment and disposal. This study will therefore touch on many of the key risks presented by shale gas development and will hopefully define them more accurately and in greater detail than exists today. Further research, however, is needed on subjects beyond hydraulic fracturing and beyond potential impacts on groundwater. Topics requiring further research include: impact on habitat of drilling pads, long-term integrity of well casing, air emissions, cumulative impacts of water withdrawals, impacts caused by spills, migration of methane, and disposal of the myriad types of waste products produced by the drilling process. In addition to researching the sources and magnitudes of the risks posed by shale gas development, additional research might also help to establish how effectively different regulatory responses have been in mitigating these risks.

Wiseman suggests that creation of a federal clearinghouse could serve as a means for communicating information about risk and best practices to state regulators.<sup>402</sup> The author of this thesis would add that an information clearinghouse, whether run by the federal government or a nonprofit multi-stakeholder group such as STRONGER, could serve as a vehicle for information exchange between state regulators regarding risks and best practices for addressing them. That is, the clearinghouse would not only disseminate federal research to the states, but also serve as a forum for information exchange among the states. Advisors from the clearinghouse could provide technical assistance and training to states when they seek to upgrade their regulatory practices. An interesting twist on the standard research-and-best-practice functions of the clearinghouse would be to also include information about enforcement practices among the various states. Collecting and disseminating comparative analysis of enforcement practices would give policy-makers, regulators, and citizens in each state a better understanding of how regulatory practices in their state compare to others around the country.

### ***Enforce Existing Federal Regulations***

As noted in Chapter 5, the federal government should retain regulatory responsibility for those externalities that have potential interstate effects. The federal government already regulates air emissions that can cross state boundaries under the Clean Air Act, interstate water contamination under the Clean Water Act, and seismic activity that can cross state lines resulting from underground injection of wastewaters under the Safe Drinking Water Act.

Based on research findings regarding risk factors and effective mitigation, the EPA should consider (and in some cases, is already considering) enhanced regulation and enforcement activity on a few fronts. The agency should consider strengthening enforcement of regulations

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<sup>402</sup> Wiseman, "Risk and Response in Fracturing Policy."

controlling air emissions, particularly methane emissions, under the Clean Air Act. The agency should also consider tightening pretreatment and effluent standards for wastewater disposal in publicly-owned treatment works under the Clean Water Act. Finally, the EPA regulates injection of drilling wastes into Underground Injection Control Class II wells under the Safe Drinking Water Act. After reports surfaced in Ohio that injection of wastewater into these wells was the likely cause of earthquakes, the state updated its implementation and enforcement practices under the Safe Drinking Water Act in recognition of this risk.<sup>403</sup> EPA could encourage other states with primacy to update their own regulation of underground injection control wells as the agency did in encouraging Pennsylvania to bring its use of publicly-owned treatment facilities into compliance with the Clean Water Act.

## **Conclusion**

This thesis aspires to make a contribution to the ongoing debate about shale gas development and hydraulic fracturing. Focusing on the role of the state in mitigating the risks associated with shale gas development, I argue that, in most circumstances, state governments are better situated to exercise regulatory authority over this type of economic activity than is the federal government. Furthermore, building on my analysis of current regulatory practice, I present a couple of ideas that both state governments and the federal government can pursue to significantly improve regulatory outcomes and further the goals of protecting public health and safety and protecting the environment without imposing unreasonable costs on an important economic activity.

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<sup>403</sup> Palmer, “Ohio Agency Says Fracking-related Activity Caused Earthquakes.”

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