

# DRILLING DEEPER

**Impacts of Hydraulic Fracturing  
and Related Grantmaking  
Strategies**

September 2012

## AUTHOR

Michael Passoff is a consultant to foundations and nonprofits on issues ranging from environment and energy to food safety and social justice. Michael served as Senior Program Director of the As You Sow Foundation's Corporate Responsibility Program for more than a decade and now serves as senior consultant on its environmental health program and hydraulic fracturing shareholder campaign. Michael has engaged with senior management at many of the largest U.S. natural gas companies including ExxonMobil, Chevron, ConocoPhillips, Apache, Anadarko, Range Resource and Ultra Petroleum, as well as being in regular communication with leading NGOs working on this issue. Michael is the founder and CEO of Proxy Impact, a proxy voting and shareholder advocacy consulting service for foundations and other mission-based organizations. Michael authors an annual *Proxy Preview* designed specifically to help foundations align their investments and mission. The Chicago Tribune called the *Proxy Preview* the "bible for socially progressive foundations." His shareholder advocacy work led him to be named by Ethisphere Magazine as one of 2009's "100 Most Influential People in Business Ethics." He also received the 2009 Climate Change Business Journal award for a successful shareholder campaign to reduce greenhouse gas emissions.

## ACKNOWLEDGEMENTS

This report was made possible by the generous support of members of Health and Environmental Funders (HEFN)'s Hydrofracking Working Group.

The author would like to offer special thanks to those foundation and NGO leaders who were interviewed, reviewed or provided content for this report: Bill Allayaud, Environmental Working Group; Andrew Behar, As You Sow; Kenny Bruno, New Venture Fund/Tar Sands Campaign; Lauren Davis, The 11th Hour Project; Lois Gibbs, CrossCurrents Foundation/Center for Health and Environmental Justice; Deborah Goldberg, Earthjustice; Marilu Hastings, Cynthia & George Mitchell Foundation; Cuong Hoang, Mott Philanthropic; Patricia Jenny, New York Community Trust; Caitlin Johnson, George Gund Foundation; Philip Johnson, Heinz Endowments; Heeten Kalan, New World Foundation; Gwen Lachelt, Earthworks/Oil & Gas Accountability Project; Rich Liroff, Investor Environmental Health Network; Amy Mall, Natural Resources Defense Council; Samantha Malone, FracTracker; Amy Panek, Park Foundation; Diane Schrauth, William Penn Foundation; Renee Sharp, Environmental Working Group; and Carol Zagrocki, Colcom Foundation.

Thanks also to HEFN staff, particularly Karla Fortunato, whose support, guidance and contributions were invaluable to this project.

Editorial support was provided by Lauren Linville, HEFN; Amy Galland, As You Sow; and Lauren Dockett, University of Hong Kong. Production design was by Winking Fish.

**FAIR USE NOTICE:** This report may contain copyrighted material whose use has not been specifically authorized by the copyright owner. We are making such material available in an effort to advance understanding of health, environmental and social issues. We believe this constitutes a 'fair use' of any such copyrighted material as provided for in Section 107 of the U.S. Copyright Law. In accordance with Title 17 U.S.C. Section 107, this report is distributed without profit for research and educational purposes. If you are interested in using any copyrighted material from this publication for any reason that goes beyond 'fair use,' you must first obtain permission from the copyright owner.

# TABLE OF CONTENTS

<b>INTRODUCTION .....</b>	<b>3</b>	<b>FUNDER STRATEGIES.....</b>	<b>16</b>
<b>HYDRAULIC FRACTURING IMPACTS .....</b>	<b>4</b>	<i>Challenges and Opportunities for Grantmakers .....</i>	<b>16</b>
<b>Environmental Impacts .....</b>	<b>8</b>	<b>Challenges .....</b>	<b>16</b>
<b>Water .....</b>	<b>8</b>	Lack of coordination .....	16
Groundwater contamination .....	8	Legal exemptions.....	16
Surface water contamination .....	9	Political support.....	16
Storage.....	9	Framing the issue.....	16
Treatment .....	9	Opposing views.....	16
Disposal.....	9	<b>Opportunities .....</b>	<b>17</b>
Earthquakes .....	9	Range of Issues.....	17
Scarcity .....	9	Visibility.....	17
Recycling .....	9	Research.....	17
<b>Air .....</b>	<b>10</b>	<b>Priorities .....</b>	<b>17</b>
Emissions .....	10	Coordination and movement building .....	17
Air quality.....	10	Research.....	17
<b>Agriculture and Wildlife .....</b>	<b>10</b>	Communications.....	17
Farming and ranching .....	10	Legal strategies .....	18
Wildlife .....	10	Immediate needs and crisis intervention .....	18
<b>Climate.....</b>	<b>11</b>	<b>Strategies .....</b>	<b>18</b>
Methane emissions .....	11	States with existing natural gas fracking operations .....	18
Bridge fuel.....	11	States with existing natural gas fracking operations – NGO activity and grantmaking examples.....	19
<b>Community Impacts.....</b>	<b>12</b>	<b>States with planned or potential         natural gas fracking operations .....</b>	<b>20</b>
<b>Social Impact.....</b>	<b>12</b>	States with planned or potential natural gas fracking operations – NGO activity and grantmaking examples.....	20
<b>Economic Impact .....</b>	<b>12</b>	<b>Local vs. national activities .....</b>	<b>21</b>
Housing.....	12	Local vs. national activities – NGO activity and grantmaking examples.....	21
Property rights and values .....	12	<b>Regional collaboration.....</b>	<b>23</b>
Water supply .....	12	<b>Issue specific collaboration .....</b>	<b>23</b>
<b>Infrastructure.....</b>	<b>13</b>	Issues of concern for funders include: .....	23
Roads .....	13	<b>Endnotes .....</b>	<b>25</b>
Pipelines.....	13		
<b>Democratic Process .....</b>	<b>13</b>		
Local control.....	13		
Citizen rights .....	13		
Political contributions and lobbying.....	14		
<b>Health Impacts .....</b>	<b>14</b>		
<b>Exposure and Contamination .....</b>	<b>14</b>		
Chemicals .....	14		
Air pollution.....	14		
Water pollution .....	14		
Radioactive material.....	15		
<b>Studies and Policy.....</b>	<b>15</b>		
Research.....	15		
Policy .....	15		



# INTRODUCTION

---

*Hydraulic fracturing, commonly referred to as fracking, is a process used in natural gas and oil drilling. Over the last several years, advancements in this technology now allow drilling from unconventional sources, particularly shale, which were previously inaccessible. This has led to a surge in natural gas operations in the U.S. that already has had significant economic, social, environmental and health impacts.*

Natural gas is being championed by industry as a cleaner and more affordable fuel than oil or coal and one that can meet U.S. energy needs for decades. Furthermore, proponents say fracking creates jobs, promotes energy independence and can transition the country into a green energy future. At the same time, critics condemn natural gas production as a dirty drilling process that can contaminate air and water sources, lead to a boom and bust economy, contribute to climate change and inhibit the development of cleaner technologies.

Both positions hold substantial implications for the health and well being of people and the planet. Grantmakers are uniquely placed to help shed light on the complexities surrounding natural gas development, and to shape policy, practices and public opinion regarding related health, social and environmental issues.

This report aims to provide grantmakers with a basic understanding of concerns surrounding the new fracking technology being used in unconventional gas and oil drilling and some of the funding strategies currently being implemented. It is divided into two parts.

**Hydraulic Fracturing Impacts:** This section provides an overview of impacts of natural gas drilling. It defines the processes used in drilling, examines existing regulations concerning the practice and outlines what is currently known about the effects on environment, communities and health.



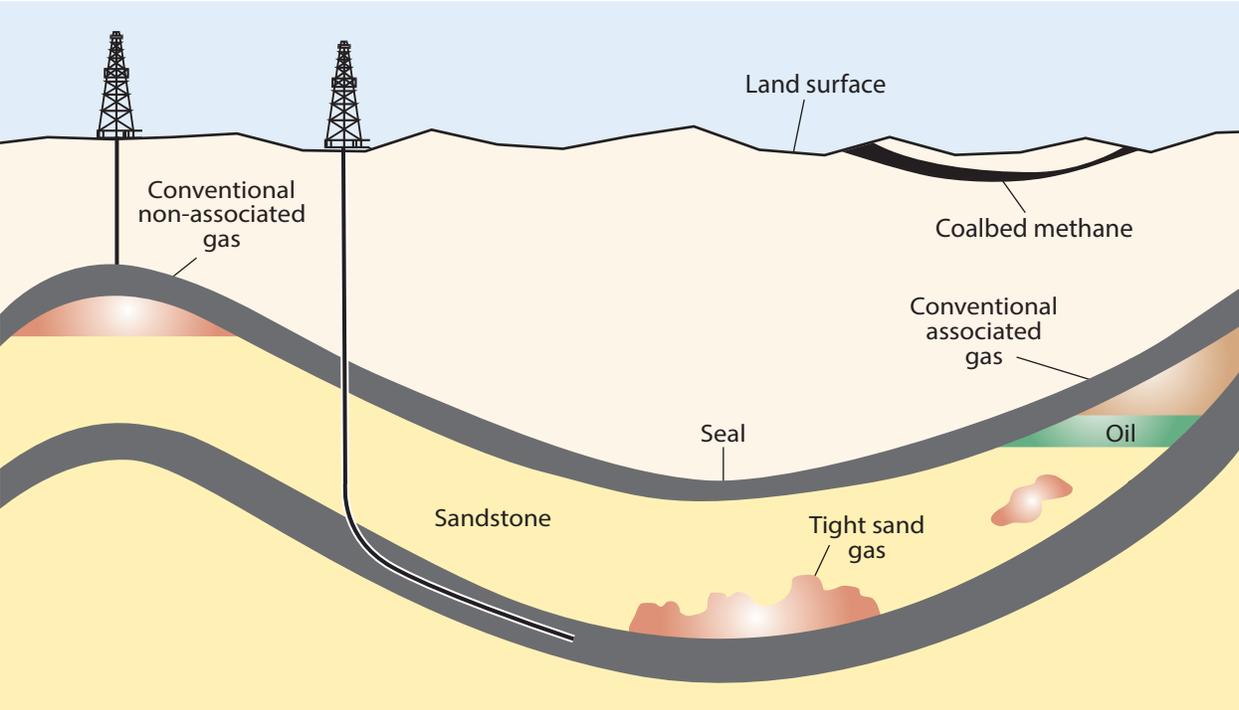
**Funding Strategies:** This section provides an overview of funding priorities and strategies, as well as examples of current grantmaking. It is based on conversations and feedback from dozens of foundations and NGOs who helped identify opportunities and challenges for interested funders.

# HYDRAULIC FRACTURING IMPACTS

Hydraulic fracturing, or fracking, is a process used in oil and gas drilling. It involves injecting a mixture of water, sand and chemicals, known as fracking fluid, deep underground, under high pressure, in order to crack fissures in rock and allow natural gas to flow to the surface. Innovations in fracking technology, such as the ability to drill horizontally, now allow drillers to tap large amounts of shale gas that were not accessible before.<sup>1</sup> This has led to a recent explosion of gas drilling in 32 shale plays across more than 30 states coast to coast with significant implications on human health, communities and the environment.

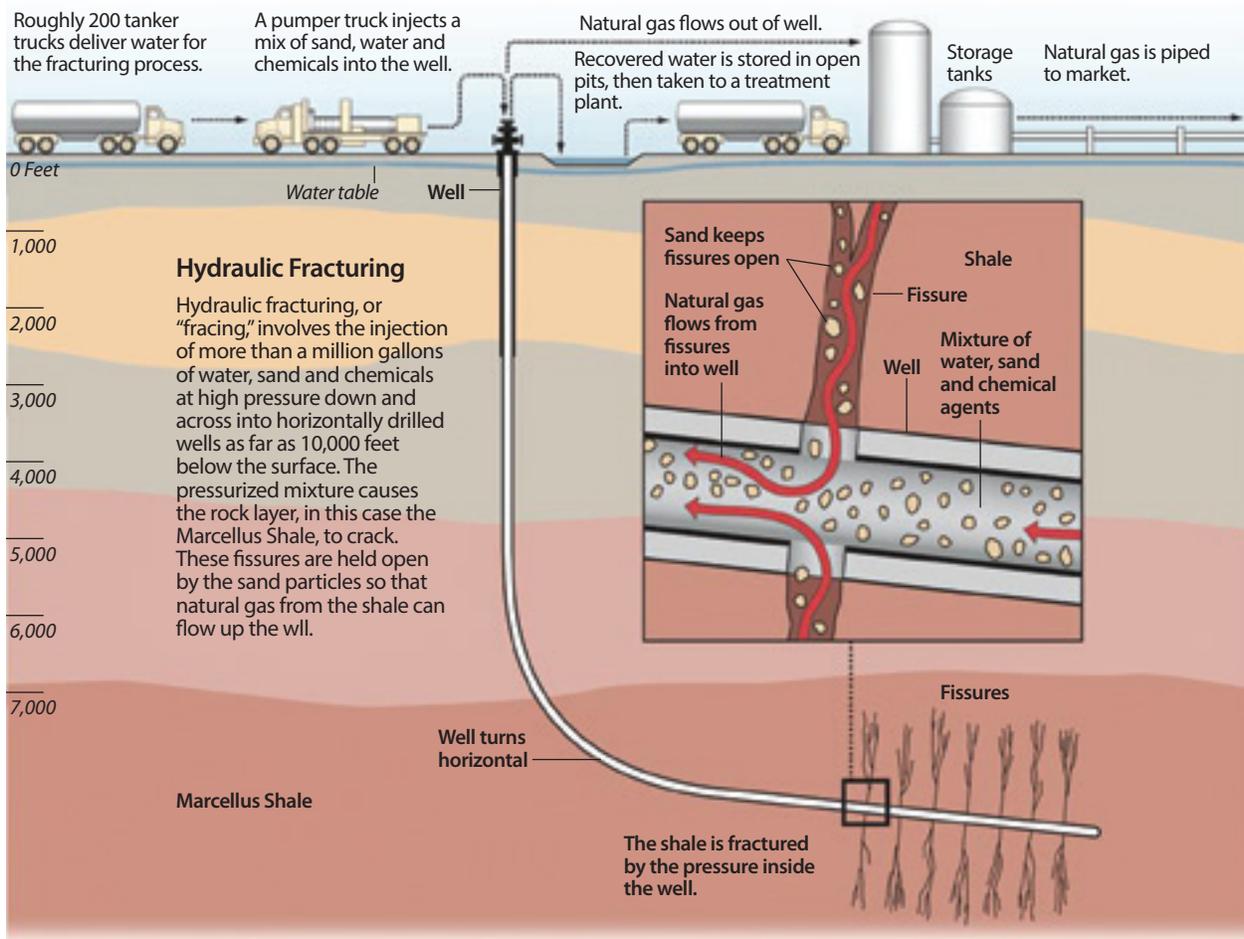
As drilling activity has expanded so has concern about the composition of fracking fluid, which is typically made up of about 90 percent water, between eight and nine percent sand and one-half to two percent chemical additives.<sup>2</sup> This small percentage of chemicals becomes a significant quantity given the enormous volumes of liquid needed to fracture wells. Water usage is generally reported to be between three to seven million gallons per frack, depending on geological conditions. Some areas, such as the Eagle Ford Shale in Texas, require more than 13 million gallons per frack.<sup>3</sup> Wells are normally fracked several times and in multiple directions.

**Figure 1: Natural gas resources**



Source: ProPublica

**Figure 2: Hydraulic fracturing process**



Source: U.S. Energy Information Administration. Graphic by Al Granberg

Consequently, millions of gallons of chemicals may be used over the life of a well. The Congressional report, *Chemicals used in Hydraulic Fracturing 2005-2009*, provides sobering insight into the content and quantity of chemicals used in fracking. Congress identified more than 650 chemicals used in natural gas operations that are considered hazardous.<sup>4</sup> These include known carcinogens such as benzene, possible carcinogens including ethylbenzene, acetaldehyde, and formaldehyde, and other compounds such as toluene and xylene that can cause serious health effects (see Health Impacts pg. 14). The report also states that oil and gas companies, as part of their fracking

process, injected “hundreds of millions of gallons of hazardous or carcinogenic chemicals into wells in more than 13 states from 2005 to 2009.” Fracking has expanded rapidly since 2009.

**Duel definitions:** fracking is just one part of the drilling process and industry uses it as a specific technical term. Yet the public, media and this publication use fracking as a general reference for unconventional oil and natural gas drilling. These different definitions have led to confusion and distrust between proponents and critics.

**Shale:** consists of layers of rock with small pockets of oil or gas. Large shale formations that are available for oil and gas exploration, development or production are known as shale plays. See Figure 3.

**Figure 3: Lower 48 states shale plays**



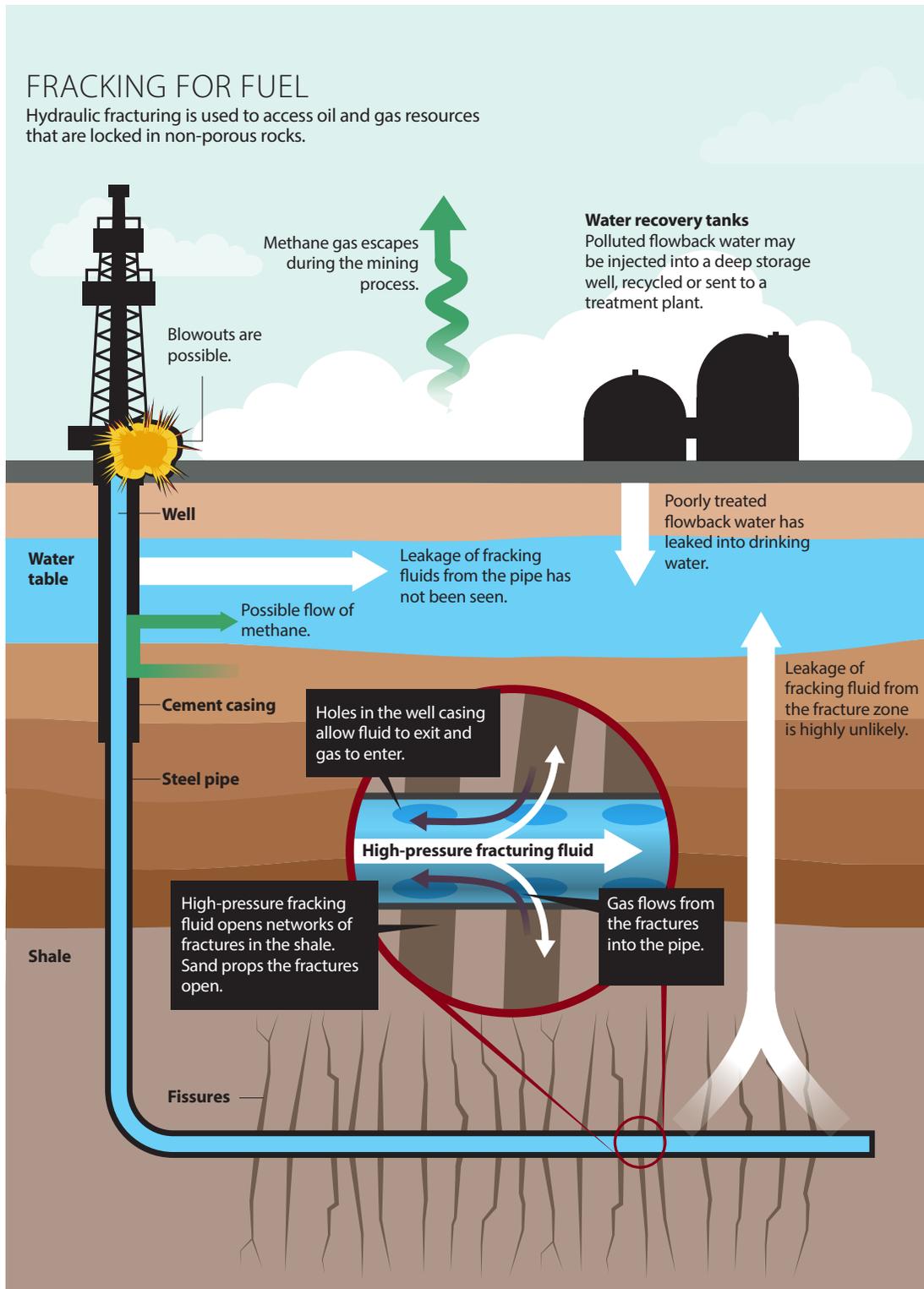
Source: U.S. Energy Information Administration

Despite its large ecological and chemical footprint, the natural gas industry has successfully won exemptions from most requirements of federal environmental laws including, the Safe Drinking Water Act, the Clean Water Act, the Clean Air Act, the Toxic Release Inventory, the Resource Conservation and Recovery Act, the National Environmental Policy Act, and Superfund cleanup efforts.<sup>5</sup> The Fracturing Responsibility and Awareness of Chemicals Act (FRAC Act) was first introduced in 2009 and would reinstate the Environmental Protection Agency's (EPA) authority to regulate fracking under the Safe Drinking Water Act.<sup>6</sup> It has garnered little political support, and is strongly opposed by members of

the natural gas industry, who claim that fracking is effectively regulated at the state level.

A few states have begun to increase fracking regulatory requirements but in most states regulation is lax.<sup>7</sup> The U.S. Department of Energy reported that 21 of the 31 drilling states it surveyed had no regulations specific to hydraulic fracturing. Only four of 31 drilling states had detailed regulations guiding hydraulic fracturing, and only nine drilling states required that some fracturing chemicals be disclosed. None of the states surveyed required that the volume of fluid left underground after fracturing be recorded.<sup>8</sup>

**Figure 4: Fracking impacts on air and water**



Source: Nature

When state agencies do attempt to tighten regulations, state resources may be insufficient to police the rapidly expanding industry. For example, in Pennsylvania, New York and Ohio, dozens of inspectors are responsible for tens of thousands of wells.<sup>9</sup> Colorado saw an increase in drilling sites in 2011, but the number of inspectors decreased. Regulators in the state levied only five fines against industry despite 516 oil and gas spills.<sup>10</sup>

## Environmental Impacts

### Water

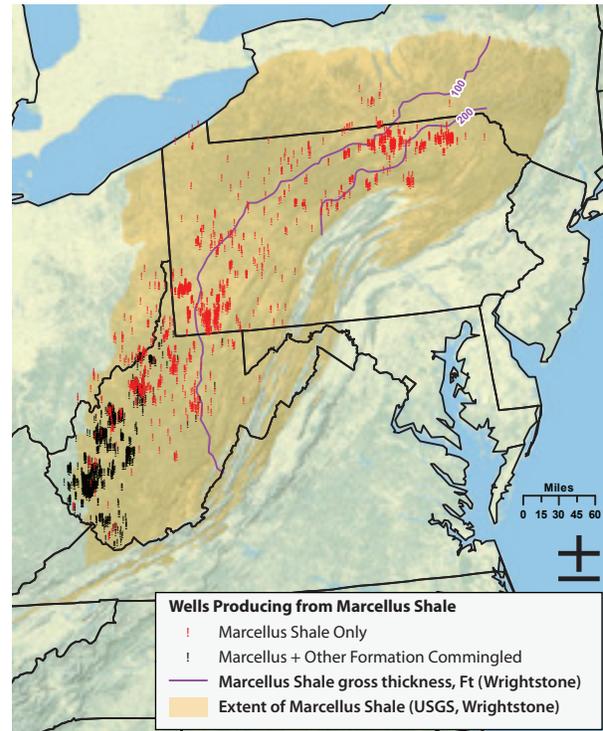
Water contamination from toxic wastewater is at the heart of the controversy over fracking. Companies conducting fracking operations must manage millions of gallons of wastewater laced with toxic chemicals. Types of wastewater include portions of fracking fluid that return to the surface, as well as wastewater that has been contaminated with naturally occurring radioactive materials, dissolved solids and heavy metals that are picked up underground and brought to the surface during and following fracking. This wastewater must be stored, transported, treated and disposed. Numerous risks accompany every stage of these operations.

### Groundwater contamination

Between 20-80 percent of fracking fluid is left underground.<sup>11</sup> Industry maintains that fracking takes place so far below fresh water sources that fluid left underground cannot reach or contaminate groundwater. Yet regulators in British Columbia affirm that fracturing shale can open up long fissures that allow fracking fluid left underground to eventually reach groundwater reservoirs. They have identified 19 “fracturing communication” incidents where new wells have met up with other wells. A Pennsylvania study of non-fracked shale showed natural pathways where brine from deep underlying formations contaminated shallow groundwater aquifers, thus raising concern that fracking increases the risk of fluid migration and contamination.<sup>12</sup> A Marcellus Shale modeling study suggests that while natural transport could take tens of thousands of years to move contaminants from shale to the surface, the new generation of high intensive fracking could reduce that transport time to hundreds of years or even to less than a decade.<sup>13</sup>

**Marcellus Shale:** a shale gas play that stretches 95,000 square miles across New York, Pennsylvania, Ohio and West Virginia. It is the largest U.S. natural gas play. See Figure 5 below.

Figure 5: Marcellus Shale



Source: U.S. Energy Information Administration

The EPA has only recently begun conducting studies of a few high-profile contamination cases, but it has already linked fracking to groundwater contamination in Wyoming.<sup>14</sup>

Similarly, methane from fracking wells has been proven to have contaminated a Pennsylvania landowner’s underground water supplies.<sup>15</sup> Groundwater contamination is also a result of conventional oil and gas drilling techniques such as casing failures, poor cement jobs and spills on the surface. Cement jobs are perhaps the most critical component for preventing groundwater contamination.<sup>16</sup> Industry has a poor record in this area.<sup>17</sup>

### Surface water contamination

After fracking, wells continue to release about 80-1200 gallons per day of “produced water,” which is brought to the surface with the shale gas.<sup>18</sup> Produced water consists of saltwater (brine), naturally occurring toxics and radioactive materials. It is released for the life of the well, which can last 40 years. There are thousands of documented cases of water contamination from drilling operations.<sup>19,20</sup> Chemical and natural contaminants are known to leak from a wide array of gas drilling operations, including gas wells, impoundment ponds, condensate tanks, compressor stations, pipelines and processing plants, as well as from illegal dumping and blowouts that can happen throughout the drilling process.<sup>21</sup>

### Storage

Once on the surface, wastewater is often kept in lined or unlined impoundment ponds that may be susceptible to torn or ripped linings, storm runoff or collapse. Impoundment ponds and wastewater in condensate tanks may also pose air pollution risks (see Air pg. 10). New York’s proposed fracking regulations call for only allowing storage of wastewater in watertight tanks. In the Marcellus Shale, several companies are looking to move to closed loop systems of fluids to try to reduce spills.<sup>22</sup>

### Treatment

Both the volume of, and contaminants in, fracking water make it untreatable at most residential treatment facilities. New York State, for example, has said it will not issue drilling permits until the companies demonstrate they are capable of adequately disposing of wastewater. An analysis of 135 New York treatment plants found only a tiny fraction could or would accept wastewater from the Marcellus Shale and only then in small amounts.<sup>23</sup>

### Disposal

Insufficient capacity for wastewater disposal could potentially limit the development of fracking, especially in Pennsylvania, which has few disposal wells. Of the almost 22 million gallons of wastewater that Pennsylvania’s Marcellus Shale operators sent to disposal wells in the first six months of 2011, nearly 99 percent went to Ohio.<sup>24</sup> Industry has also looked to dispose of toxic wastewater by selling it for “beneficial use.” Its high salt content makes it an alternative for de-icing or dust

suppression on roads. Kansas has proposed legislation allowing solid waste from fracking to be spread on fields without requiring a solid waste permit.<sup>25</sup> Despite these efforts, Pennsylvania regulators say the illegal disposal of wastewater into rivers continues to be a problem because the number of drilling rigs continues to grow.<sup>26</sup>

**Disposal (injection) wells:** a deep well, often a depleted oil or gas well, in which waste fluids can be injected for disposal.

### Earthquakes

The U.S. Geological Survey found that the injection of fracking wastewater into disposal wells in Ohio, Texas, Colorado, Arkansas and Oklahoma coincides with an increase in earthquakes in those areas.<sup>27</sup> A link between disposal wells and earthquakes was first identified in the 1960’s. Disposal wells can be drilled down more than 9,000 feet. It is believed that when these fluids reach an existing geological fault that is already stressed, the influx of pressurized injection water may allow the fault to slip.<sup>28</sup>

### Scarcity

Unlike other types of wastewater that can be restored to local rivers and streams, most fracking wastewater cannot be legally returned to the watersheds – thus creating or contributing to water scarcity issues in some areas. In more arid regions, such as Texas, Colorado, and Wyoming that have experienced dire drought conditions in recent years, water scarcity is also a social and economic issue (see Community Impacts pg. 12).

### Recycling

Disposal and scarcity problems have led some natural gas companies to develop recycling capacity. In the Marcellus Shale, nearly every company now does some recycling of its liquid waste, although these efforts vary greatly – from 0.2 percent by Exxon to more than 90 percent by other companies.<sup>29</sup>

## Air

While the primary environmental concern about fracking has been its impact on water quality, there is a growing body of research that demonstrates risks to air quality. Natural gas operations release methane, a potent global warming pollutant that produces volatile organic compounds (VOCs), which adversely affect health (see Climate, pg. 11 and Health Impacts pg. 14).

**Volatile organic compounds (VOCs):** chemicals that easily vaporize from liquid into gas.

**Misters:** devices used to turn wastewater into fine droplets of water.

## Emissions

Air emissions from fracking may include both deliberate and accidental events. Companies vent dissolved gas as fracking fluids are pumped out. Venting can go on for a month or more until gas production is fully up and running and connected to a pipeline.<sup>30</sup> Air emissions, known as fugitive emissions, also occur as gas leaks from storage tanks, pipelines and compressor stations, which pump natural gas through pipelines. These emissions alone include hundreds of tons per year of known pollutants such as nitrogen oxides, sulfur dioxide, airborne particulates, carbon monoxide and VOCs.<sup>31</sup> They are regulated at the state and federal level, as they are known to contribute to smog levels (see Health Impacts pg. 14).<sup>32</sup> VOCs also evaporate into the air from the wastewater in impoundment ponds, a process that is deliberately sped up by the use of misters.

## Air quality

Studies show a link between poor air quality and fracking. Rural Wyoming, known for its breathtaking vistas, now has worse smog than Los Angeles because of a boom in natural gas drilling.<sup>33</sup> Utah had a similar experience in 2011 when the wintertime levels of ozone near fracking operations in the eastern part of the state were higher than in New York City.<sup>34</sup> In Denver, air samples of what was expected to be urban smog turned out to include methane from nearby gas fields.<sup>35</sup> Dallas-Fort Worth, the largest urban center in the Barnett Shale, has daily air pollution emissions from local natural gas drilling now surpassing totals from all local traffic emissions.<sup>36</sup>

**Figure 6: Air pollution linked to fracking operations**



Source: U.S. Geological Survey/Denver Post

## Agriculture and Wildlife

### Farming and ranching

Contaminated water and air have led to concerns about impacts on crops and the quality of dairy and meat from farms in fracking areas. Researchers are just beginning to look into the many reports of livestock illness, death and stillborn or stunted offspring.<sup>37, 38</sup> In Alberta, the heart of Canada's oil and gas region, many farmers report problems with their water. Few of these reports become public as farmers sign confidentiality agreements in return for replacement of their water wells.<sup>39</sup> In 2012, the National Farmers Union in Canada, the Ohio Farmers Union, the Pennsylvania Association for Sustainable Agriculture and the Northeast Organic Farming Association of New York all have called for a fracking moratorium.<sup>40, 41, 42</sup>

### Wildlife

Anecdotal reports abound of animals found dead near fracking operations or in nearby waterways. Testing, when done at all, often takes place well after the incident has occurred, making conclusive links to fracking difficult. Wildlife also suffers habitat fragmentation from well site and infrastructure construction. Pipelines and roads in particular, act as barriers of dispersal for some species and as avenues for invasion for others.<sup>43</sup> NiSource Gas Transmission has asked for a 50-year "incidental take" permit for

its gas pipeline that extends 15,000 miles across 14 U.S. states, encompasses 10 million acres and includes critical habitat and conservation areas that are home to over 100 endangered, threatened and proposed endangered species (see Pipelines pg. 13).<sup>44</sup> Fracking is also taking place in protected areas such as state forests or federal lands, particularly in western U.S. states with more national parks and federally-held properties.<sup>46</sup> In the Mid-Atlantic region, biocides used to control bacterial growth in drill pipes have raised concern about impacts on aquatic life and oyster beds in the Chesapeake Bay.<sup>47</sup>

### Climate

Natural gas is touted as a cleaner option that provides a lower-carbon alternative to coal or oil, but researchers question whether or not gas helps reduce greenhouse gas (GHG) emissions overall. On one hand, burning natural gas as a fuel produces less carbon dioxide than coal and moderately less than oil. Yet natural gas drilling produces a much higher amount of methane than coal or oil. Questions about natural gas methane leakage are increasingly of concern. Methane is a more destructive greenhouse gas and can trap heat at 23 times the rate of carbon dioxide. About 40 percent of U.S. methane emissions come from natural gas and accounts for 19-44 percent of U.S. GHG emissions.<sup>48</sup>

### Methane emissions

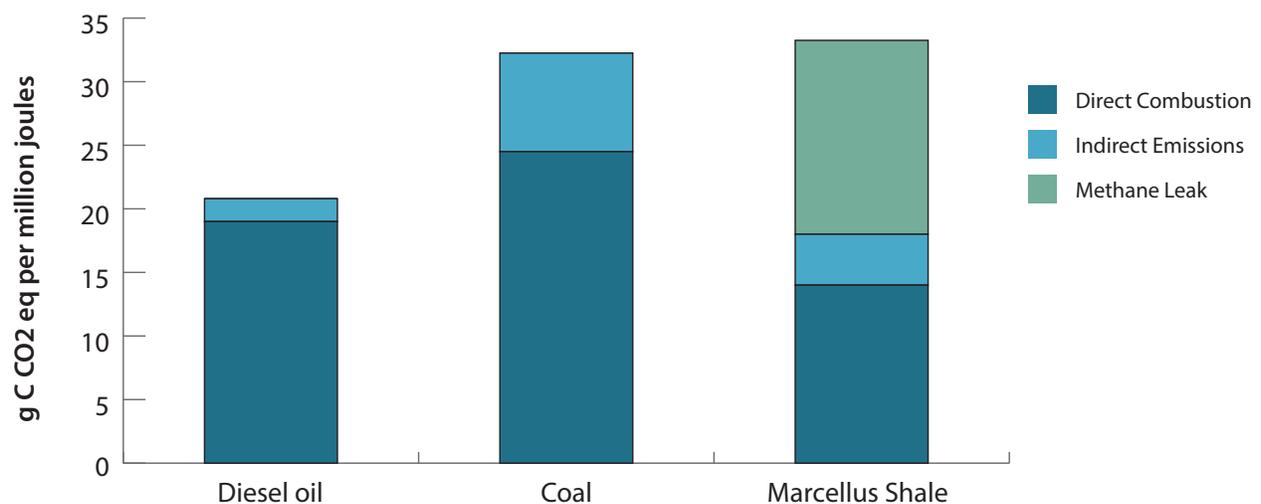
A Cornell study contends that the amount of methane lost from multiple sources during fracking has the potential to make natural gas one-fifth to twice as bad as coal from a GHG standpoint.<sup>49</sup> Methane leaks are common at the wellhead, from pipes and from storage facilities during transport and delivery. However, another Cornell study team drew the opposite conclusion. Researchers estimated that natural gas' GHG footprint is more likely to be half or one-third that of coal, with the assumption that technological and worker improvements eliminate methane leaks.<sup>50</sup> The discrepancies in these studies highlight how much more research is needed to reach consensus on the GHG impacts of methane emissions during natural gas development.<sup>51</sup>

**Bridge fuel:** a lower-carbon fuel alternative to coal or oil that is used while zero-carbon energy options such as solar and wind are developed.

### Bridge fuel

Recent studies challenge the idea of defining natural gas as a “bridge fuel” based on its carbon emissions alone. A U.K. study concluded that shale gas would not likely serve as a transition fuel since its lifecycle emissions of carbon dioxide are still incompatible

**Figure 7: Estimate of greenhouse gas warming potential for various fuels**



Source: Robert Howarth, Cornell University

with the Copenhagen Accord, which calls for an urgent de-carbonization of the electricity supply. The study also states that without a meaningful cap on GHG emissions, developing shale gas production is likely to increase net carbon emissions and delay zero carbon technologies.<sup>52</sup>

A U.S. study came to a similar conclusion. The researchers estimated that switching all coal plants to natural gas over 40 years would generate half as much GHG per watt-hour of electricity, but that the impact on global warming would be negligible. They too point to the inclusion of zero-carbon energy sources such as conservation, wind, solar, nuclear power and possibly carbon capture and storage to achieve substantial climate goals.<sup>53</sup>

Of further concern is the abundance of cheap shale gas on the emerging renewable energies market. Renewable energy advocates and industry representatives report diminished demand for renewables from utilities turning from coal to gas.<sup>54</sup>

---

## Community Impacts

---

Natural gas development has brought billions of dollars into the U.S. economy in the form of increased employment and tax revenues to communities. The promise of financial windfalls to local communities, many of which have few other new economic opportunities, has made natural gas drilling a highly attractive prospect. Yet the influx of a booming industry into rural and suburban communities changes them in ways for which few are prepared.

### Social Impact

Fracking often may bring an influx of hundreds of itinerant workers. In communities experiencing rapid development, population surges have led to increases in crime, drugs and sexually transmitted diseases, among other social ills.<sup>55, 56</sup> The sudden increases in population can also strain existing social services such as police, hospitals and schools, often with corresponding financial burdens. A large population of temporary workers can raise tensions between existing residents and those they view as outsiders. Communities may be further split when some members support fracking and others do not.<sup>57, 58, 59</sup>

### Economic Impact

Alongside fracking's widely-touted positive economic benefits are emerging adverse impacts. Natural gas related businesses flourish while non-gas related businesses lose employees and struggle with higher costs. Communities, and even neighbors, may be split between financial winners and losers.

### Housing

Higher wages paid to temporary gas workers result in higher costs of living including inflation and, in particular, skyrocketing housing costs. In such cases, poor and fixed-income residents such as the elderly are hit the hardest.<sup>60</sup> An increase in homelessness is commonly reported. A Pennsylvania study concluded that families were the most likely to become homeless in natural gas boomtowns, which also can lead to their being split up as children are placed in foster care.<sup>61</sup>

### Property rights and values

Many landowners unknowingly live on "split estates" in which they own the land but do not own the sub-surface or mineral rights to their property. Gas companies often buy these sub-surface rights and then may conduct fracking without the permission of the landowner. New York allows for "compulsory integration," which can force a landowner to lease their land if 60 percent of the property around them is leased to drill.<sup>62</sup> Thousands of landowners have joined class action lawsuits in Texas, Virginia and Pennsylvania claiming that gas companies have misrepresented or not lived up to the terms of the leases.<sup>63</sup> Fracking has also led to homeowner concerns about reduced property values and problems in getting mortgages and insurance.<sup>64</sup> At the same time, some homeowners are demanding the right to drill in areas where fracking has been banned.<sup>65</sup>

### Water supply

Fracking is water intensive, often competing for resources particularly in arid regions and agricultural communities. Colorado officials projected a 35 percent increase in water use for oil and gas operations from 2010 to 2015.<sup>66</sup> This is in a region that may already not have enough water to sustain expected population and agriculture levels. In Colorado, drillers can lease water from municipalities and often have more financial resources to spend than other users. Texas is experiencing its worst drought since the late 1800's, which has placed oil and gas operators in

direct competition with other water users including business, cities and landowners. Scarcity concerns led Grand Prairie, Texas to become the first city to ban the use of city water for fracking.<sup>67</sup>

**Fracking is water intensive, often competing for resources particularly in arid regions and agricultural communities. Scarcity concerns led Grand Prairie, Texas to become the first city to ban the use of city water for fracking.**

### Infrastructure

Construction of roads, processing, storage facilities and pipelines all add to an altered landscape and a changing feel for agricultural, rural and suburban communities.

### Roads

Towns and rural roadways are typically built for local traffic not industrial operations. About a thousand large trucks are needed for just one fracking operation; there are thousands of wells going up in states like Texas, Wyoming and Pennsylvania and thousands more proposed for New York and other states. The impact of tens of thousands of trucks and tankers on these roads is predictable: extensive road damage, a surge in traffic accidents and increased traffic noise and pollution.

### Pipelines

The U.S. Government Accountability Office estimates that only about 10 percent of 240,000 miles of natural gas pipelines are regulated. Thousands of miles of pipelines are being built to transport fracked natural gas. Many of these pipelines go through densely populated areas, such as neighborhoods in Fort Worth, Texas. Unregulated pipelines means they are not regularly inspected for leaks or corrosion and officials in some states do not even know where the new pipelines are. Industry is not required to report pipeline-related fatality, injury or property damage information about unregulated lines.<sup>68</sup> Pipeline development may also involve eminent domain applications in order to condemn private property for construction. Landowners have little recourse and are often in a “take it or leave

it” situation regarding compensation.<sup>69</sup> Pipeline construction and lack of regulation raises significant environmental and health implications as well.

### Democratic Process

Fracking poses a number of unique legal questions. These include exemptions from federal environmental and health laws, a community’s right to zone industry in non-industrial residential zones, an individual’s right to prevent drilling impacts on their home and person and a state’s right to limit or monitor public speech. Legal responses vary greatly from state to state.

### Local control

In New York, more than 100 communities have embraced “Home Rule” rights to ban or place a moratorium on fracking. The State Supreme Court has upheld that ruling to date.<sup>70</sup> In contrast, Pennsylvania legislators passed Act 13, which removes local control of zoning where industry can operate.<sup>71</sup>

**Home rule:** the right for a local city or county to set up a system of self-government without receiving a charter from the state.

**Pennsylvania’s Act 13:** removed the ability from municipalities to use zoning regulations to limit or ban fracking. The State Supreme Court has been asked to review it.

### Citizen rights

Fracking also has had implications for individual rights. Pennsylvania’s Act 13 requires doctors to sign a non-disclosure agreement before receiving information about potentially toxic chemicals to which their patients may have been exposed.<sup>72</sup> Health professionals have been vocal in their concerns about what they see as a gag order that prevents them from properly treating stricken individuals. Meanwhile, Pennsylvania’s former Homeland Security director hired a counter-terrorism security firm to monitor anti-fracking activists, including monitoring of public hearings at the Pittsburgh City Council and those viewing the anti-fracking documentary *Gasland*. Intelligence bulletins on these activities were provided to state police, local authorities and selected natural gas companies.<sup>73</sup>

### **Political contributions and lobbying**

The natural gas industry has spent millions of dollars in lobbying and contributions to political campaigns.<sup>74, 75</sup> The American Legislative Exchange Council (ALEC) is an industry-supported organization that provides model bills to promote corporate-friendly legislation. ALEC is actively promoting a fracking chemical disclosure bill that provides loopholes for non-disclosure. The bill was initiated by ALEC member ExxonMobil, although this affiliation is never disclosed by lawmakers introducing it in their states.<sup>76</sup> ALEC has come under increasing scrutiny for its promotion of controversial legislation, which has caused a number of large companies such as Coca Cola and Amazon to cancel their memberships.<sup>77, 78</sup>

---

## **Health Impacts**

---

Among the most contentious issues surrounding natural gas drilling are negative health impacts from fracking and the industry's refusal to provide full disclosure regarding fracking chemicals.

### **Exposure and Contamination**

#### **Chemicals**

A study of 353 chemicals used in natural gas operations found that at least 75 percent could negatively affect the skin, eyes and other sensory organs, along with the respiratory and gastrointestinal systems. Approximately 40-50 percent could affect the nervous system, immune and cardiovascular systems; 37 percent could affect the endocrine system; and 25 percent could cause cancer and mutations.<sup>79</sup>

***Many chemicals used by natural gas companies are defined as hazardous under major federal statutes designed to protect people and the environment against toxic contamination. As noted previously, fracking is exempt from these laws.***

Many chemicals used by natural gas companies are defined as hazardous under major federal statutes designed to protect people and the environment against toxic contamination. The list of known chemicals associated with fracking includes the carcinogen benzene and other possible carcinogens such as ethylbenzene, acetaldehyde and formaldehyde. If these chemicals were released from an industrial facility, reporting to the EPA would be required and specific clean-up protocols prescribed.<sup>80</sup> As noted previously, fracking is exempt from many of these laws.

#### **Air pollution**

Natural gas operations involve deliberate venting of gases and thousands of diesel trucks moving to and from drill sites. These activities release a significant amount of air pollutants, including VOCs that contribute to poor air quality (see Environmental Impacts, pg. 8). VOCs can cause a wide range of illnesses including asthma and other respiratory diseases.<sup>81</sup> A Texas hospital system in six counties with heavy drilling (93,000 natural gas wells) said in 2010 that it found a 25 percent asthma rate for young children, more than three times the state rate of about seven percent.<sup>82</sup> A three-year Colorado study found a higher number of hazardous chemicals, including benzene, trimethylbenzenes, xylenes and aliphatic hydrocarbons in the air near fracking wells. These exposures contribute to acute and chronic health problems for those living near natural gas drilling sites.<sup>83</sup>

#### **Water pollution**

Water contamination is most likely to happen from wastewater transportation and disposal, well casing leaks and surface spills (see Water pg. 8). An analysis of produced water from thousands of wells at oil, gas and coal operations showed toxicity levels above thresholds for irrigation and surface water discharge. In fact, high salinity levels in oil and gas wastewater has made treatment an unlikely or unfeasible option.<sup>84</sup>

## **Radioactive material**

Fracking wastewater picks up naturally occurring radioactive material underground, such as radium, which has been shown to cause liver, bone and breast cancers.<sup>85</sup> Health problems can arise if it enters a person's body by eating, drinking or breathing.<sup>86</sup> Exposure can come from leaks, illegal dumping and when wastewater has been sold as a de-icer or dust suppressant for roads. In Pennsylvania, the natural gas company Ultra Resources sent 155,000 gallons of wastewater, with levels of radioactivity almost 700 times the levels allowed in drinking water, to nine different towns for dust suppression.<sup>87</sup> Wastewater can also run off drilling sites contaminating surface water and entering the food supply.

## **Studies and Policy**

### **Research**

Anecdotal evidence of fracking-related illness is plentiful, with commonly reported instances of headaches, dizziness, muscle spasms, vomiting, diarrhea, rashes and nosebleeds. Evidence in Texas, Wyoming, Louisiana, North Dakota and Pennsylvania increasingly links worsening health metrics among neighbors of gas wells and related infrastructure. In these cases, the onset of symptoms frequently coincides with drilling.<sup>88</sup>

Children, in particular, are more vulnerable to environmental hazards according to the American Pediatric Society. In Pennsylvania, over 3,000 gas wells and permitted well sites are within two miles of 320 day care centers, 67 schools and nine hospitals.<sup>89</sup>

Industry representatives do not dispute the symptoms reported, but they do not agree that drilling or related activity is the cause. Company spokespeople regularly point out that there may be natural or previous contamination of the site and that some contaminants can be a result of common sources such as car exhausts, gas stations or smoking.<sup>90</sup>

Yet, few studies have looked at the community health impacts from natural gas operations. As with other research needs related to fracking, health studies are complicated by a lack of baseline testing, undisclosed chemicals, multiple sources of exposure, lack of monitoring and tracking systems and a lack of data transparency.<sup>91</sup>

## **Policy**

At a policy level, regulators and policymakers have often overlooked public health impacts due to fracking. Pennsylvania's 52-member advisory panel on Marcellus Shale drilling has not included any members with medical or public health expertise. The same is true for advisory panels in Maryland and the U.S. Secretary of Energy. In New York, 250 state-based health care professionals and medical societies warned Governor Andrew Cuomo that the state failed to analyze public health impacts of fracking in its rush to approve permits for drilling.<sup>92</sup>

***At a policy level, regulators and policymakers have often overlooked public health impacts due to fracking. In New York, 250 state-based health care professionals warned Governor Cuomo that the state failed to analyze health impacts of fracking in its rush to approve permits for drilling.***

# FUNDER STRATEGIES

---

The impacts of fracking are of pressing concern to a growing number of foundations and donors. Fracking has had significant influence on state and local policies and will likely affect U.S. policies ranging from agriculture to the environment to international trade, as well as help further define the role of citizen and corporate rights. This section will cover challenges and opportunities for philanthropy to address concerns about the public health, environmental and community impacts of fracking.

The public has responded to these concerns with an explosive growth of hundreds of organizations in just a few short years. Despite an abundance of grassroots activity, movement building and coordination are just beginning to emerge. The petrochemical industry, on the other hand, has spent hundreds of millions of dollars in sophisticated lobbying and media campaigns aimed at influencing government regulatory decisions.

Initial philanthropic support on this issue has come from a handful of foundations, many primarily focused on Pennsylvania and New York. Yet interest in this issue is high with dozens of foundations actively trying to evaluate what role they can or should play. Philanthropy, like the general public, is becoming aware that the scale and scope of natural gas development crosses many geographic and issue boundaries that can shape our world for decades to come.

Over 20 foundations and NGOs were interviewed and asked what they believe to be current challenges, opportunities and priorities that funders should be considering at this time. The following summarizes these comments, as well as comments and recommendations from dozens of funders participating in related webinars, panels and conferences.

***Philanthropy, like the general public, is becoming aware that the scale and scope of natural gas development crosses many geographic and issue boundaries that can shape our world for decades to come.***

---

## Challenges and Opportunities for Grantmakers

---

### Challenges

***Lack of coordination:*** Hundreds of NGOs and grassroots groups have formed to address fracking. Many of these are efforts that address specific issues, such as water contamination, property rights or local gas drilling operations and thus are often fragmented and diffuse in their efforts to produce widespread change.

***Legal exemptions:*** The lack of applicable federal regulation leaves few traditional legal options to address issues on a national scale.

***Political support:*** Fracking has many political champions supporting it at the federal and state level. Industry has fostered this support through substantial investment in the form of campaign contributions, public relations and lobbying.

***Framing the issue:*** An industry advertising and media campaign has effectively portrayed fracking as a safe and beneficial activity.

***Opposing views:*** Opinion is divided over key questions such as the role of natural gas in stabilizing the climate and enabling transitions to cleaner sources of energy or the true economic costs and benefits to communities.

## Opportunities

**Range of issues:** The wide variety of health, environmental, social, legal, political and economic issues surrounding fracking offers multiple entry points for grantmakers.

**Visibility:** From President Obama to rural communities to Hollywood celebrities, there is growing awareness of this issue and a chance for grantmakers to define a national agenda for fracking policy.

**Research:** Initial studies on the health, environmental and social impacts of fracking have identified the need for additional research.

---

## Priorities

---

### Coordination and movement building

Community concern has resulted in the emergence of many local groups that are new to organizing and advocacy and have limited capacity. Outreach, training and support at the local level likely would improve their preparation and response. Many local participants are focused on impacts to their communities and do not view themselves as activists or as part of a larger effort. Better coordination and collaboration among groups could allow them to learn from each other and leverage their efforts. Linking local groups to regional, state and national groups would help mobilize constituents into applying political pressure. Political support is essential for any significant legal or regulatory changes related to fracking.

Capacity building, convening, coordinating and collaborating efforts could be beneficial at all levels, including within philanthropy. Identifying common ground will be essential as many fracking opponents are local residents and do not view themselves as “activists” or “environmentalists,” and as groups employ different strategies, such as those who support fracking but want to mitigate negative impacts and those who oppose it outright. In addition, there is often a cultural barrier between local residents and national advocacy groups that needs to be bridged.

*Many local participants are focused on impacts to their communities and do not view themselves as activists or as part of a larger effort. Better coordination and collaboration among groups could allow them to learn from each other and leverage their efforts.*

### Research

Research is essential to improve information and understanding of the health, environmental, social and economic impacts of fracking. In particular, baseline studies would allow for evaluation of long-term cumulative effects. The exponential growth of this industry, dearth of research and absence of any significant regulatory agency oversight and analysis mean that all parties are working with incomplete data. Documenting impacts in those states impacted by fracking is essential so decision makers have accurate information. Collecting data could be facilitated by helping to train residents, ranchers and other non-scientists how to document impacts. Issues beyond community impacts, such as fracking’s ability to create underground pathways to groundwater, its contribution to earthquakes and climate change and its economic costs and benefits, would also supply crucial information. Both foundations and the gas industry are supporting university studies of these issues.

### Communications

The movie *Gasland* and the use of social media have been highly successful in raising awareness about risks related to this issue. Conversely, industry is pouring hundreds of millions of dollars into a coordinated advertising and media campaign that portrays fracking as clean, safe and economically beneficial to all. Those concerned about fracking have been at a disadvantage in getting their voices heard in the mainstream press. National groups have no unified messaging and smaller NGOs tend to have little media capacity. Development of a media strategy could be shared with local, regional and national efforts. Information portals and data collection sites could enable the public to quickly find recent studies, reports and related information.

## Legal strategies

Many consider that regulatory reform is critical to ensure that fracking is done safely. Fracking's exemption from federal regulations as described earlier (see pg. 6) presents significant limitations to effective oversight. National groups have turned to providing substantial comments on proposed new guidelines such as the EPA's oil and gas air standards and wastewater discharge regulations. Challenges against related federal rulings, such as Forest Service and National Park Service mineral rights laws are also possible. State and local stakeholders are using a wider variety of approaches such as zoning laws and demands on state or municipal regulatory agencies to better regulate air emissions, waste disposal and water treatment standards. Linking natural gas impacts to air quality has so far proved to be the fastest entry point for legal challenges. For example, natural gas companies will pay more than \$70 million in Wyoming alone for violating air emission standards. Limitations on wastewater disposal and treatment also have the potential to limit how much drilling can be done.

### *Immediate needs and crisis intervention*

States with fracking are facing immediate impacts with few options for local communities. Illness, loss of drinking water, dying livestock, homelessness and overburdened social services are among the impacts with which communities struggle for solutions. In Pennsylvania, foundations helped launch a health clinic for residents experiencing illnesses thought to be related to fracking. This clinic provides direct medical networking support to residents and also helps collect data needed to monitor the issue. Foundations could make program-related investments or loans to provide immediate relief to affected families and communities.

*National groups have turned to providing substantial comments on proposed new guidelines such as the EPA's oil and gas air standards and wastewater discharge. State and local stakeholders are using a wider variety of approaches such as zoning laws and demands on state or municipal regulatory agencies.*

---

## Strategies

---

Foundations have adopted different strategies to identify and prioritize their grantmaking. Most approach this through a geographic or issue focus and use common strategic methods such as research and monitoring, public education and advocacy, media and communications and policy and legislation. Yet there are some important strategic differences and options depending on if a state is already allowing large scale fracking operations or still evaluating if it will do so. Those focused on local or national solutions are developing different strategies as well.

The following tables include illustrative examples of NGO activities and strategies. At least one NGO is listed although others may also be engaged. This list is meant to show a variety of groups and tactics and is not intended as a comprehensive list of all organizations working on an issue, or as a set of funding recommendations.

### *States with existing natural gas fracking operations*

Foundations in states that are experiencing fracking are faced with on-the-ground impacts that need to be assessed and mitigated. In these states, funders are not only dealing with existing natural gas operations, but also typically dealing with strong political support for fracking (especially at the gubernatorial level), poor state regulatory oversight and a divided public between those financially benefitting and not benefitting.

Foundations in Pennsylvania, a state that has seen an explosion of natural gas drilling activity in just a few years, have responded with support for **research** so the public and politicians can make informed decisions based on sound data; **public education** to raise awareness about fracking; grassroots **advocacy** to empower local communities; and **mitigation** and **monitoring** of existing impacts such as health problems or lack of access to clean water.

## States with existing natural gas fracking operations – NGO activity and grantmaking examples:

### Research

- Researching municipal and economic concerns, social impacts, groundwater contamination, air quality, environmental impacts, public health impacts, geochemical and isotopic studies of watersheds to track contaminants and reclamation of shale pads as early-successional habitats: **Carnegie Mellon University, Dickinson College and University of Pittsburgh**
- Training volunteers to monitor water resources and report violations of state laws to appropriate state agencies: **Trout Unlimited Pennsylvania Chapter**
- Training community members to assess Marcellus Shale development and upload data to a platform linking permitting regulations with developments with instructions for how to file a compliant with state agencies: **Marcellus Citizen Stewardship Project, Three Rivers Waterkeeper, GASP Pittsburgh and FracTracker**
- Sampling the air near fracking sites for toxic chemicals: **Global Community Monitor and Clean Water Action**
- Collecting and supplying vetted, evidence-based, scientific information on fracking with emphasis on lifecycle impacts: **Physicians Scientists & Engineers for Healthy Energy**
- Documenting fracking related spills and water contamination: **Riverkeeper and Food and Water Watch**
- Cataloguing fracking chemicals and potential health impacts: **The Endocrine Disruption Exchange**
- Recording oil and gas industry funding of universities and exploring questions of research impartiality: **Public Citizen**

### Public education and advocacy

- Developing an educational website on hydraulic fracturing: **Pennsylvania State Public Broadcasting**
- Convening public forums and chapter study groups, and distributing information at libraries, fairs and feed stores: **League of Women Voters**
- Hosting forums for local community groups to get together and share information and ideas: **Shale Gas Outrage**
- Developing a shale lease guide for landowners: **Pennsylvania Environmental Council**
- Holding a workshop for family farmers to discuss the range of impacts, resources and protections: **Pennsylvania Association for Sustainable Agriculture**
- Tracking oil and gas lobbying contributions to politicians: **Common Cause and Conservation Voters of Pennsylvania**

### Mitigation and monitoring

- Providing medical assistance and support to those affected by fracking operations: **Southwest Pennsylvania Environmental Health Project**
- Administering a community-based health assessment and air monitoring : **Texas Oil & Gas Accountability Project**
- Testing well water for lower income residents: **Pennsylvania Headwaters**
- Developing and testing new approaches and tools for drilling to minimize impacts to natural habitats: **The Nature Conservancy**
- Producing a publication to provide regulators and industry with control strategies and best practices: **Group Against Smog and Pollution**

## States with planned or potential natural gas fracking operations

Raising **public awareness** and supporting grassroots **advocacy** is also a key focus in states where fracking is not yet established. Baseline data research is needed in these states so that any impacts from fracking can be identified and measured over time. Yet a different set of options exist for those states that are still debating fracking. These include trying to establish **legislative** and **regulatory standards** that would determine how natural gas companies must operate before allowed into the

state. For example, in California, legislation was introduced to require full disclosure of fracking chemicals. In many cases, proponents of regulatory reform also call for a moratorium until a report on potential impacts is completed.

Community control of zoning laws is an option in some states. In New York, more than 100 towns have passed **local bans** or **moratoriums** against fracking. At press time, New York has the most active opposition to fracking with lessons for other states debating fracking policy.

### States with planned or potential natural gas fracking operations – NGO activity and grantmaking examples:

#### Public education and advocacy

- Coordinating a letter to the governor from health professionals calling for study of potential health impacts: **Physicians Scientists & Engineers for Healthy Energy**
- Testifying on public health impacts of fracking: **Water Defense**
- Helping landowners understand their rights and risks before signing drilling leases: **Shenandoah Valley Network, Fleased and Gas Drilling Awareness for Cortland Country**
- Exposing gas industry lobbying contributions to political candidates: **North Carolina Voters for Clean Elections**
- Providing resources and information sharing for regional groups: **Shale Shocked**
- Hosting public forums and submitting comments to town board and state environmental impact statements: **Dryden Resource Awareness Group**

#### Legislative and regulatory actions

- Sponsoring legislation to require disclosure of fracking chemicals and locations: **Environmental Working Group and Earthworks**
- Submitting public comments on state Environmental Impact Statements: **Natural Resources Defense Council**

#### Moratoriums and bans

- Helping communities ban drilling within their legal limits: **Community Environmental Defense Council**
- Petitioning for an amendment to the state constitution to ban fracking: **Ban Michigan Fracking**

## Local vs. national activities

To date there have been more organized **public education** and **advocacy efforts** at the state level than the national level. This is partly because of the lack of federal regulation or policy and because many funders have geographic restrictions to fund in-state.

There has been considerable action focused on **state regulatory agencies**, which seem to be responding to public pressure. This pressure has been enough to gain some governmental action and media attention, but more organized pressure would likely produce better results. For example, a handful of states have improved their fracking chemical disclosure rules – an improvement from the virtual non-disclosure that had existed – yet the new rules also allow key exemptions and fall short of the public demand for full disclosure. Fracking has started to become a political issue for a few politicians, with growing political pressure expected on more politicians in the future.

Some funder support has gone to **legal challenges** against regulatory agencies. There appear to be opportunities here given the wide variety of regulations related to fracking. The results of EPA and other federal studies may produce legal challenges. Litigating against large corporations is daunting for most people, yet some landowners have launched joint action with NGO support.

At press time there is not a unified national effort for funders to support directly. However, many funders and advocates at the local, state and national levels are exploring options to strengthen nationwide communication and coordination to address fracking concerns.

National groups are playing a key role in responding to proposed **federal regulatory actions**, and they have produced a number of projects, such as model legislation, industry key performance indicators and educational materials that could serve as templates nationwide. **Research** on central issues, such as the amount of methane released through fracking operations and the toxicity of fracking chemicals will help shape a larger debate on this issue.

Some organizations have been very successful in building fracking awareness via **media** outlets. For example, both local and national groups were quick to utilize social media, an alternative to industry dominated mainstream media. Foundation support helped launch the documentary *Gasland*, which has been highly effective in introducing and organizing people around this issue. Artists, filmmakers and writers alike are drawing more attention to fracking. Funder support for **shareholder advocacy** has also resulted in heightened awareness of fracking risks in the financial community and generated significant concern among investors.

### Local vs. national activities – NGO activity and grantmaking examples:

#### Public education and advocacy

- Organizing rallies: ***Earthworks, 350.org and Protecting Our Waters***
- Building coalitions: ***Catskill Mountainkeeper, Food and Water Watch, Frack Action, United for Action, Artists Against Fracking and Chefs for the Marcellus***
- Publishing guides and fact sheets related to fracking: ***The Network for Public Health Law, Western Organization Resource Councils and Clean Water Action***

- Designing an interactive website that provides maps, graphs, databases and recent reports related to hydraulic fracturing: ***FracTracker***

#### State legislation and regulatory agencies

- Making policy recommendations on soil and erosion control: ***Pennsylvania Environmental Council***
- Developing ‘polluter pays’ regulation such as bonding requirements to assure funds are available to cover ongoing risks and legacy costs: ***Environment America***

continued >

## Local vs. national activities – NGO activity and grantmaking examples (continued):

### State legislation and regulatory agencies continued >

- Tracking and providing technical comments and reports on state efforts to regulate well and drilling pit construction, air permitting rules, wastewater discharge and water quality rules and chemical disclosure requirements: **Sierra Club**
- Monitoring and submitting formal comments to environmental review processes to ensure projects meet legal requirements: **Natural Resources Defense Council, Earthjustice and Riverkeeper**
- Reviewing and analyzing state regulatory enforcement records: **Earthworks**

### Litigation

- Suing public agencies for failure to turn over public records regarding oil and gas drilling in state parks: **Sierra Club Ohio Chapter**
- Taking a public commission to court for not allowing public review of ingredients in hydraulic fracturing fluids: **Powder River Basin Resource Council and Wyoming Outdoor Council**
- Suing companies for violating state and national air pollution laws: **Penn Future**

### Federal legislation and regulatory agencies

- Petitioning the EPA to require companies to disclose chemical ingredients in fracking fluids: **Earthjustice and Pavilion Area Concerned Citizens**
- Organizing scientist letter protesting conflicts of interest on Department of Energy panel on fracking: **Environmental Working Group**
- Organizing action alerts and letters to Congress in support of the FracAct: **Credo, Change.org, Democracy in Action, Delaware Riverkeeper, Keep Tap Water Safe and Citizens for a Healthy Community**

### Research

- Cataloguing fracking chemicals and potential health impacts: **The Endocrine Disruption Exchange**
- Studying amount of methane emissions from natural gas drilling: **Environmental Defense Fund**
- Researching economic costs and benefits, methane migration near gas wells, climate impacts and impacts on animals: **Duke University and Cornell University**

### Media and Arts

- Utilizing Facebook, Email and Twitter for action alerts, signature gathering, organizing and disseminating information: **Stop Fracking Ohio, New Yorkers Against Fracking, Stop Arkansas Fracking, Farmers Against Fracking and Stop the Frack Attack**
- Posting YouTube videos, “I Love my NY Water” and “My Water’s On Fire Tonight:” **Clean Water Not Dirty Drilling Coalition and Studio 20 NYU**
- Producing fracking documentaries: **Gasland**
- Conducting independent investigative reporting: **ProPublica**
- Analyzing media coverage on fracking: **Fairness and Accuracy in Reporting**
- Producing blog with fracking reports and articles: **DeSmog Blog**
- Producing video documentary series on fracking: **Gas Rush Stories**
- Taking photographs depicting fracking’s impact on landscapes and communities: **The Marcellus Shale Documentary Project**

### Shareholders

- Filing shareholder resolutions, meeting with company executives, developing investor fact sheets and publishing Key Performance Indicators for natural gas drilling companies: **As You Sow, Investor Environmental Health Network and Interfaith Center on Corporate Responsibility**

## Regional collaboration

Natural gas shales, covering several states and watersheds, lend themselves to regional collaboration. Funders interviewed repeatedly identified regional collaboration strategies as needed.

Some funders are already familiar with regions covered by larger shales, like the Marcellus Shale in Pennsylvania, New York, Ohio, West Virginia and Maryland. Not all realize that there is potential to collaborate with funders in the Chesapeake Bay area as the Delaware River runs through New York and Pennsylvania into the Bay. Similarly, the Great Lakes may experience fracking water discharge from waterways in Michigan, Illinois, Ohio, Pennsylvania and New York.

There seems to be little funding in the Rocky Mountain states despite active fracking operations in Wyoming, Montana, Utah, Colorado and New Mexico. Likewise, few funders appear to be active in the Prairie or Midwest states even with significant oil shale drilling in North Dakota and shales identified in Nebraska, Kansas, Missouri, Iowa and Illinois. In southern states, shales cut across Texas, Oklahoma, Arkansas and Louisiana, all of which have ongoing fracking activities. Fracking for oil has gone virtually unregulated in California for decades and new gas shales are being explored along the coast from Monterey to Los Angeles and in the state's Central Valley.

## Issue specific collaboration

Fracking is a multi-faceted issue, raising significant questions for a variety of issue-focused funders.

### Issues of concern for funders include:

#### Climate and energy funders

- Contribution to climate change via methane emissions and/or carbon emissions above Copenhagen Accord goals
- Impact of increased natural gas production and cheap shale gas on the development of renewable energy

#### Water funders

- Impact on drinking water quality and watersheds
- Contribution to water scarcity and potential competition between natural gas industry and public needs

#### Environmental health funders

- Extent and impact of chemical exposures from fracking fluids
- Identifying clusters of health impacts near fracking operations

- Public health impacts related to air and water quality throughout gas production, processing and distribution
- Market and health implications of shifts to natural gas as a chemical feedstock

#### Agriculture and food funders

- Impacts on livestock and crops from reduced or contaminated water, air and feedstocks
- Fracking waste disposal in fields and loss of arable lands
- Food security and contamination risks

#### Health funders

- Increase in environmental exposures and their contribution to respiratory, neurological, developmental and cardiac health
- Ability of health systems to address increased demands

continued >

## Issues of concern for funders include (continued):

### Civic participation funders

- Impact of natural gas-related legislation on civil rights, property rights, corporate rights, municipal vs. state rights and state vs. national jurisdiction
- Political contribution and lobbying disclosure

### Wildlife and conservation funders

- Natural gas drilling in protected areas
- Impacts of air, water, noise pollution and habitat destruction on wildlife, ecosystems and outdoor recreation

### Economic development and policy funders

- Accurate projections for economic growth and job creation
- Impacts of a boom and bust economy on generating state tax revenue and potential legacy and clean-up costs

### Globalization and social justice funders

- Implications of industry plans to produce U.S. gas for global export
- Effects of gas development on equity and climate justice in developing countries

### Smart growth funders and rural funders

- Impacts of introducing industrialization into rural and suburban communities
- Increased demand on social services to address issues of homelessness, housing, education and medical services for new workers and their families

### Labor rights funders

- Monitoring worker health and safety
- Rights and treatment of largely transient work forces

### Ocean and marine ecosystem funders

- Impacts of fracking used in off-shore drilling
- River runoff into estuaries and bays
- Impacts of wastewater on ecosystems

### Media funders

- Role of social media, public media and documentaries
- Analysis of media coverage and effective media strategies
- Development of communications strategies

### Transportation funders

- Natural gas as an alternative fuel option
- Impact on road quality and safety

---

## Endnotes

---

- 1 Unlike conventional oil or gas wells that tap into pooled reservoirs, shale is made of layers with small pockets of oil or gas caught in the shale formation. Large areas are called 'shale plays' by the oil and gas industry and refer to a geographic area which is now 'in play' for exploration, development, or production. In 1980's there were four North American shale plays, today there are at least 32 shale plays (an eight-fold increase) in more than 30 states coast to coast.
- 2 Common compounds include: Acid to dissolve mineral and initiate cracks in the rock; friction reducer "slicks" the water to minimize friction; surfactants increase the viscosity of the fracture fluid; clay stabilizer prevents clays from swelling or shifting; gelling agent thickens the water in order to suspend the sand; scale inhibitor prevents scale deposits in the pipe; pH adjusting agent adjusts the pH of fluid to maintains the effectiveness of other components, such as crosslinkers; Breaker allows a delayed break down of the gel; crosslinker carrier fluids and maintains fluid viscosity as temperature increases; iron control prevents precipitation of metal oxides; corrosion Inhibitor prevents the corrosion of the pipe. *Fracfocus* <http://fracfocus.org/chemical-use/what-chemicals-are-used>.
- 3 Kiah Collier, "Railroad Commission, Halliburton officials acknowledge amount of water used for fracking is problematic," *San Angelo Standard Times*, July 14, 2011.
- 4 According to the report, 14 companies "used over 2500 hydraulic fracturing products containing 750 compounds. More than 650 of these products contained chemicals that are known or possible human carcinogens, regulated under the Safe Drinking Water Act, or listed as hazardous air pollutants," United States House of Representatives Committee on Energy and Commerce, "Chemicals Used in Hydraulic Fracturing," April 2011.
- 5 The **Safe Drinking Water Act** – designed to protect drinking water sources including above ground and below ground water. In most cases, the EPA regulates chemicals used in underground injection; however the 2005 Energy Policy Act stripped the EPA of its authority to monitor hydraulic fracturing (with the exception of the use of diesel in fracking fluids). The New York Times dubbed this the "Halliburton loophole", alleging that then Vice President Dick Cheney, formerly CEO of Halliburton (the largest maker of fracking fluid), shepherded this provision through Congress.

The **Clean Air Act** – sets limits for major pollution sources including aggregates from multiple smaller sources from one operator. Oil and gas wells are exempt from this aggregation which in essence eliminates reporting from fracking operations.

The **Clean Water Act** – regulates the release of pollutants into waterways. Amendments exempted oil and gas production from stormwater runoff permits and redefined sediment as a non-pollutant. Consequently, sediment run-off from well and infrastructure construction and operation into streams and rivers are not covered by the Act.

The **Resource Conservation and Recovery Act** – regulates hazardous waste at all stages including generation, transportation, treatment, storage and disposal. Oil and gas hazardous waste was exempted by the EPA after existing state and federal regulations were found to be adequate. The exemption means hazardous waste regulations vary across states and could allow oil and gas to pollute hazardous waste freely.

The **Superfund** law – makes companies liable for clean -up costs from releasing hazardous materials into the environment, yet several toxic chemicals on the Superfund list are exempted if used for oil and gas production, and natural gas itself is excluded as a hazardous substance.

- Renee Lewis Kosnik, "The Oil and Gas Industry's Exclusions and Exemptions to Major Environmental Statutes," *Oil and Gas Accountability Project /Earthworks*, October, 2007, <http://www.earthworksaction.org/files/publications/PetroleumExemptions1c.pdf?pubs/PetroleumExemptions1c.pdf>.
- 6 Senator Robert Casey, Jr., "Statement for the Record, Introduction of the Fracturing Responsibility and Awareness of Chemicals (FRAC) Act," June 9, 2009, <http://casey.senate.gov/newsroom/press/release/?id=3D78271C-E412-4B63-95B8-419E75CE2BB6>.
  - 7 Responding to public concern over the impacts from fracking, Arkansas, Colorado, Texas, and Wyoming have all increased frack fluid disclosure requirements. Pennsylvania imposed more stringent standards for total dissolved solids (TDS) to end unlimited discharges of drilling waste into streams and rivers, which has helped to reduce the practice considerably. At press, New York, New Jersey, and Maryland state lawmakers placed moratoriums on drilling pending studies to determine whether it endangers drinking water and public health; however, New York does have vertical well drilling.
  - 8 U.S. Department of Energy, Office of Fossil Energy, National Energy Technology Lab, and the Ground Water Protection Council, "State Oil and Natural Gas Regulations Designed to Protect Water Resources," May 2009.
  - 9 Kara Cusolito, "America's Next Drilling Disaster?" *The Nation*, June 9, 2010.
  - 10 Troy Hooper, "Report: Colorado oil, gas regulators 'inadequate' not enforcing rules," *The Colorado Independent*, March 20, 2012.
  - 11 U.S. Environmental Protection Agency, "Hydraulic Fracturing Research Study," *Science in Action*, June 2010, <http://www.epa.gov/safewater/uic/pdfs/hfresearchstudyfs.pdf>.
  - 12 N. Warner, et al. , "Geochemical evidence for possible natural migration of Marcellus Formation brine to shallow aquifers in Pennsylvania," *Proceedings of the National Academy of Sciences of the United States (PNAS)*, July 24, 2012, <http://www.pnas.org/content/109/30/11961.full>.
  - 13 Tom Myers, "Potential Contaminant Pathways from Hydraulically Fractured Shale to Aquifers," *Ground Water*, February 2012.
  - 14 Kirk Johnson, "EPA links tainted water in Wyoming to hydraulic fracturing for natural gas," *New York Times*, December 8, 2011, [http://www.nytimes.com/2011/12/09/us/epa-says-hydraulic-fracturing-likely-marred-wyoming-water.html?\\_r=1](http://www.nytimes.com/2011/12/09/us/epa-says-hydraulic-fracturing-likely-marred-wyoming-water.html?_r=1).
  - 15 A. Stewart, "Pennsylvania Landowners Settle Groundwater Contamination Suit Against Chesapeake Energy Corp.," Yahoo Finance, June 25, 2012.
  - 16 Charles Groat, "Separating Fact From Fiction in Shale Gas Development," Energy Institute, The University of Texas at Austin, February 15, 2012, [http://energy.utexas.edu/index.php?option=com\\_content&view=article&id=151:shale-gas-regulation&catid=1:features&Itemid=146](http://energy.utexas.edu/index.php?option=com_content&view=article&id=151:shale-gas-regulation&catid=1:features&Itemid=146).
  - 17 Wells consist of several layers of steel casing, each of which is covered by an outside layer of cement to seal off any fluids or gas from leaking into the earth and migrating upward to water sources. The Environmental Defense Fund estimates that one in ten wells have improper cement jobs (the most infamous example of an inadequate cement job being the BP Deepwater Horizon oil spill in the Gulf of Mexico).

- 18 Bill Chameides, "Natural Gas, Hydrofracking and Safety: The Three Faces of Fracking Water," *National Geographic*, September 20, 2011.
- 19 Abrahm Lustgarten, "Buried Secrets: Is Natural Gas Drilling Endangering U.S. Water Supplies?" *ProPublica*, November 13, 2008, <http://www.propublica.org/article/buried-secrets-is-natural-gas-drilling-endangering-us-water-supplies-1113>.
- 20 Craig Michaels, et al., "Fractured Communities: Case Studies of the Environmental Impacts of Industrial Gas Drilling," *Riverkeeper*, September 2010, <http://www.riverkeeper.org/wp-content/uploads/2010/09/Fractured-Communities-FINAL-September-2010.pdf>.
- 21 Charles Groat and Thomas Grimshaw, "Fact-Based Regulation for Environmental Protection in Shale Gas Development," *The Energy Institute*, University of Texas at Austin, February 2012, [http://energy.utexas.edu/images/ei\\_shale\\_gas\\_regulation120215.pdf](http://energy.utexas.edu/images/ei_shale_gas_regulation120215.pdf).
- 22 Personal communication, ExxonMobil Corporation, March 2, 2012, and Range Resources, March 14, 2012.
- 23 The New York State Department of Environmental Conservation (DEC) raised concerns in 2009 regarding wastewater treatment and said it will not issue drilling permits until the companies demonstrate they are capable of adequately disposing of waste water. It listed three options for companies - having it processed at sewage plants in NY, trucking it to specialized treatment plants in nearby states, or injecting it underground. Of the 11 out-of-state plants, nine could not take more wastewater and two refused to respond. Of the six NY injection wells, only one was licensed to accept gas wastewater (which it uses for its own operations). [http://www.propublica.org/article/drill-wastewater-disposal-options-in-ny-report-have-problems-1229#nyc\\_wastewater\\_update](http://www.propublica.org/article/drill-wastewater-disposal-options-in-ny-report-have-problems-1229#nyc_wastewater_update).
- 24 Ohio approved 29 permits for injection wells in 2011 (mostly for out of state water) after averaging about four a year for the past two decades. This included 93% of the water sent to the Youngstown, Ohio well that had to be closed after 11 nearby earthquakes. Mark Niquette, "Ohio Tries to Escape Fate as a Dumping Ground for Fracking Fluid," *Bloomberg*, Jan 31, 2012.
- 25 John Green, "Regulations waived for surface, other safety," *Hutchinson Kansas*, May 7, 2012, <http://www.hutchnews.com/Todaystop/Fracking--surface>.
- 26 David B. Caruso, "Despite Overhaul, Gas Wastewater Still A Problem," *The Associated Press*, March 12, 2011.
- 27 Mark Drajem, "Fracking Tied to Unusual Rise in Earthquakes in U.S.," *Bloomberg*, April 12, 2012.
- 28 Terrance Henry, "How Fracking, Drilling and Earthquakes Are Linked," *State Impact*, February 8, 2012, <http://stateimpact.npr.org/texas/2012/02/08/how-fracking-drilling-and-earthquakes-are-linked/>.
- 29 As You Sow, "Shareholder rebuttal to the ExxonMobil opposition statement regarding hydraulic fracturing risks," *Exempt Solicitation*, Submitted to the U.S. Securities and Exchange Commission, May 2012.
- 30 Jeff Tollefson, "Air sampling reveals high emissions from gas field," *Nature*, February 7, 2012.
- 31 Don Hopey, "EPA Probing Washington County Shale Operations," *Post-Gazette*, February 13, 2012, <http://www.post-gazette.com/pg/12044/1209896-503-2.stm>.
- 32 Mark Jaffe, "Like Wyoming, Utah finds high wintertime ozone pollution near oil, gas wells," *Denver Post*, February 26, 2012, [http://www.denverpost.com/business/ci\\_20042330#ixzz1ppW8T3yV](http://www.denverpost.com/business/ci_20042330#ixzz1ppW8T3yV).
- 33 Wendy Koch, "Wyoming's smog exceeds Los Angeles' due to gas drilling," *USA Today*, March 9, 2011.
- 34 The Utah Department of Environmental Quality is studying if there is a link to the 10,000 oil and gas wells in that area. The peak ozone value is 139 parts per billion, which is 85% higher than the federal health standard. Ozone exacerbates asthma and other respiratory diseases. Ozone is created when VOCs mix with heat and sunlight, which in this case was likely enhanced by a heavy winter snow cover. Mark Jaffe, "Like Wyoming, Utah finds high wintertime ozone pollution near oil, gas wells," *Denver Post*, February 26, 2012, [http://www.denverpost.com/business/ci\\_20042330#ixzz1ppW8T3yV](http://www.denverpost.com/business/ci_20042330#ixzz1ppW8T3yV).
- 35 Natural gas wells in the area are losing about four percent of their gas to the atmosphere (not including additional losses in the pipeline and distribution system) according to the National Oceanic and Atmospheric Administration (NOAA) and the University of Colorado, Boulder. NOAA also found high concentrations of butane, ethane and propane in Erie, east of Boulder, where hundreds of natural-gas wells are operating. [http://www.denverpost.com/business/ci\\_20042330#ixzz1ppW8T3yV](http://www.denverpost.com/business/ci_20042330#ixzz1ppW8T3yV).
- 36 Al Armendariz, Emissions from Natural Gas Production in Barnett Shale Area and Opportunities for Cost-Effective Improvements, Jan. 26, 2009, [http://www.edf.org/documents/9235\\_Barnett\\_Shale\\_Report.pdf](http://www.edf.org/documents/9235_Barnett_Shale_Report.pdf).
- 37 R. Oswald, M. Bamberger, "Impacts of Gas drilling on Human and Animal Health," *New Solutions*, Vol. 22(1) 51-77, 2012, <http://63.134.196.109/documents/mpactsofGasDrillingonHumanandAnimalHealth.pdf>.
- 38 Chuck Gill, "Marcellus Shale activity affecting county-level dairy production," *Pennsylvania State University*, March 5, 2012.
- 39 Personal communication with the Alberta Surface Rights Group, May 21, 2012.
- 40 "Canadian Farmers Call for a Fracking Moratorium," *The Marcellus Effect*, February 25, 2012, <http://marcelluseffect.blogspot.com/2012/02/canadian-farmers-call-for-fracking.html>.
- 41 "Ohio Farmers Union calls for fracking moratorium," *Ohio Farmer*, February 6, 2012.
- 42 J. Vogel, "Sustainable, Organic Farm Groups Urge Fracking Moratorium," *Farm Futures*, June 20, 2012.
- 43 M. Brittingham, "A Research Update on the Effects of Marcellus Shale exploration and development on wildlife habitat and birds: Preliminary Results," *Pennsylvania State, College of Agricultural Science*, August 25, 2011.
- 44 "Natural Gas: The Inside Story" Telebriefing (23:22), *Earthjustice*, September 2011, <http://earthjustice.org/features/campaigns/telebriefing-natural-gas-the-inside-story>.
- 45 *Earthjustice*, "Comments on the NiSource Draft Multi-Species Habitat Conservation Plan and the U.S. Fish & Wildlife Service Draft Environmental Impact Statement," Submitted to the U.S. Fish and Wildlife Service, December 13, 2011.
- 46 Scott Detrow, "Can Pennsylvania's forest survive additional Marcellus Shale drilling?" *State Impact*, National Public Radio, September 12, 2011, <http://stateimpact.npr.org/pennsylvania/2011/09/12/can-pennsylvanias-state-forests-survive-additional-marcellus-shale-drilling/>.
- 47 Tom Pelton, "Treatment of Fracking Wastewater Removes Pesticide... But What About Other Chemicals?" *Bay Daily*, Chesapeake Bay Foundation, March 8, 2011.
- 48 Drew T. Shindell, et al., "Improved Attribution of Climate Forcing to Emissions," *Science*, October 30, 2009, <http://www.sciencemag.org/content/326/5953/716#corresp-1>.

- 49 Robert Howarth, et al., "Methane and the greenhouse gas footprint of natural gas from shale formations," *Climatic Change Letters*, DOI: 10.1007/s10584-011-0061-5, <http://www.springerlink.com/content/e384226wr4160653/fulltext.pdf?MUD=MP>.
- 50 Lawrence Cathles, et al., "A commentary on 'The greenhouse-gas footprint of natural gas in shale formations,'" by R.W. Howarth, R. Santoro, and Anthony Ingraffea," *Climate Change*, Cornell University, January 3, 2012.
- 51 A report by a major British investment firm concludes that natural gas can produce 50 percent less carbon dioxide than coal, but the short-term climate impact of its methane emissions negates much or all of the benefit of coal-gas switching for the first two or three decades after it occurs. Fiona Harvey, "Using shale gas over coal does not help climate, says big gas investor," *The Guardian*, May 29, 2012, <http://www.guardian.co.uk/environment/2012/may/29/shale-gas-coal-climate-investor>.
- 52 Ruth Wood, et al., "Shale gas: a provisional assessment of climate change and environmental impacts," *The Tyndall Centre for Climate Change Research University of Manchester*, January 2011.
- 53 "...rapid deployment of low-emission energy systems can do little to diminish the climate impacts in the first half of this century. Conservation, wind, solar, nuclear power and possibly carbon capture and storage appear to be able to achieve substantial climate benefits in the second half of this century; however, natural gas cannot."
- N.P. Myhrvold and K Caldeira, "Greenhouse gases, climate change and the transition from coal to low-carbon electricity," *Environmental Research Letters*, Vol. 7, No. 1, February 16, 2012, <http://iopscience.iop.org/1748-9326/7/1/014019/article>.
- 54 Fiona Harvey, "'Golden Age of Gas' Threatens Renewable Energy," *The Guardian*, June 3, 2012.
- 55 Steve Orr, "Fracking: Bane or Boon? A Look into Industry's presence in Pa.," *The Democrat and Chronicle.com*, December 18, 2011.
- 56 "Drilling Boom Brings Surge in Crime to Small Towns," *The Associated Press*, October 26, 2011.
- 57 Peter Applebome, "Drilling debate in Cooperstown NY is personal," *New York Times*, October 29, 2011, <http://www.nytimes.com/2011/10/30/nyregion/in-cooperstown-fight-over-gas-drilling-civility-is-fading.html>.
- 58 Kristin Wyatt, "Drilling advances prompt escalating fight in Colorado," *The Aspen Times*, January 21, 2012, <http://www.aspentimes.com/article/20120121/NEWS/120129978/1077>.
- 59 Kirk Johnson, "Drilling in new areas ushers in era of tension," *New York Times*, October 24, 2011, <http://www.nytimes.com/2011/10/25/us/oil-drilling-in-new-areas-ushers-in-era-of-tension.html?hp>.
- 60 Jeffrey Jacquet, "Wyoming Boomtowns: Social and Economic Impacts Of Natural Gas Drilling," Natural Gas Drilling Workshop, January 12, 2009.
- 61 J. Williamson and B. Kolb, "Marcellus Natural Gas Development's Effect on Housing in Pennsylvania," Center for the Study of Community and the Economy, Lycoming College, October 31, 2011, <http://marcellus.psu.edu/resources/PDFs/housingreport.pdf>.
- 62 Emma Jacobs, "Compulsory integration takes heat for forcing drilling on landowners," *WRVO*, August 16, 2011, <http://innovationtrail.org/post/compulsory-integration-takes-heat-forcing-drilling-landowners>.
- 63 Ian Urbina and Jo Craven McGinty, "Learning Too Late of the Perils in Gas Well Leases," *New York Times*, December 1, 2011.
- 64 Ian Urbina, "Rush to Drill for Natural Gas Creates Conflicts With Mortgages," *New York Times*, October 19, 2011.
- 65 Neela Banerjee, "Fracking debate divides New York landowners," *Los Angeles Times*, February 19, 2012.
- 66 Tasha Eichenseher, "Water: in drilling country, water rights stir fracking questions," *Energy Wire*, February 9, 2012.
- 67 Mike Lee, "Parched Texans Impose Water-Use Limits for Fracking Gas Wells," *Business Week*, October 6, 2011, <http://www.businessweek.com/news/2011-10-06/parched-texans-impose-water-use-limits-for-fracking-gas-wells.html>.
- 68 "Auditors say federal officials need to step up oversight on gas lines tied to fracking," *Fox News*, March 24, 2012.
- 69 Associated Press, "Landowners fight eminent domain in PA gas fields," *Fox News*, January 31, 2012, <http://www.foxnews.com/us/2012/01/31/landowners-fight-eminent-domain-in-pa-gas-field>.
- 70 Dan Wiessner, "New York Rulings Could Embolden Towns to Ban Fracking," *Thompson Reuters News & Insight*, February 28, 2012.
- 71 Ben Price, "Fracking spurs a municipal mutiny in Pennsylvania," *Philadelphia Inquirer*, May 23 2012.
- 72 "Pa. Lawmaker wants to lift doctor-patient gag order in Marcellus Shale law," *CBS News*, April 19, 2012.
- 73 Tom Barnes and Tracie Mauriello, "Terrorism advisory group aided Marcellus Industry," *Pittsburg Post-Gazette*, March 29, 2012, <http://www.post-gazette.com/stories/local/state/analysis-terrorist-advisory-group-aided-marcellus-industry-264198/>.
- 74 Jim Snyder, "Natural gas lobby challenging coal," *The Hill*, March 1, 2010, <http://thehill.com/business-a-lobbying/84123-natural-gas-lobby-steps-up-to-challenge-coal?page=2#comments>.
- 75 Common Cause PA, "New Report: Natural Gas Industry Has Spent More Than \$23 Million to Influence PA Elected Officials," Marcellus Money, July 12, 2012, <http://marcellusmoney.org>.
- 76 Mike McIntire, "Conservative Nonprofit Acts as a Stealth Business Lobbyist," *New York Times*, April 21, 2012, [http://www.nytimes.com/2012/04/22/us/alec-a-tax-exempt-group-mixes-legislators-and-lobbyists.html?\\_r=2&hpw](http://www.nytimes.com/2012/04/22/us/alec-a-tax-exempt-group-mixes-legislators-and-lobbyists.html?_r=2&hpw).
- 77 Corbett Daly, "ALEC under fire as Coke drop its membership," *CBS News*, April 5, 2012.
- 78 Amy Martinez, "Amazon says it will improve warehouse conditions," *Los Angeles Times*, May 24, 2012.
- 79 T. Colborn, et al. "Natural gas operations from a public health Perspective," *Human and Ecological Risk Assessment*, Volume 17, Issue 5, September, 2011, <http://www.tandfonline.com/doi/abs/10.1080/10807039.2011.605662>.
- 80 Dusty Horwitt, Senior Analyst, Environmental Working Group and Theo Colborn, President, The Endocrine Disruption Exchange, letter to David Patterson, Governor of New York and Michael Bloomberg, Mayor of New York City, August 11, 2008, available at: <http://www.awwa.org/files/Publications/WaterWeek/1219434939844.pdf>.
- 81 Mark Jaffe, "Like Wyoming, Utah finds high wintertime ozone pollution near oil, gas wells," *Denver Post*, February 26, 2012, [http://www.denverpost.com/business/ci\\_20042330#ixzz1ppW8T3yV](http://www.denverpost.com/business/ci_20042330#ixzz1ppW8T3yV).
- 82 Ian Urbina, "Regulation Lax as Gas Wells' Tainted Water Hits Rivers," *The New York Times*, February 26, 2011, <http://www.nytimes.com/2011/02/27/us/27gas.html?pagewanted=all>.

- 83 Lisa McKenzie, et al., "Human Health Risk Assessment of Air Emissions from Development of Unconventional Natural Gas Resources," *Science of the Total Environment*, 424:79-87. May 2012, <http://www.ncbi.nlm.nih.gov/pubmed/22444058>.
- 84 A Beebe, et al., "Chemical and physical characterization of produced waters from conventional and unconventional fossil fuel resources," *Chemosphere*, September 2011.
- 85 The New York Department of Environmental Conservation found levels of radium-226, a radioactive derivative of uranium, at up to 267 times the limit for safe discharge when they analyzed 13 samples of hydraulic fracturing wastewater. Abraham Lustgarten, "Is New York's Marcellus Shale Too Hot to Handle?" *ProPublica*, November 9, 2009.
- 86 Ian Urbina, "Regulation Lax as Gas Wells' Tainted Water Hits Rivers," *New York Times*, February 26, 2011.
- 87 "Drilling Down: Documents: Politics, Recycling and Tracking of Natural Gas Waste," *New York Times*, March 1, 2011, <http://www.nytimes.com/interactive/2011/03/01/us/natural-gas-documents-2.html#document/p64/a10110>.
- 88 Charles Groat and Thomas Grimshaw, "Fact-Based Regulation for Environmental Protection in Shale Gas Development," The Energy Institute, University of Texas at Austin, February 2012, [http://energy.utexas.edu/images/ei\\_shale\\_gas\\_regulation120215.pdf](http://energy.utexas.edu/images/ei_shale_gas_regulation120215.pdf).
- 89 Barb Harris, "Fracking exposes children to industrial toxins," *EcoWatch*, September 6, 2012, <http://ecowatch.org/2012/fracking-children/>.
- 90 Theo Colborn, et al., "Natural Gas Operations from a Public Health Perspective," *Human and Ecological Risk Assessment: An International Journal*, Volume 17, Issue 5, pages 1039 – 1056, September 2011, <http://www.tandfonline.com/doi/abs/10.1080/10807039.2011.605662>.
- 91 Roxana Witter, et al., "Health Impact Assessment for Battlement Mesa, Garfield County Colorado," Colorado School of Public Health, University of Colorado, September 2010.
- 92 New York Medical Professionals letter to Governor Cuomo, October 5, 2011.



## **About HEFN**

The Health and Environmental Funders Network (HEFN) is a network of grantmakers investing at the intersections of health and the environment. HEFN's mission is to maximize the impact of philanthropy on environmental health and environmental justice.

**For more information, please visit  
[www.HEFN.org](http://www.HEFN.org)**



Health and Environmental Funders Network  
4805 St. Elmo Avenue, 2nd Floor  
Bethesda, MD 20814  
phone: (301)656-7650  
fax: (301)656-7652  
email: [info@hefn.org](mailto:info@hefn.org)  
[www.HEFN.org](http://www.HEFN.org)

September 2012