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Evaluating the Oversight of Shale Gas Production for Ideas to Manage Risks

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Evaluating the Oversight of Shale Gas Production for Ideas to Manage Risks

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Abstract

To encourage shale gas production in the United States, Congress enacted exceptions so that producers would not have to comply with established regulatory oversight designed to protect people and the environment. However, hydraulic fracturing in the Marcellus shale play is quite different from previous natural gas production. The presence of toxic substances in underlying rock strata and the need of a disposal option for flowback waters create additional risks. In response to these risks, governments may revise their regulatory controls to reconcile energy production with health and environmental protection.

Keywords: shale gas; regulations; public health; environmental damages
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Introduction

As part of an effort to develop and produce energy from domestic sources, governments around the world are seeking alternative energy sources. One new source is the commercial viability of extracting natural gas from shales. By using horizontal drilling with hydraulic fracturing, deep deposits of shale gas can now be tapped. However, fracturing for natural gas is controversial because the well drilling and production may release contaminants into the air, ground, and water. Persons and communities dependent on drinking water sources are concerned about the toxic substances in fracturing fluids (US Department of Energy, 2011; Skone, 2012). Disposal of wastewater from fracturing activities presents challenges and potential problems. In addition, significant releases of air pollutants also accompany gas extraction activities (Howarth et al., 2011). Uncertainties about future adverse health and environmental consequences from shale gas production activities challenge policy makers in determining whether additional governmental oversight is needed.

Federal, state, and local governments, as well as regional agencies, have taken actions that address the potential for water contamination from shale gas production (Blohm et al., 2012). Some states including New York, New Jersey, and Maryland temporarily banned some hydraulic fracturing activities until more information was available on environmental and human health risks. This paper looks at legislative and regulatory provisions to discern how governmental actions are balancing the production of shale gas with responsibilities to protect land, water, and air resources as well as human health. An evaluation of the regulatory provisions that are or could be employed to regulate shale gas production raises the question of who should bear the risks of health and environmental damages that accompany gas production activities. State and local governments have sought the creation of jobs and economic activity without fully considering the costs that shale gas production places on neighbors, communities, and future generations (Hatzenbuhler and Centner, 2012). The discussion of governmental regulatory oversight identifies four suggestions for managing externalities accompanying shale gas production: (1) greater oversight, (2) public disclosure of fracturing chemicals, (3) severance taxes, and (4) encouraging less damaging practices.

Environmental and Health Concerns

A majority of Americans are not cognizant of the environmental conditions that existed prior to the adoption of major US federal environmental legislation. In 1970, Congress adopted the Clean Air Act authorizing the development of comprehensive federal and state regulations to restrict damaging gaseous emissions. In 1972, Congress's attention focused on clean water and new authority was provided to the Environmental Protection Agency (EPA) in Clean Water Act to implement pollution control programs.

Additional provisions for water quality were featured in the Safe Drinking Water Act of 1974. The Resource Conservation and Recovery Act of 1976 and the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 addressed hazardous wastes. These legislative enactments established basic health and safety requirements that preclude persons and states from imposing costs and damages on neighboring and downstream resource users. The success of these laws in preventing harm means that few Americans have experienced the personal suffering, injuries, or damages that used to accompany activities polluting the environment.

The meaning of pollutant reduction rules in the United States may be contrasted with damages associated with industrial production without adequate governmental oversight in other parts of the world. In analyzing health effects from fine particulate matter pollution in Guangzhou, China, researchers estimated that 9,700 premature deaths could be prevented annually if the city would meet the air quality standards of the European Union (Jahn et al., 2011). Water contamination problems in Kenya show that, in the absence of governmental regulations assuring water quality, lapses will lead to health problems (Hayanga, 2007). Furthermore, if a government fails to enforce its laws, persons will engage in prohibited activities that cause additional contamination of resources (Mohammad, 2011).

Since the above-noted US federal laws were enacted prior to the use of current horizontal drilling and hydraulic fracturing technology, the issue is whether the laws are adequate to respond to pollution problems posed by shale gas production. More significantly, exceptions granted to the oil and gas industry in the Energy Policy Act of 2005 to foster the production of domestic sources of energy eliminate some significant provisions that protect people and property (US Public Law 109-58, 2005). Given exceptions in five major laws in the United States and toxic substances from rock strata being present in some wastewater, it is not clear that existing federal oversight is sufficient to safeguard public health and environmental resources.

Possible Water Pollution

The greatest concern centers on water pollution and whether sufficient oversight exists to preclude shale gas production activities from contaminating sources of drinking water (Finkel and Law, 2011). To encourage domestic energy production, the Energy Policy Act provided an exemption to the US Safe Drinking Water Act (US Code, 2006, tit. 42, § 300h). Under this exception, the federal government provides little oversight over toxic chemicals that are injected during hydraulic fracturing while other underground injections are regulated (Roberson, 2012; Tiemann and Vann, 2012). Rather, states have drinking water laws that provide oversight.

A second problem involves potential contamination of surface waters by the flowback of wastewater generated from gas production (Gradijan, 2012; Skone, 2012; Wiseman, 2012a). After cracking open a well, large amounts of wastewater return to the surface and are sometimes temporarily stored on site in artificial impoundments (URS Corporation, 2011). However, shale gas

producers do not need a permit under the Clean Water Act if they do not contaminate water through contact with 'overburden, raw material, intermediate products, finished product, byproduct, or waste products' (US Code, 2006, tit. 33). The absence of sufficient oversight of flowback waters by the federal government raises concerns about possibilities of contamination.

A third water pollution concern is whether publically owned treatment works (POTWs) constructed to treat sewage are appropriate for the treatment of wastewater (Latham, 2011). Shale gas producers in Texas and other western states are able to re-inject fracturing liquid wastes deep underground where they are stored (Rahm and Riha, 2012). However, in areas of the eastern United States, the geology is unsuitable for nearby injection wells, meaning that some other disposal outlet is needed for wastewater (Rahm and Riha, 2012). Some producers have turned to local POTWs and have made arrangements to have their wastewater treated and discharged into surface waters.

However, fracturing wastewater contains some very different chemicals than sewage. In addition to toxic chemicals used for fracturing, the Marcellus shale play releases substances from the rock strata that include arsenic, selenium, radio-nuclides, and other noxious organics (Keister, 2010; Balaba and Smart, 2012). Given changes in chemical combinations used in fracturing, the time and expense of submitting data sheets for new chemical mixtures, and the costs of testing, problems in following mandatory treatment procedures may cause a POTW to accidently discharge harmful contaminants into surface waters. Despite the best regulatory controls to preclude the discharge of wastewater containing substances that exceed maximum contaminant levels, lapses may be expected and downstream water users could be exposed to harmful substances.

Possible Land and Air Pollution

Despite the toxic materials that are discharged from shale gas production, fracturing wastes are exempted from the Resource Conservation and Recovery Act's federal hazardous waste regulations (US Code, 2006, tit. 42, § 6921). The exemption is founded on how the waste material was generated (US EPA, 2002), and was based in part on the need for economic activity. Under this exemption, trace amounts of hazardous substances may be released into the environment. For hazardous substances including natural gas, natural gas liquids, liquefied natural gas, and synthetic gas usable for fuel regulated under the Comprehensive Environmental Response, Compensation and Liability Act, an exemption means safeguards are not applicable to protect humans and the environment (US Code, 2006, § 9601).

Shale gas operators also do not need to report annual releases of toxic chemicals under the federal Emergency Planning and Community Right-to-Know Act except for cases where a sufficient quantity of a hazardous substance is released (US Code, 2006, tit. 42, § 11023). This means that fracturing operations may use hazardous chemicals in close proximity to people and communities without sufficient information for use by responders to emergencies. Shale gas production employs a wide range of toxic chemicals

that may affect the endocrine system, brain and nervous system, and the immune and cardiovascular systems (Colborn et al., 2011).

Governments are concerned about the abandonment of dry holes and unproductive wells that may contaminate water supplies (Mitchell and Casman, 2011). In the absence of a responsible property owner to pay for actions required to prevent contamination, costs in safeguarding public health may fall on a government. In 2009, the state of Pennsylvania deemed it necessary to expend considerable public funds to plug 259 abandoned wells because of leaking natural gas, oil, and acid mine drainage into groundwater, surface water, and air that threatened public health (Finkel and Law, 2011).

Another concern involves the release of air pollutants from shale gas production (US EPA, 2013; Schneiderman, 2012). Drilling releases toxic volatile compounds and methane from drilling activities that can mix with nitrogen oxides from the exhaust of stationary drilling equipment to produce ozone, which can drift nearly 200 miles to damage people's lungs as well as crops (Colborn et al., 2011). Air pollutants accompanying gas production also include elevated levels of benzene, ethyl-benzene, toluene, and xylene meaning that air emission from wells may cause increased eye irritations, asthma symptoms, acute childhood leukemia, acute myelogenous leukemia, and multiple myeloma (McKenzie et al., 2012). A study on the Barnett shale in Texas showed that 'the aggregate effect of oil and gas construction and resultant air pollution was greater than all vehicular traffic in the Dallas-Fort Worth area' (Mergen et al., 2011). A recent report by EPA observed that limitations in air quality data 'have contributed to emission factors of questionable quality' (US EPA, 2013).

Health Risks

A major concern with shale gas production is that faulty equipment and human error may result in injuries. Risks of future damages from accompanying production activities have not been adequately considered. Exposure to chemicals used for fracturing can have delayed, lifelong effects on people and may span generations (Colborn et al., 2011). A survey of the shale gas industry in four states funded by the Energy Institute of the University of Texas disclosed violations that may cause health damages (Wiseman, 2012b). Others report of groundwater contamination and becoming ill due to the exposure to fracturing fluids and difficulties in learning the origin of injurious chemicals (Obold, 2012; FPL Farming Ltd. v. Environmental Processing Systems, LC, 2011). Yet plaintiffs advancing claims for injuries arising from shale gas production have not been successful in establishing their cases (King et al., 2012). Given the lack of information on low-dose cumulative health effects of contaminants from gas wells and complications in establishing exposure to carcinogens causing injuries, plaintiffs will have difficulties in proving their cases (Jenner and Lamadrid, 2013; Vandenberg et al., 2012).

The lack of sufficient research on conditions concerning shale gas extraction from the Marcellus shale play precludes determinations that there are no adverse environmental consequences (Wiseman, 2009). Given the large

variety of chemicals being employed in shale gas production (URS Corporation, 2011), the short time since the chemicals have been used, the time periods before contaminants moving through groundwater can be detected, and the lack of specialized training of health professionals who are treating exposed individuals, it is too early to claim that there are no injuries. Because there are no long-term health studies, it cannot be said that the various chemical mixtures used in fracturing and the wastewater discharges do not lead to serious injury. Experts originally concluded that ethylene dibromide was safe but subsequent health studies offered proof that it was injurious to human health (US EPA, 1983).

Reliance on State Regulations

In the absence of sufficient federal oversight, individual US states have needed to weigh the benefits of energy production against potential long-term damages consisting of human health problems and environmental degradation. As might be expected, states have addressed shale gas production quite differently. Americans in states familiar with gas extraction, such as Texas, have tended to welcome the development of wells under existing governmental oversight (Rahm, 2011). New jobs, income, and economic development accompanying gas extraction have been important to many communities (Wiegle, 2011). Years of experience of producing energy without serious health or environmental consequences have led to unquestioned support for new hydraulic fracturing activities. However, where energy exploration has not been as prevalent, such as Maryland and New York, states have proceeded more cautiously (Rahm and Riha, 2012).

While the flexibility offered by state regulation of shale gas production might be applauded, the question remains whether the federal government is meeting its obligations to protect citizens in states downstream (including downwind) from gas production activities. Governments should also be concerned about cumulative effects of pollutants. Water and air pollutants flow to other states. A state government overseeing gas production activities may not fully consider all of the costs imposed out-of-state. State governments may be unable to adopt first-best policy instruments creating distortions in environmental choices (Kunce and Shogren 2005). Federal oversight is needed to protect people, resources, and the environment in situations where there are spillovers of pollutants from another state.

Identifying Regulatory Needs

The evaluation of US federal legislation addressing the risks and pollution that accompany shale gas production suggests that Congress and state legislatures have acted to encourage shale gas production at the expense of long-term health and environmental damages. Shale gas production should not

posit damages on people, communities, and future users of water and air resources. At the same time, governments do not need to adopt overlapping or unnecessary requirements that detract from the efficient production of energy. The challenge is to preserve the viability of shale gas production while guaranteeing the public a healthy and safe environment. Four suggestions are offered to enhance federal oversight of shale gas production to better reconcile competing interests.

Greater Federal Oversight

The initial shortcoming is the absence of adequate oversight by the US federal government. Fostering domestic energy production should not embody the removal of health, safety, and environmental provisions that successfully have protected Americans for a generation. Rather, shale gas production offers the United States an opportunity to expand beneficial economic activities while protecting people and the environment. The US federal government has an obligation to protect people from harmful activities affecting commerce among the states. In situations where a state may foist pollutants on downstream resource users, only involvement by the federal government can provide redress.

The exemptions for gas extraction activities enacted by the Energy Policy Act of 2005 and other federal laws need to be changed given the problems that accompany shale gas production. This was recognized in a bill considered by the US House of Representatives (US HR Bill 1084, 2011). US HR Bill 1084 sought to repeal the exemption for hydraulic fracturing in the Safe Drinking Water Act and require the disclosure of chemicals intended for use in underground injection to the Administrator of the primary state enforcement agency (US HR Hearing, 2011). The need for a revision to federal legislation is based on recent information suggesting that accidents accompanying injections of toxic chemicals can cause significant health and environmental problems.

Another example of the need for federal regulation is the discharge of radioactive wastewater to surface waters being used downstream as sources of drinking water. Radioactively-charged effluents from fracturing wastewater being treated at POTWs in Pennsylvania have been discharged into the Monongahela and Susquehanna rivers (Latham, 2011). In other locales, elevated amounts of benzene, and mercury in flowback challenge operators to adequately treat wastewater to preclude toxic levels from being discharged into surface waters (URS Corporation, 2011). People in downstream communities need federal safeguards to ensure safe drinking water supplies.

Public Disclosure of Hazardous Substances

The second suggestion is to provide governmental officials access to more information about the toxic chemicals being used to fracture wells (US HR Hearing, 2011). When Congress amended the toxic reporting requirements of the Emergency Planning and Community Right-to-Know Act so that hazardous substances used in fracturing do not need to be reported, it restricted the ability of responders to emergencies to respond to emergency situations. Without

information of toxic substances, medical personnel are limited in providing immediate treatment to persons accidentally exposed to toxic chemicals. Congress could repeal this exception. The public disclosure of more information offers three benefits. Such disclosure would support faster and effective cleanup efforts where spills occur (Wiseman, 2011). Public disclosure of toxic chemicals being used might encourage drilling companies to find combinations of safer chemicals. Finally, the disclosure of chemicals would allow individuals to make choices about exposure to risks.

A number of US state legislatures have acknowledged the public's call for more information about the toxic substances employed in fracturing activities by considering legislation that requires disclosure (Pennsylvania House Bill 1950, 2012; Texas Natural Resources Code, 2012). The disclosure legislation generally notes that for qualified medical emergencies, health professionals should have access to the ingredients of chemical mixtures that are trade secrets (Texas Administrative Code, 2012). Other provisions may require the disclosure of ingredients for spills (Colorado Code of Regulations, 2012).

Severance Taxes for Cleanup Costs and Damages

A third need for addressing the risks and damages that accompany shale gas production involves the implementation of a mechanism that would provide monies to use in addressing cleanup costs and damages. Production activities are accompanied by accidents, and bankrupt and abandoned wells require attention to prevent public harm. Reports suggest that surface spills and discharges partially-treated wastewater have occurred (Urbina, 2011). These events recommend the development of a funding mechanism for addressing mishaps and providing recompense to uncompensated injured victims.

Rather than relying on general tax revenues to pay for costs arising from gas extraction activities, shale gas production should be setting aside monies for these expenses. This would follow the 'polluter pays' principle under which businesses emitting pollutants internalize the costs related to damages they cause. States with shale gas plays should consider developing a natural gas severance tax to fund oversight of production activities and pay for damages accompanying accidents (Allen, 2011). The implementation of a severance tax could help the market more accurately reflect the costs being imposed by shale gas production resulting in a more efficient allocation of resources.

Less-damaging Production Practices

Recovery of shale gas is an economic enterprise that would respond to incentives and regulations. Through planning and environmental assessments, region-appropriate strategies may be implemented to manage shale gas development to minimize pollution and damages (Rahm and Riha, 2012). Current practices involving the use of hazardous chemicals and processes having adverse effects on the environment can be changed if the industry is encouraged to develop environmentally-friendly alternatives (URS Corporation, 2011). Technological choices exist. Alternatives involving wastewater chemistry, cost-effectiveness, reuse and discharge plans, and

byproducts may be selected to reduce pollutant discharges accompanying shale gas production (Amadun et al., 2009).

For example, shale gas producers are cognizant of the costs that are needed to safely dispose of fracturing wastewater. Although on-site treatment is costly, procedures exist to reduce the need for fresh water and trucking costs thereby decreasing negative environmental externalities. It has also been acknowledged that additional on-site treatment technologies would likely evolve if there was a regulatory call for it (URS Corporation, 2011). Governments and the shale gas industry need to work together to develop technology, processes, and policies to minimize the adverse health and environmental effects accompanying shale gas production.

Conclusion

With the encouragement of domestic sources of energy, the United State has rapidly expanded its natural gas production. With exceptions exempting shale gas activities from requirements of several federal laws, fracturing activities are being conducted without sufficient oversight of major federal environmental laws that exist to protect people and the environment. In the absence of adequate federal protection, individual US state governments have had to develop laws and regulations to provide for public safety and protect their water, air, and land resources from contaminants. Yet, the efforts by many states do not fully respond to the risks accompanying shale gas production.

The economic advantages of not imposing additional requirements for natural gas extraction activities should be balanced against increases in the complexity of different states' regulations, governments' regulatory costs, the imposition of health costs on persons living and working downstream and downwind, and the damages to the country's natural resources. Current regulations are not doing enough to encourage the adoption of new technology and processes that could minimize risks and damages.

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