The Shale Gas Boom and the Need for Rational Policy

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High-volume, slick water hydraulic fracturing of shale relies on pumping millions of gallons of surface water laced with toxic chemicals and sand under high pressure to create fractures to release the flow of gas. The process, however, has the potential to cause serious and irreparable damage to the environment and the potential for harm to human and animal health. At issue is how society should form appropriate policy in the absence of well-designed epidemiological studies and health impact assessments.

The issue is fraught with environmental, economic, and health implications, and federal and state governments must establish detailed safeguards and ensure regulatory oversight, both of which are presently lacking in states where hydraulic fracturing is allowed. (Am J Public Health. 2013;103:1161-1163. doi:10.2105/AJPH.2013.301285)

BALANCING THE NEEDS OF THE economy and society with the protection of the environment and health is not a new issue. Countless global examples exist, such as the contamination of bodies of water as a result of oil spills, degradation of the environment resulting from coal mining or mining for metals and ore, and unregulated industrial growth contributing to air, soil, and water pollution. As the global demand for energy, be it oil, coal, nuclear, hydroelectric, wind, or solar, accelerates, the challenge to meet the demand without causing undue harm to either the environment or human health becomes more complicated and difficult.

Oil and coal combined represent nearly 60% of the world's energy supply. Both, however, have the disadvantage of having a negative impact on the environment, including but not limited to contributing to atmospheric pollution. Natural gas is abundant around the world and is commonly viewed as a cleaner and more efficient energy source. Moreover, it is easy to transport, reasonably economical, requires comparatively quick construction timelines and low capital costs, and has the added advantage of bringing jobs to economically depressed regions where natural gas reserves are plentiful.

The search for energy alternatives has benefited substantially from advances in technology. Unconventional drilling is now the primary method used to extract natural gas from vast scale deposits by means of high-volume, horizontal hydraulic fracturing from long laterals using multi-well pads. This extraction process relies on pumping millions of gallons of surface water laced with sand and toxic chemicals (slick water) under high pressure to open or create fractures in the shale formation, thus releasing the flow of gas to the surface. Along with the natural gas, massive quantities of waste fluids are also returned to the surface. Of the fracking fluid, 30% to 70% will re-surface as flowback fluid, bringing with it toxic substances including heavy metals, volatile organic compounds including benzene, and naturally occurring radioactive materials. The materials acquired by the flowback fluid can be equally as or more toxic than the hydraulic fracturing fluid injected into the wells. The disposal and storage of the flowback waste fluids is a significant public health issue. Presently, flowback waste fluids are held in open reserve pits or in non-airtight metallic containers, the contents of which must be disposed of safely because of the real possibility of contamination of air and soil, as well as waterways and watersheds. To date, most states do not have adequate regulations on drilling, particularly related to the disposal of these toxic fluids. Concerns about the potential for contamination of water provided the impetus for the US Environmental Protection Agency to study the issue. In December 2011, the agency released a draft report of its investigation of groundwater contamination near Pavillion, Wyoming, and concluded that the groundwater was likely contaminated by the hydraulic fracturing activities.

Despite this finding, current laws allow the oil and gas industry to inject hazardous materials unchecked near drinking-water supplies. Fracturing fluids are exempted from the Safe Drinking Water Act, which authorizes the Environmental Protection Agency to set national health-based standards for drinking water to protect against both naturally occurring and manmade contaminants that may be found in drinking water. The oil and gas industry was granted this exemption in the Energy Policy Act of 2005, which amended the Safe Drinking Water Act to exclude 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.

The natural gas extraction process itself produces emissions of multiple health-hazardous air pollutants, including benzene, toluene, ethylbenzene, xyylene, formaldehyde, hydrogen sulfide, acrylonitrile, and methylene chloride. Air quality is further compromised by heavy truck traffic to and from the drilling site. One well site could require as many as 3389 one-way truck trips, according to the New York Department of Environmental Conservation's 2011 draft environmental impact statement on hydrofracking.

Natural gas extracted from shale may also contribute substantially to global greenhouse gas emissions. Natural gas is composed largely of methane, a powerful greenhouse gas with a global warming potential far greater than that of carbon dioxide. An estimated 3.6% to 7.9% of the...
methane from shale gas production escapes to the atmosphere in quantities that are twice as great as those from conventional gas. Recent studies by the National Oceanic and Atmospheric Administration have indicated that methane is leaking at rates even higher than previously anticipated. Reconciling the benefits of natural gas and its potential harms to both the environment and public health is a key challenge facing policymakers.

At present, the natural gas industry operates in a world in which safety measures are self-regulated, laws are protective of the industry rather than of those living in close proximity to drilling sites, and environmental remediation is the reactionary norm. If precautions are not enforced, unconventional drilling for natural gas has the potential to cause serious and irreversible damage to the environment by having a negative impact on air, soil, and water quality as well as the climate.

The paucity of scientific evidence looking at the public health impact of natural gas extraction complicates the issue. It is difficult and potentially dangerous to formulate policy and regulations in a vacuum. Although there have been anecdotal reports of adverse health effects (e.g., severe headaches, sinus problems, nosebleeds) among those living in close proximity to shale gas drilling, there is a paucity of objective, evidence-based epidemiological research. Witter et al. in their review of the available literature, showed that evidence of risk to human health ranges from the comparatively benign (e.g., psychological problems) to the more serious (e.g., cancer, cardiovascular disease, and asthma). Implicit in this review is a lack of well-designed epidemiological studies to scientifically quantify the potential for human harm. That being said, in the absence of health impact assessments on human health, animals can often shed light on the potential harmful effects of drilling. Like the canary in the coal mine, cows, horses, poultry, and other wildlife can be used as sentinels to forecast impacts to human health.

Animals tend to suffer more direct exposure and have shorter life and reproductive cycles than humans. A recent qualitative study published in a peer-reviewed journal focused on the impact of gas drilling on animal health (interviews conducted with animal owners in Colorado, Louisiana, New York, Ohio, Pennsylvania, and Texas). The researchers documented reproductive (e.g., irregular cycles, failure to breed, stillbirths), neurological (e.g., seizures, incoordination, ataxia), gastrointestinal (e.g., vomiting, diarrhea), and dermatological (e.g., hair and feather loss, rashes) problems among livestock. These findings need to be verified in a more quantitative study; the implications for animal health as well as for the beef and dairy industries could be considerable. Moreover, on the basis of the findings from this qualitative study, we argue that the need to study the potential for harm to human health is urgent.

The concern over the paucity of evidence has highlighted the distinction between science-based advocacy and advocacy-based science. Scientists who have expressed support of hydraulic fracturing have been accused of being part of the industry’s back pocket, and those who have come out against it have been accused of promoting their own environmental agenda. The role of science in advocacy is important, but regardless of one’s position, methodologically well-designed studies need to be conducted on which policy recommendations should be made. With regard to the public health implications of natural gas drilling, we should not conclude that an absence of data implies that no harm is being done. The burden of proof should not be the public’s to bear.

In the absence of methodological studies, many states and countries have taken a precautionary stance and banned drilling. France and Bulgaria have banned hydraulic fracturing. The United Kingdom, however, is moving ahead with drilling despite strong protests against this decision. Other countries with large natural gas deposits such as Poland, South Africa, and Canada are under pressure from the gas industry to allow drilling for natural gas. In the United States, New York State, in contrast to neighboring Pennsylvania, has an extended moratorium on drilling pending review of an environmental impact assessment conducted by the State Department of Environmental Conservation. Concerns about the content of the report, as well as fears of water contamination, prompted the governor to ask the state health commissioner to form a panel to determine whether the Department of Environmental Conservation adequately addresses potential impacts to the environment and to the public’s health.

In his 2012 State of the Union Address, President Obama said that his administration would take every possible action to safely develop natural gas energy. He called on companies that drill for gas on public lands to disclose the chemicals that they use. The president’s implied message is that his industry needs to be developed without jeopardizing the health and safety of people and animals. The Centers for Disease Control and Prevention, in a recent statement by the Director’s Advisor, recommended further study is warranted to better understand the potential public health impacts.

Natural gas has been in the formation for millions of years and is not going anywhere and will continue to be an important source of energy, but in the absence of health impact assessments on both wildlife and humans, the rush should be tempered. Given the potential for harm, we advise precautionary measures and support the burden of proof potentially harmful actions rest on the assurance of safety in the face of scientific uncertainty. So ever it it’s true living in areas both active and planned drilling to study the potential for harm to mandate policies and strict regulations to ensure that adverse effects to the public health are not an unfortunate consequence of an industry that is eager to capitalize on its new energy boon.

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