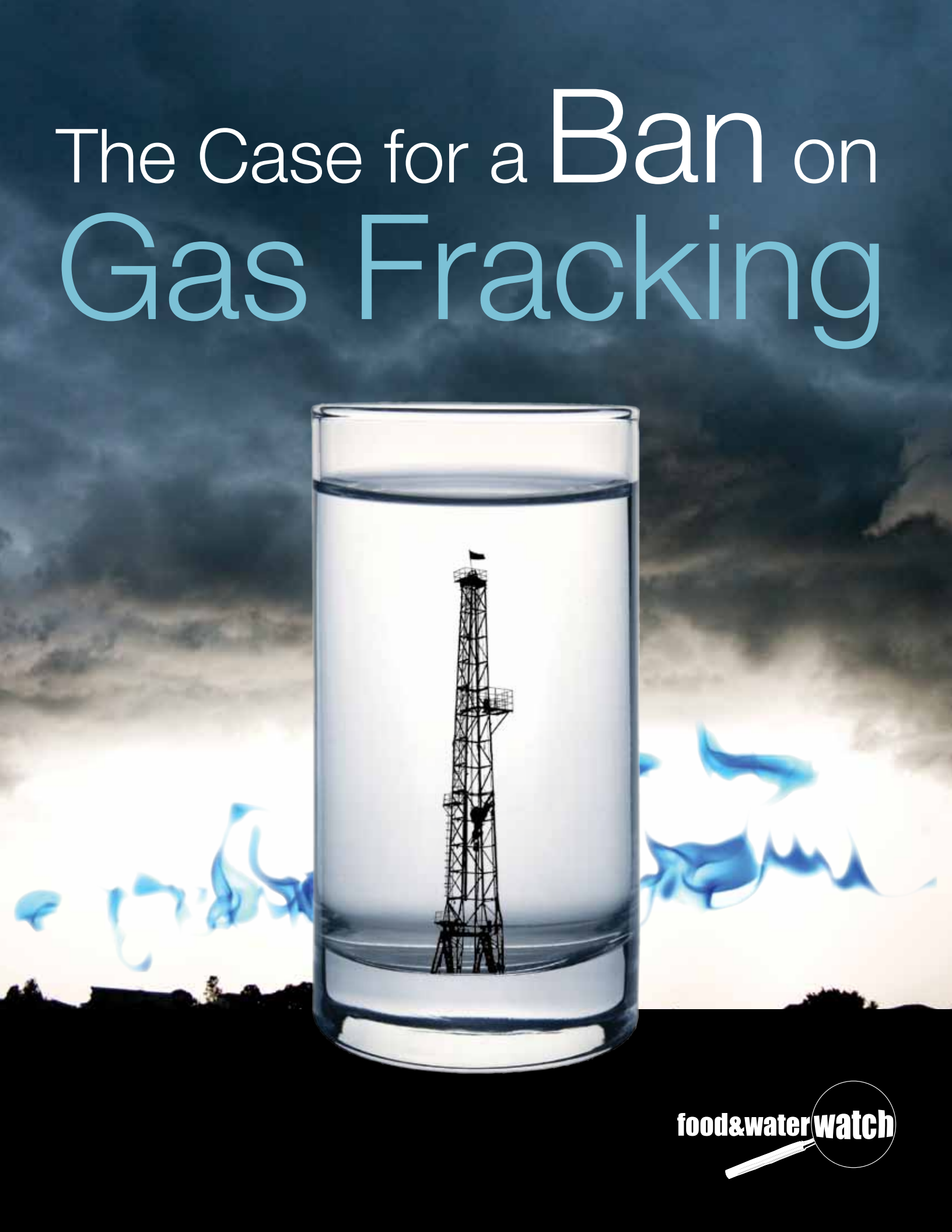
The Case for a Ban on Gas Fracking



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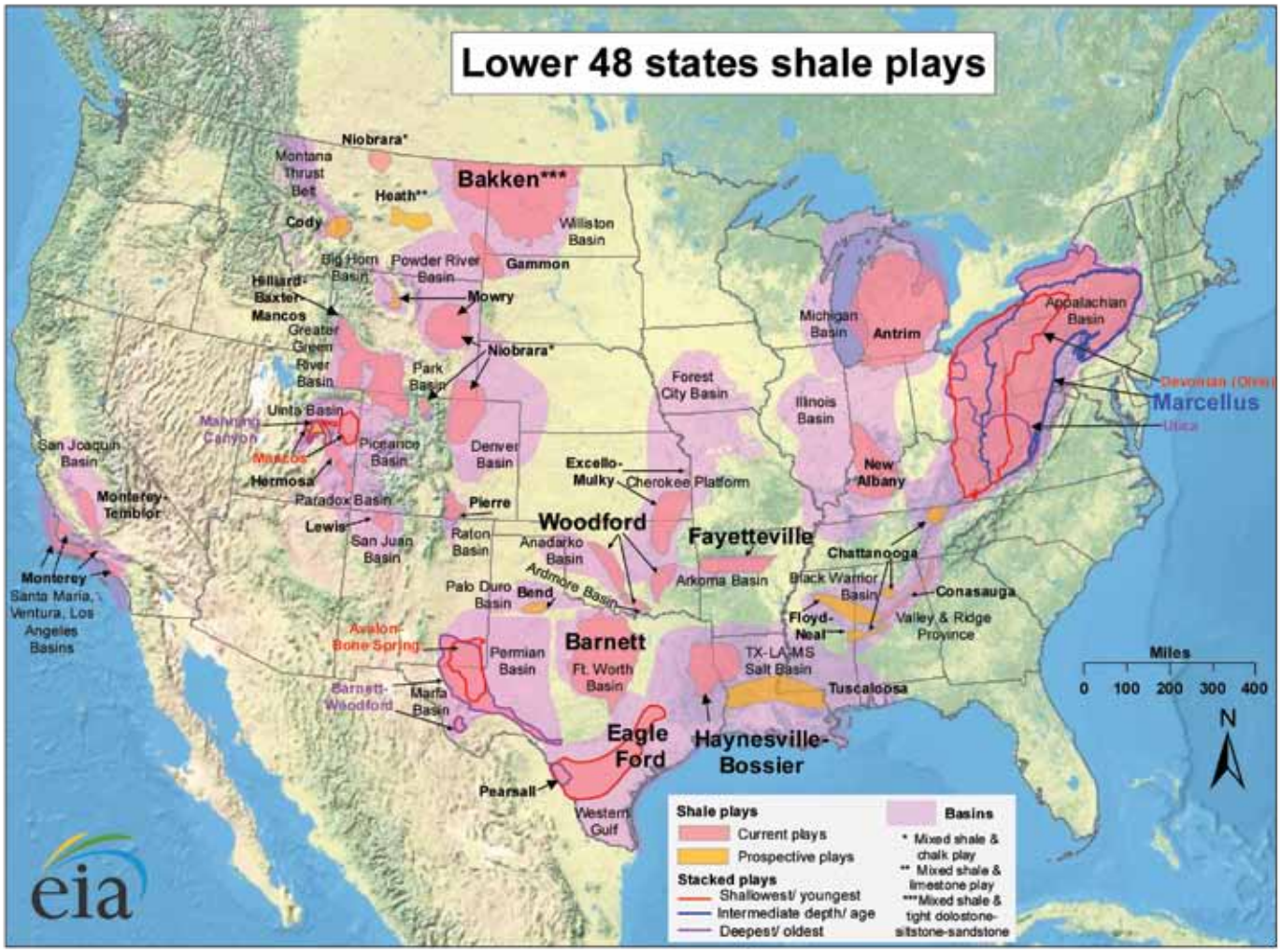

Source: Energy Information Administration, based on data from various published studies. Updated: May 9, 2011

About Food & Water Watch

Food & Water Watch works to ensure the food, water and fish we consume is safe, accessible and sustainable. So we can all enjoy and trust in what we eat and drink, we help people take charge of where their food comes from, keep clean, affordable, public tap water flowing freely to our homes, protect the environmental quality of oceans, force government to do its job protecting citizens, and educate about the importance of keeping shared resources under public control.

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The Case for a Ban on Gas Fracking

Executive Summary

Over the past decade, there has been a rush for new natural gas across America using a controversial — and often polluting — drilling method. Hydraulic fracturing, known as fracking, injects a mixture of water, sand and chemicals under high pressure into dense rock formations — shale, tight sandstone or coal beds — to crack the rock and release natural gas. Fracking has been around for decades, but the techniques, technologies and chemicals used to reach new, remote gas reserves are more intensive and riskier than conventional gas drilling.

The rapid expansion of this new form of fracking has brought rampant environmental and economic problems to rural communities. Tens of billions of gallons of water are used for fracking each year, and that amount would only grow if proposed drilling moves forward. Accidents and leaks have polluted rivers, streams and drinking water supplies. Regions peppered with drilling rigs have high levels of smog as well as other airborne pollutants, including potential carcinogens. Rural communities face an onslaught of heavy truck traffic — often laden with dangerous chemicals used in drilling — and declining property values. The "bridge fuel" of fracking could well be a bridge to nowhere.

Over the past 18 months, at least 10 studies by scientists, Congress, investigative journalists and public interest groups have documented environmental problems with fracking. Findings include:

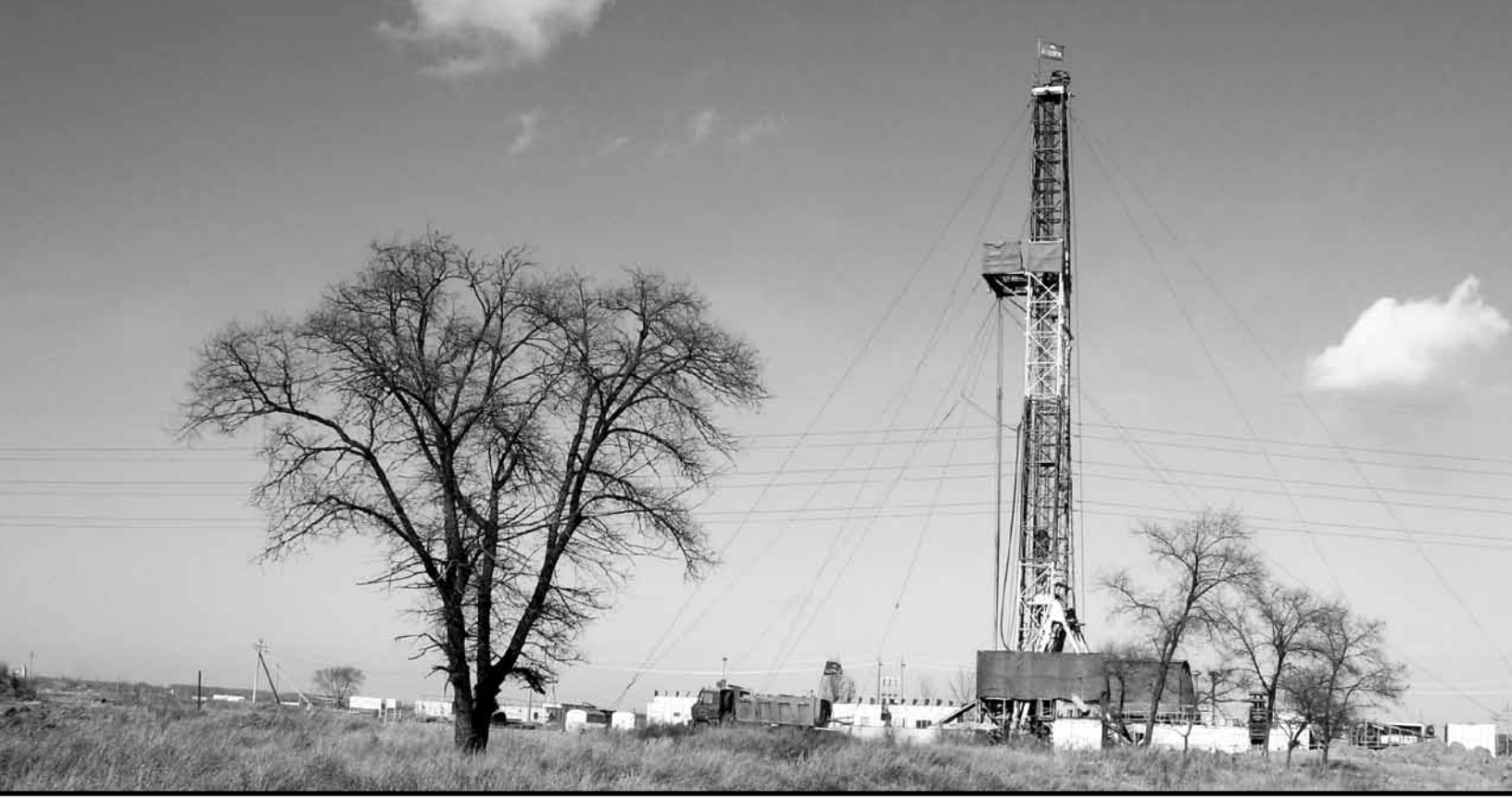
- Toxic chemicals present in fracking fluid could cause cancer and other health problems.[1]
- Fracking wastewater contains high levels of radioactivity and other contaminants that wastewater treatment plants have had difficulty removing; this potentially contaminated wastewater can then be discharged into local rivers.[2]
- In Pennsylvania, more than 3,000 gas fracking wells and permitted well sites are located within two miles of 320 day care centers, 67 schools and nine hospitals.[3]

Fracking is exempt from key federal water protections, and federal and state regulators have allowed unchecked expansion of fracking, creating widespread environmental degradation. Overwhelmed state regulators largely oversee the practice. Even if the laws on the books were strengthened, fracking poses too severe a risk to public health and the environment to entrust effective and rigorous regulatory oversight to these officials. Both state and federal regulators have a poor track record of protecting the public from the impacts of fracking. Congress, state legislators and local governmental bodies need to ban shale gas fracking.

The lax regulation and technological advances spurred a fracking gas rush across America that some industry insiders called a "natural gas revolution" and a "game changer."[4] Energy analysts and oil tycoon T. Boone Pickens bolstered this rush by promoting natural gas as a promising "bridge fuel" for the United States to transition from dirty fossil fuels to clean, renewable sources of energy. However, fracking itself may release enough of the greenhouse gas methane to counterbalance the lower carbon dioxide emissions from burning the natural gas.[5] To safeguard public health and the environment, the federal government should ban shale gas fracking.

Recommendations

- Ban shale gas fracking in the United States.
- Close loopholes that exempt fracking from key federal air and water environmental regulations.
- Aggressively invest in energy efficiency and renewable energy sources that would result in a sustainable energy future for the country.



Introduction

Billionaire oil tycoon T. Boone Pickens is a major natural gas proponent.[6] Pickens has invested millions of dollars promoting natural gas and has a 45 percent stake in a natural gas filling station company.[7] He is pushing for federal subsidies for vehicles that use natural gas — including ones that would fill up at filling stations built by the company he partially owns.[8] He promotes natural gas as a promising "bridge fuel" for the United States to transition from dirty fossil fuels to clean, renewable sources of energy.[9]

Some energy analysts, including the MIT Energy Initiative and the Center for American Progress, believe that natural gas is a better fossil fuel alternative than coal or oil, especially if the gas is domestically produced.[10] While Pickens' energy policy proposal, known as the Pickens Plan, originally called for large wind energy investments to supplant natural gas power plants, his current plan focuses primarily on natural gas, and he has cancelled the bulk of a $1.5 billion wind turbine order.[11]

Natural gas seems like it could solve many of America's energy problems. Natural gas combustion is less polluting than coal for electricity or oil for vehicle fuel.[12] Moreover, if enough natural gas could be found in America, it could reduce dependence on imported oil.[13] But the promise of this bridge relies on freeing natural gas locked deep inside rock formations using a controversial and environmentally risky drilling technology called hydraulic fracturing, or "fracking."

U.S. conventional gas fields — including large pockets of natural gas and porous rock fields that do not require aggressive fracking to release the gas — are insufficient to meet the added demand for a bridge fuel. For example, the Center for American Progress estimated that powering 3.5 million additional trucks and buses with natural gas would require an additional 2.7 trillion cubic feet of natural gas.[14] Conventional gas reserves have been stagnant and are projected to decline.[15]

But over the past decade, oil and gas companies have expanded U.S. gas reserves by using improved fracking methods to extract gas from rock sources that were previously uneconomical to access — especially shale.[16] The Potential Gas Committee reported that the potential shale gas reserves tripled in just five years, from about 200 trillion cubic feet in 2006 to nearly 700 trillion cubic feet in 2010.[17] The biggest energy companies shifted their exploration and investments to capture these new gas reserves. In June 2010, an article in *The Wall Street Journal* called shale gas "one of the hottest investments in the energy sector."[18] Even companies from China and India have begun investing in U.S. shale gas.

China's state-owned energy company has a one-third stake in Chesapeake Energy, including a piece of the Eagle Ford shale play in South Texas, and India's largest company, Reliance, bought a 45 percent stake in another firm's Eagle Ford field.[19]

This rush to fracking has been facilitated by millions of dollars in advertising and in lobbying Congress to sell "clean" natural gas to the American public. Between 2005 and 2010, the 10 largest natural gas producers and two trade associations spent more than $370 million lobbying for their interests.[20] Meanwhile, Pickens alone committed to spend $82 million to promote his natural gas plan, which includes government subsidies to help shift most commercial vehicles from gasoline and diesel to natural gas.[21]

The promise of natural gas has been a nightmare for the neighbors of fracking gas wells. Hydraulic fracturing injects a mixture of water, sand and chemicals underground under high pressure to crack dense rock formations — shale, tight sandstone or coal beds — and release natural gas. Fracking has been around for decades, but the techniques, technologies and chemicals used to reach these new, remote gas reserves are more intensive and riskier than those used on conventional gas wells.

Drilling accidents can and do occur, spilling the often-dangerous chemical slurry into waterways. The natural gas and chemicals can migrate from wells into aquifers and pollute the water table. Fracking may also release enough of the greenhouse gas methane during extraction to counterbalance the lower carbon dioxide emissions from burning the natural gas.[22]

Over the past 18 months, at least 10 studies by scientists, Congress, investigative journalists and public interest groups have documented environmental problems with fracking. *The New York Times* reported high levels of radioactivity and toxics in wastewater from fracking and the inability of most wastewater treatment plants to address these contaminants.[23] The *Associated Press* found that Pennsylvania had failed to account for one-fifth of its fracking wastewater and that treatment plants struggled to remove contaminants that can pose cancer risks with long-term exposure.[24] The U.S. House Energy and Commerce Committee, the Environmental Working Group and the Endocrine Disruption Exchange found toxins in fracking fluids.[25] A Duke university study published by the National Academy of Sciences demonstrated that methane levels in shallow drinking water wells were 17 times higher near active gas drilling areas than inactive areas.[26] Other reports demonstrated the potentially high levels of greenhouse gas emissions from fracked gas wells; the large number of day care, school and hospitals near gas wells in Pennsylvania; the lobbying efforts by the oil and gas industry to prevent stronger federal regulatory oversight of fracking; and an extensive case-study review of the environmental impacts of fracking. (See box on page 3.)

Top 10 Natural Gas Producers, 2010

Company	Millions of Cubic Feet/Day
ExxonMobil*	2,596
Chesapeake Energy	2,534
Anadarko	2,272
BP	2,184
Devon Energy	1,960
Encana	1,861
ConocoPhillips	1,777
Chevron	1,314
Royal Dutch Shell plc	1,153
EOG Resources	1,133

Source: National Gas Supply Association, Top 40 Producers. March 23, 2011. *Does not include Exxon's 2010 acquisition of XTO Energy.

The neighbors of fracking have experienced these significant risks firsthand. In 2009, fracking fluids had so polluted wells in Dimock, Pennsylvania, that some families could no longer drink from their taps.[27] An Ohio house exploded after a fracked gas well leaked large volumes of methane into the home's water supply.[28] Texas neighborhoods near fracked gas wells have high reported levels of airborne neurotoxins and the carcinogen benzene.[29]

Millions of Americans all across the country face these environmental calamities. Natural gas companies could employ fracking in any of the shale, tight sand or coalbed rock formations that lie under the majority of states. Federal and state regulators have allowed unchecked expansion of fracking, causing widespread environmental degradation. Fracking is exempt from key federal water protections and is largely overseen by overwhelmed state regulators.

Citizens, scientists, local businesses, healthcare professionals, government officials and ex-industry executives are standing up to stop fracking. In April 2011, a record 30,000 public comments were submitted to the Delaware River Basin Commission opposing fracking in the river basin.[30] In spring 2011, thousands of people rallied against fracking.[31] By June 2011, at least 58 municipalities had passed resolutions or ordinances against fracking.[32] Even Secretary of Interior Ken Salazar noted at a 2011 hearing that the problems with fracking were "the Achilles' heel that could essentially kill natural gas."[33]

This type of drilling poses unacceptable risks to the American public and it is ultimately a misguided energy policy direction for the United States. Fracking has the greatest impact on communities near the gas head and downstream from the wells, where residents face the largest threat of air and water

pollution, but concerns over widespread fracking extend beyond individuals' backyards. The bridge fuel of fracking could well be a bridge to nowhere, relying on polluting and risky fossil fuel extraction and sidestepping more promising and genuinely renewable alternative energy solutions.

To safeguard public health and the environment, the federal government should ban shale gas fracking and invest in a sustainable energy future for the country.

Ten Studies and Investigations, January 2010 to May 2011

New York Times (February 2011):[34] The investigative report highlighted fracking's severe environmental risks, including the radioactivity in drilling wastewater that is sometimes hundreds to thousands of times the U.S. Environmental Protection Agency (EPA)'s drinking water standard. Three-quarters of the gas wells reviewed in Pennsylvania and West Virginia produced wastewater with high levels of radiation.[35] Pennsylvania wells produced more than 1.3 billion gallons of wastewater over the past three years and most of it was sent to treatment plants that were unequipped to remove many of its toxic materials — at least 12 plants in three states discharged this partly treated waste into rivers, lakes and streams.[36]

House Energy and Commerce Committee (January 2011, April 2011): [37] The congressional investigations found that fracking fluids contained 750 chemicals, some of which were very hazardous to human health, including benzene and lead. Fracking fluids even included diesel fuel, which contains carcinogens such as benzene and toluene and is the only fracking chemical that requires a permit to inject into wells under Safe Water Drinking Act.

Riverkeeper (September 2010):[38] The report presents hundreds of environmental fracking case studies from Pennsylvania, Ohio, West Virginia, Texas, Arkansas, Colorado and Wyoming. It documents well blowouts, surface water spills, groundwater contamination, air pollution, permit violations and improper waste management.

Cornell University (March 2011): The published study found that shale fracking could have a greater effect on climate change than coal and oil over the life cycle of its production.[39] While natural gas combustion releases less carbon dioxide, drilling in shale and tight sand formations releases considerable volumes of the greenhouse gas methane. The EPA estimates that methane traps 21 times more heat by weight than carbon dioxide, the most prevalent and well-known greenhouse gas.[40]

Environmental Working Group (January 2010):[41] An investigation of the chemical disclosure records of drilling corporations found that some fracking fluids contained up to 93 times more benzene than diesel. The amount of benzene from a single fracked well could contaminate more than 100 billion gallons of drinking water.

PennEnvironment Research and Policy Center (May 2011):[42] The study examined Pennsylvania's more than 3,000 gas fracking wells and found permitted well sites within two miles of 320 day care centers, 67 schools and nine hospitals.

Duke University (April 2011):[43] The study, published by the National Academy of Sciences, found that average methane concentrations in shallow drinking water in active gas drilling areas were 17 times higher than those in non-active areas. The methane concentrations of drinking water closest to active gas wells were considered potential explosion hazards.

Endocrine Disruption Exchange (September 2010):[44] Scientists conducted a study accepted for publication in the *International Journal of Human and Ecological Risk Assessment* that found that 25 percent of fracking chemicals could cause cancer; 37 percent could disrupt the endocrine system; 40 to 50 percent could affect the nervous, immune and cardiovascular system; and more than 75 percent could affect the skin, eyes and respiratory system, resulting in problems like skin and eye irritation or flu-like symptoms.

Associated Press (January 2011):[45] The review of Pennsylvania's fracking water treatment revealed the state could not account for the disposal method of 1.28 million barrels of wastewater (one-fifth of the annual total) due to faulty reporting. Some drinking water utilities downstream from fracking wastewater facilities have struggled to sufficiently treat or remove trihalomethanes, which can cause cancer with chronic exposure. A lack of adequate oversight has allowed wastewater from fracking to contaminate the Delaware River Basin, which supplies drinking water for 15 million people in four states.

ProPublica (2011):[46] An ongoing investigation into fracking since 2008 found court and government documentation of more than 1,000 cases of water contamination in Colorado, New Mexico, Alabama, Ohio and Pennsylvania.[47] Reporters have unearthed gas and oil company campaign donations to members of Congress opposed to fracking disclosure requirements and catalogued individual and community case studies on the dangers of fracking, including environmental violations and contamination.[48]

The History and Next Wave of Fracking

Hydraulic fracturing is not a new technique, but its recent application to hard rock formations and the tremendous scale of the current rush for more gas is a radical departure from the conventional wells of the past. Hydraulic fracturing injects hydraulic fluids — a mixture of water, chemicals and sand — into wells to create pressure that cracks the rocks, allowing the gas to escape and flow out of the wells.[49] Drilling companies have used fracking in limited applications since the 1860s for oil and water well production,[50] but Halliburton is credited with the first commercial application to produce natural gas in 1949.[51] By the 21st century, hydraulic fracturing was used in 90 to 95 percent of all oil and gas wells.[52]

The gas industry insists that hydraulic fracturing has been safely used in thousands of wells for decades. The vice chairman of the Oklahoma Corporations Commission, which regulates gas and oil wells, testified before the Senate in 2011 that the state's 100,000 fracked wells have operated for more than 60 years without contaminating groundwater.[53] The president of the U.S. Energy Development Corporation, a company that operates more than 500 gas wells in New York, nearly all of which were fracked, told the *Buffalo News*, "It is completely safe — it's been proven to be completely safe."[54] But this next generation of horizontal fracking into hard rock is significantly different from traditional vertical well fracking. It is far more powerful — and more dangerous — than drilling methods used in the past.

Up until just the past decade, most on-shore natural gas production came from porous "conventional" rocks such as limestone and sandstone,[55] where loosely held gas flows into vertical wells drilled straight into the ground.[56] Fracking was used to stimulate the soft rock around the vertical shaft to release the gas. Other rocks such as shales, tight sands and coal beds contained gas, but it was locked tightly in the rock formations, making it uneconomical to extract.[57] According to a paper by ALL Consulting, many early shale wells "were never able to produce a marketable quantity of natural gas."[58]

Economically releasing gas from these tighter hard rock deposits requires more force, new techniques and a potentially toxic brew of chemicals to access the gas. This new generation of fracking involves curving "horizontal" wells into the rock formation to increase the extraction of gas from each well.[59] Then, the drillers inject a mixture of water, sand and chemicals (often toxic ones) known as "slickwater" fracking fluid to suspend the sand and prop open the fractures, as well as lubricants to speed the fluid into the well.[60] In 2011, the EPA estimated that 70 to 140 billion gallons of water are pumped into 35,000 fracking wells annually.[61] Fracking fluid is injected into the wells in stages that apply high pressure to crack the length of the horizontal well.[62] The pressure created by these techniques has been compared to exploding a massive pipe bomb underground.[63]

Some of the fracking fluid remains in the well, but some of it is discharged back up the well (creating what the industry calls "produced water"), a waste product that may include toxic chemicals and pollutants leached from the rock.[64] Much of this liquid may be made up of fracking fluids, although part of it is water from the rock formation,[65] which can be saltier than seawater.[66] The Groundwater Protection Council estimates that anywhere from around 30 percent to more than 70 percent of the injected fluids are discharged from the well; other estimates run as high as 100 percent of the fracking fluids.[67] Unconventional gas wells need to be re-fracked with additional high-pressure chemical-water injections to maintain their productivity, meaning the risk of contamination or accidents is long-term; for some shale gas wells, this must happen about every five years for decades.[68]

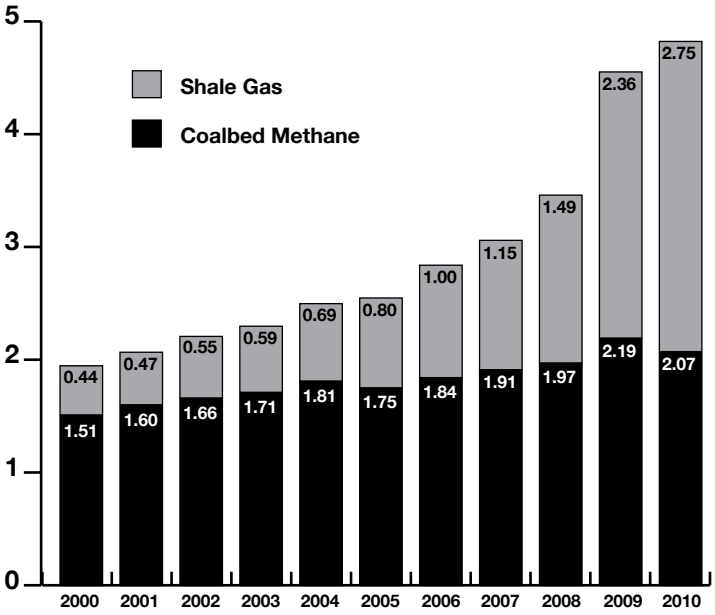
Fracking America: Coming to a Rock Formation Near You

These technological advances spurred a fracking gas rush across America that some energy analysts and industry insiders have called a "natural gas revolution" and a "game changer."[69] Gas companies first developed the Barnett shale reserves in Texas and gas production there skyrocketed more than 3,000 percent between 1998 and 2007.[70]

Drillers then targeted other shales as well — the Fayetteville Shale in Arkansas, the Woodford Shale in Oklahoma, the Haynesville Shale in Louisiana and the Marcellus Shale, which underlies parts of Pennsylvania, New York, Ohio, West Virginia, Virginia, Maryland and Kentucky.[71] A professor of geosciences at Penn State said that the Marcellus has the potential to be a "Super Giant gas field."[72] In Pennsylvania, the number of Marcellus gas wells jumped nearly six-fold from about 280 in 2008 to 1,600 in 2010.[73] Nationally, the number of fracking wells increased 41 percent from 37,239 in 2004 to 52,616 in 2008, according to data compiled by ProPublica.[74]

The fracking rush spurred U.S. production of natural gas, which had been stagnant since the 1990s.[75] Unconventional production, from coalbed methane and shale gas fields, increased nearly 150 percent from 1.95 trillion cubic feet in 2000 to 4.82 trillion cubic feet in 2010.[76] Shale gas alone increased from 1 percent to 20 percent of the U.S. supply between 2000 and 2010, according to the energy consulting group IHS CERA.[77] Between 2006 and 2010, shale gas production rose an average of 48 percent annually.[78] But the rapid escalation of production with little federal or state oversight has exposed neighboring residents and the environment to unacceptable risks.

Fracked Natural Gas Production Surges, in Trillions of Cubic Feet



Source: U.S. Energy Information Administration.

The pressure created by fracking techniques has been compared to exploding a massive pipe bomb underground.

Asleep at the Switch, Cops off the Beat

Federal and state regulators have largely turned a blind eye to the environmental degradation caused by next-generation fracking and the rapid rise of drilling in new areas. The EPA under the George W. Bush administration declared fracking safe, and Congress exempted it from clean water laws. Regulators that monitor fracking are underfunded and understaffed.[79] The oil and gas industry have stepped into this regulatory vacuum to prevent any sensible environmental oversight. The vice president of public and government affairs for the ExxonMobil Corporation warned, "Government policies did not cause the shale gas revolution in this country — but they could stop it in their tracks."[80]

In 2004, the Bush administration EPA released a study focused on coalbed methane reservoirs that concluded fracking posed "little or no threat" to underground drinking water sources.[81] It has been widely discredited for ignoring case studies of fracking contamination.[82] An EPA environmental engineer, Weston Wilson, catalogued the study's scientific shortcomings: It failed to independently collect data and demand industry disclosures, it did not know the contents of fracking fluids, and the EPA terminated the investigation after finding evidence that toxic and carcinogenic substances were being injected into underground drinking water sources, among other findings.[83] Ben Grumbles, who was EPA's assistant administrator for water at the time the report was released, later claimed, "EPA, however, never intended for the report to be interpreted as a perpetual clean bill of health for fracking or to justify a broad statutory exemption from any future regulation under the Safe Drinking Water Act."[84] Yet, that's exactly what happened.

The flaws of the study were effectively enshrined in law when fracking was exempted from provisions of the Safe Drinking Water Act. The Energy Policy Act of 2005 exempted the oil and gas industry from a wide range of federal environmental

and public health regulations.[85] It explicitly excluded hydraulic fracturing from the Safe Drinking Water Act's regulations of underground injection wells.[86] This exemption has been called "the Halliburton loophole" because of the ties between Vice President Dick Cheney and the company credited with the first commercial-scale application of fracking.[87]

This exemption allowed gas companies to inject almost any chemical, including toxics and carcinogens, into fracked wells. Companies do not even disclose what chemicals are in the fluid they inject into wells, claiming they are proprietary trade secrets.[88] One Halliburton executive told the Colorado Oil and Gas Commission that disclosing the chemicals in fracking fluids was "much like asking Coca-Cola to disclose the formula of Coke."[89] In April 2011, a few companies voluntarily disclosed the chemical composition of their fracking fluids in an apparent effort to stave off regulatory oversight.[90]

Oil and gas exploration and production activities are also exempt from Clean Air Act requirements to aggregate emissions from small sources. Fracking companies are subject only to the Clean Air Act rules for individual wells that emit more hazardous air pollutants than the regulatory threshold.[91]

Efforts are underway to close the fracking loopholes. Since new water contamination reports have surfaced, Congress has commissioned a new study by the EPA to reevaluate the impact of fracking on drinking water resources.[92] Industry groups attacked the project as too broad in scope.[93] Congress has also introduced legislation (the Fracturing Responsibility and Awareness of Chemicals Act, known as the FRAC Act) to close the Safe Drinking Water Act loophole and require firms to disclose the contents, but not recipes, of their fracking fluids.[94] Other legislation (the Bringing Reductions to Energy's Airborne Toxic Health Effects Act, or BREATHE Act) would close the energy industry's exemption from the Clean Air Act.[95]

These measures only require the gas exploration industry to comply with the same environmental laws as everyone else. Nonetheless, industry has battled even these limited steps forward. In January 2011, bipartisan congressional members of the Natural Gas Caucus (whose 83 members received a combined $1,742,572 in campaign contributions from the oil and gas industry between 2009 and 2010) opposed proposed U.S. Department of Interior rules to disclose fracking chemicals used on public lands.[96] Industry representatives claim that EPA oversight of fracking under the Safe Drinking Water Act would unleash environmental lawsuits that would force the agency to enact even more stringent regulations.[97] The Independent Petroleum Producers of America attacked the BREATHE Act for imposing a "permitting burden" for reporting well emissions.[98]

The current void in federal regulation has left oversight to the states.[99] The director of state policy at Duke University's

A family in Albany, New York, protests fracking in their community. Photo courtesy of April Hawthorne.

Nicholas Institute for Environmental Policy Solutions noted, "The industry has started drilling in most states, and regulators have struggled to keep up."[100] A *New York Times* investigation demonstrated the inadequacy of current regulatory oversight and the difficulty of understaffed state authorities to effectively monitor the booming fracking industry, finding: "Gas producers report their own spills, write their own spill response plans and lead their own cleanup efforts."[101] Even when violations are reported, Pennsylvania regulators, for example, are twice as likely to issue warnings than to impose fines.[102]

States also are conflicted about coming down hard on fracking pollution — they receive revenues from drilling permits, taxes and royalties. This is especially true during economic downturns. Pennsylvania attributed $1.1 billion in state revenue from 2006 to 2011 to natural gas drilling.[103] Fracking revenue is attractive to a state facing an $866 million budget cut for 2011-2012.[104] This may have contributed to lackluster oversight. For example, in March 2011, the Pennsylvania Department of Environmental Protection issued a memo requiring that political appointees in the state capital preapprove all field enforcement actions against gas drilling operations in the Marcellus Shale.[105] This requirement was removed after loud public outcry.[106]

Some state efforts to curb fracking pollution have been met with stiff lobbying resistance. Gas industry lobbying ramped up significantly once fracking moratorium bills were introduced in New York.[107] In 2010, natural gas and energy companies spent $1,204,567 lobbying against these bills in New York.[108] The current loophole-ridden laws and haphazard enforcement leave communities and the environment vulnerable to fracking pollution.

Airborne Pollution

Natural gas fracking extraction emits greenhouse gases, smog-inducing compounds, and potential carcinogens causing dangerous health and environmental effects. A 2011 Cornell University study found that shale gas has a greater greenhouse gas footprint than conventional gas or oil.[109] While natural gas combustion releases less carbon dioxide than oil, gasoline or coal combustion, breaking shale and tight sand formations releases considerable volumes of the greenhouse gas methane, which according to the EPA, is a greenhouse gas that is 21 times more powerful an agent of global warming than carbon dioxide, the most prevalent and well-known greenhouse gas.[110] The EPA uses the estimate provided in the Second Assessment Report by the Intergovernmental Panel on Climate Change from 1996.[111] A more recent study from 2009 suggests that methane has as much as 105 times the global warming potential as carbon dioxide by weight over the first 20 years after its emission and as much as 33 times the global warming potential over 100 years.[112] Using these updated estimates about the warming effect of methane, the Cornell researchers found that shale gas could have a greenhouse gas footprint that is twice that of coal over 20 years and a comparable footprint over a century.[113]

Methane is also highly flammable and a serious safety hazard.[114] Methane is the primary component of natural gas and can leak out of drilling casings into shallow water wells or be present in pipelines used to transport natural gas from the drilling site.[115] When methane saturates drinking water wells, a home's tap water can become explosive. The documentary *Gasland* depicted homeowners setting the water from their kitchen faucets on fire.[116]

A 2011 National Academy of Sciences paper found that methane concentrations in several shallow drinking water wells close to active gas wells exceeded the action level for potential fire hazard recommended by the U.S. Department of Interior.[117] In 2008, an Ohio house exploded after methane infiltrated its water source, largely because of fracking.[118] In 2010, after the EPA instructed Wyoming residents not to drink their water because of contamination from a common fracking fluid, some residents also used fans while bathing to reduce the likelihood of explosions.[119] In 2010, the EPA determined that two homes in Texas were at risk of explosion because of high levels of natural gas found in their water from nearby fracking operations.[120]

The film *Gasland* shows homeowners setting contaminated water from their home faucet on fire. Photo copyright Josh Fox/*Gasland*.

A Texas hospital serving six counties near drilling sites reported asthma rates three times higher than the state average; one quarter of young children in the community had asthma.

Other airborne pollutants from fracking sites threaten the health of people living nearby. Methanol, formaldehyde and carbon disulfide are known hazardous air pollutants found near fracking sites.[121] Residents of Dish, Texas, located near 11 natural gas compression stations became concerned about the odor, noise and health problems they were experiencing, which included headaches and blackouts. They also observed neurological defects and blindness in their horses.[122] Their mayor fruitlessly reported these accounts to Texas regulators and eventually hired a private environmental consultant, who in 2009 found that air samples contained high levels of neurotoxins and carcinogens.[123] The Texas Commission on Environmental Quality (TCEQ) found airborne benzene, which can cause immune disorders and cancer, near Barnett Shale wells at levels of 500 to 1,000 parts per billion — more than five times higher than allowable limits.[124]

Some of the airborne pollutants from fracked gas wells, like volatile organic compounds, can react with sunlight to create smog.[125] Many areas around Texas, for example, have been affected. The natural gas and oil industry in the Barnett Shale area produced more smog-forming emissions during the summer of 2009 than produced by all motor vehicles in the Dallas-Fort Worth metropolitan area, with annual greenhouse gas emissions equivalent to those of two coal-fired power plants.[126] In 2009, Wyoming failed to meet federal air

standards for the first time, partly because 27,000 gas wells, most of which were drilled within the previous five years, were emitting toluene and benzene.[127] Sublette County, a rural Wyoming community with a high concentration of gas wells, has recorded higher ozone levels than those in Houston and Los Angeles.[128] Air pollution is associated with significant adverse health effects. A Texas hospital serving six counties near drilling sites reported asthma rates three times higher than the state average; one quarter of young children in the community had asthma.[129]

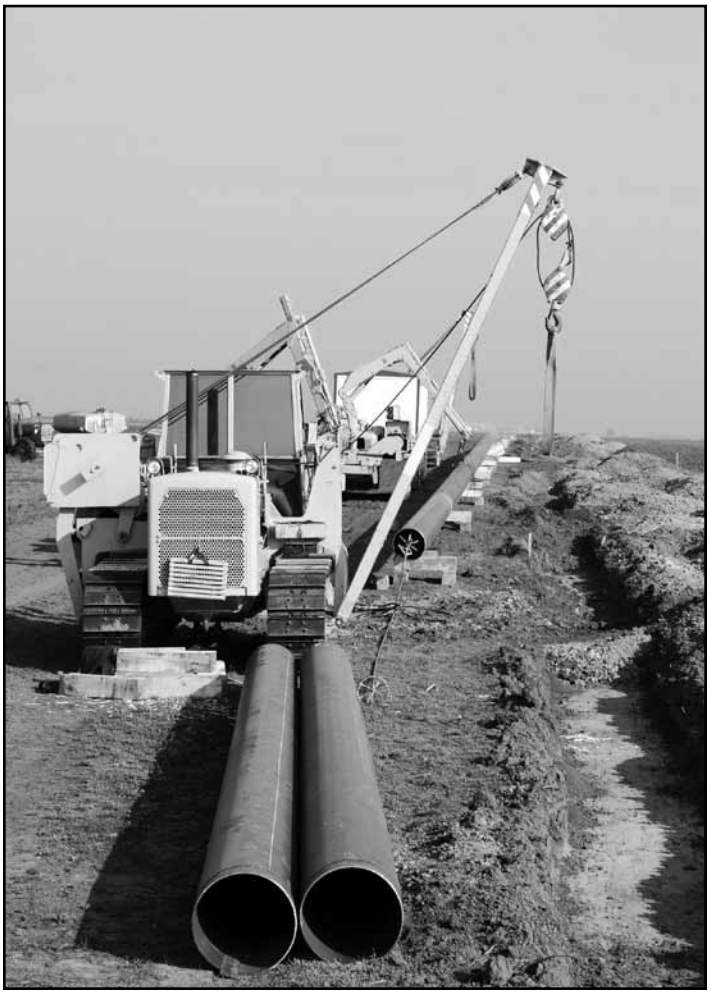
Water Pollution from Fracked Gas Wells

The rapid increase in fracking wells has polluted drinking water supplies and waterways. The wells can experience a rupture or blowback under tremendous pressure, spilling chemical-laden water into surface water or groundwater. Natural gas and chemicals can migrate into aquifers and wells.

Spills, leaks and accidents on the surface can pollute waterways. A gas industry attorney admitted in a *Pittsburgh Post-Gazette* column, "If improperly handled, used fracking fluid can contaminate surface water just like other liquid waste from drilling operations."[130] Chemicals in fracking fluid have contaminated water supplies near gas wells. Livestock have died from drinking water tainted with spilled fracking fluids.[131] West Virginia authorities were investigating whether fracking fluids caused fish kills that left the Dunkard Creek lifeless.[132]

Despite these problems, the industry maintains that fracking is safe, frequently using the discredited 2004 EPA study to bolster this claim.[133] Many proponents suggest the fracking fluid injections occur so far underground that it cannot affect drinking water. In congressional testimony, the executive vice president of Devon Energy Company reiterated that regulators have never found that fracking caused groundwater contamination.[134] He implied that since thousands of feet and many layers of rock separate gas wells from aquifers, and because of the casing and sealing around gas wells, fracking could not pollute drinking water.[135] Some gas energy apologists even deny that fracking fluids themselves are dangerous. One former lobbyist for the Colorado Oil and Gas Association told a *Denver Post* columnist, "There's nothing more dangerous in that fluid than what's in your makeup, honey, or your toothpaste or what you use to clean your hot tub."[136]

Fracking fluids include diesel fuel, which contains the known carcinogen benzene, among other toxic chemicals.



But the chemicals in fracking fluids are far from safe. Three recent studies have documented the human health risks from commonly used chemicals in fracking fluids. In 2011, the U.S. House Energy and Commerce Committee found that between 2005 and 2009, 14 oil and gas companies injected 780 million gallons of fracking chemicals and other substances into wells,[137] including 10.2 million gallons of fluids containing known or suspected carcinogens and 11.7 million gallons containing chemicals regulated under the Safe Drinking Water Act.[138] Fracking fluids even included more than 30 million gallons of diesel fuel, which contains the known carcinogen benzene, among other toxic chemicals, and is the only fracking fluid that requires a permit to inject into wells under Safe Water Drinking Act.[139]

A 2010 Environmental Working Group investigation into the chemical disclosure records of drilling corporations found that some fracking fluids contained other petroleum products with as much as 93 times more benzene than is in diesel.[140] The amount of benzene from a single fracked well could

contaminate more than 100 billion gallons of drinking water.[141] Scientists at the Endocrine Disruption Exchange found that 25 percent of fracking chemicals could cause cancer; 37 percent could disrupt the endocrine system; 40 to 50 percent could affect the nervous, immune and cardiovascular systems; and more than 75 percent could affect the sensory organs and respiratory system, likely causing problems such as skin and eye irritation and flu-like symptoms.[142]

The dangers are more than just theoretical. These chemicals have contaminated water supplies across the country. ProPublica identified more than 1,000 cases of water contamination near drilling sites documented by courts, states and local governments around the country prior to 2009.[143] Pennsylvania cited 451 Marcellus Shale gas wells for 1,544 violations in 2010 alone.[144] Some notable affected communities include:

- **Pavillion, Wyoming:** In 2010, the EPA released a preliminary study that found possible drinking water contamination near fracking wells and recommended that residents avoid drinking their tap water.[145] The EPA investigated 39 rural water wells and found benzene and methane in wells and groundwater.[146] The wells were also contaminated with the fracking chemical 2-butoexythanol phosphate, which has harmful health effects.[147]

- **Dimock, Pennsylvania:** In 2009, Pennsylvania regulators ordered the Cabot Oil and Gas Corporation to cease all fracking in Susquehanna County after three spills at one well within a week polluted a wetland and caused a fishkill in a local creek.[148] The spills leaked 8,420 gallons of fracking fluid containing a Halliburtan-manufactured lubricant that is a potential carcinogen.[149] Fracking had so polluted water wells that some families could no longer drink from their taps.[150] Pennsylvania fined Cabot $240,000, but it cost more than $10 million to transport safe water to the affected homeowners.[151] In December 2010, Cabot paid $4.1 million to 19 families that contended that Cabot's fracking had contaminated their groundwater with methane.[152]

- **Garfield County, Colorado:** The county's 8,000 natural gas wells have inched closer to residential areas.[153] A hydrological study found that as the number of gas wells in the heavily fracked county increased, methane levels in water wells also rose.[154] State regulators fined EnCana Oil and Gas for faulty well casings that allowed methane to migrate into water supplies through natural faults.[155]

- **Parker County, Texas:** In 2010, the EPA determined that fracked gas wells had contaminated a drinking water aquifer with methane, benzene and other natural gas chemicals that were chemically fingerprinted to the gas well.[156]

Fracking Routes of Water Contamination

Fracking well casings can leak and equipment failures can cause blowouts. Fracking wastewater can spill from storage pits. In 2008, a wastewater pit in Colorado leaked 1.6 million gallons of fluid, which migrated into the Colorado River.[157] When injected into the ground, the fracking fluids can contaminate underground water sources.[158] Groundwater contamination could be permanent because it happens slowly and can easily go undetected; cleanup can be expensive and is sometimes impossible.[159]

Leaks and Blowouts

The high-pressure injection of fracking fluids can cause leaks in well casings and blowouts of well equipment, where the underground pressure overpowers the drilling rig. Leaky well casings at shallow depths can allow fracking fluids to leach into groundwater.[160] A National Academy of Sciences study found that average methane concentrations in shallow drinking water wells in active gas areas were 17 times higher than those in non-active areas, possibly due to leaky gas-well casings.[161]

The massive pressure and multiple fracks used during a gas well's lifetime increases the likelihood that well casings will fail and pollute aquifers.[162] In 2010, a malfunctioning "blowout preventer" at a Pennsylvania gas well failed to prevent a 75-foot tall geyser of gas and drilling fluid that spilled 35,000 gallons on the ground before it was contained.[163] (A faulty blowout preventer also contributed to the BP Gulf oil spill of April 2010.[164]) In January 2011, 21,000 gallons of fracking fluid and flowback water spewed from a Tioga County well when a valve was erroneously left open, releasing hazardous chloride, sodium, barium and strontium, as

well as hydrochloric acid used in the fracking fluid.[165] Two months after a fire in the company's fracking liquid storage tanks injured three people, a Chesapeake Energy well spurted thousands of gallons of fracking fluid in Bradford County due to a cracked well casing.[166] Local families were forced to evacuate their homes.[167] Pennsylvania had cited Chesapeake Energy 284 times for violations and taken 58 enforcement actions since 2008.[168]

Aquifer Migration

Fracking fluids and gases can leak into aquifers through well shafts or rock faults. High-pressure horizontal fracking disturbs natural underground rock formations and can have unintended consequences, even after the drilling is complete. Horizontal wells are more likely than vertical wells to encounter pre-existing cracks in the rock formation where the gas can migrate and enter aquifers.[169] A 2011 Duke University study demonstrated that groundwater near fracking operations has higher methane concentrations.[170] If methane can migrate, it is likely that other chemicals can as well.[171]

Underground gas well leaks can contaminate nearby water sources if the cracks in the shale caused by fracking overlap with natural faults and fractures in the rocks.[172] Through these fracture and fault networks, toxic chemicals from the fracking fluids, the gas itself, or naturally occurring radioactive chemicals and salts can migrate into nearby aquifers that provide drinking water.[173] These natural faults and geological fractures are common in places like New York state.[174] For example, New York City's water supply is drawn from a region with prevalent geologic faults. The city opposed fracking near its pristine watershed, since the impact of fracking on these geological structures has not been studied sufficiently.[175] A New York hydrogeologist observed that the interconnection of natural faults and fractures would make fracking dangerous even if the fluids were not toxic because it could allow underground saline or radioactive fluids to mix with freshwater sources.[176]

Fracking Wastewater Pollutes Waterways

Although some fracking fluid remains in the well, about 30 to 70 percent of the injected fluids are discharged as wastewater.[177] For example, in 2009, Pennsylvania's oil and gas wells produced 9 million gallons of wastewater a day; by 2011, the wells were expected to create 19 million gallons.[178] The waste can be so toxic and concentrated that it is very difficult to dispose of safely. One method to get rid of fracking waste is to inject it in disposal wells in rock formations underground.[179] This method is common for most shale plays except the Marcellus Shale because Appalachian geology is unsuitable for underground injection.[180] Only a few injection wells exist in Pennsylvania.[181] Drillers near population centers can send fracking waste to local wastewater treatment plants, which treat and dilute the wastewater and release it into surface waters.[182]

Standard wastewater treatment cannot handle the chlorides, total dissolved solids, organic chemicals, bromide and fracking fluid chemicals.[183] The water also contains substances, including possibly radioactive elements, picked up during its journey underground.[184] A 2011 *New York Times* investigative report found that nearly three-quarters of the more than 240 Pennsylvania and West Virginia studied gas wells produced wastewater with high levels of radiation, including at least 116 wells with levels that were hundreds of times the EPA's drinking water standard, and at least 15 wells with levels thousands of times the standard.[185] According to ProPublica, no Pennsylvania wastewater treatment plant was expected to be able to remove total dissolved solids from the water until 2013.[186]

In Pennsylvania, at least half of the waste went to public sewage plants between 2008 and 2009.[187] A 2011 *Associated Press* report found that Pennsylvania could not account for the disposal method of 1.28 million barrels of its wastewater (one-fifth of the annual total) due to faulty reporting.[188] In August 2010, despite industry backlash, Pennsylvania strengthened its fracking wastewater regulations, but treatment plants that had already accepted fracking waste were allowed to continue to do so under the same treatment standards.[189] As of April 2011, 15 of those 27 plants were still accepting fracking wastewater.[190] Pennsylvania does not require all sewage plants to test for radioactivity; regulators and industry officials discount the risk of radioactivity in the waste.[191] After the *New York Times* study was released, the EPA urged Pennsylvania to require community water systems near plants that treat Marcellus Shale wastewater to test for radiation and reevaluate discharge permits of wastewater treatment plants that dispose of fracking waste.[192] The Center for Healthy Environments and Communities (CHEC) at the University of Pittsburgh tested the wastewater of a treatment facility in Indiana County, Pennsylvania, and found barium at rates 14 times the EPA drinking water standard, strontium at 746 times the standard, benzene at twice the standard and total dissolved solids at 373 times the standard.[193]

Much of this fracking wastewater ends up in rivers after its incomplete treatment. These discharges have already been a major problem. The Monongahela River in Pennsylvania might be one of the most endangered rivers in the country, partially due to the large portions of pollution from Marcellus Shale fracking waste.[194] Even after 2010 rules reduced fracking pollution, the Pennsylvania Department of Environmental Protection estimated that gas wastewater was causing 5 to 10 percent of the pollution in the river.[195] Pennsylvania's rivers have higher levels of bromides, which react with treatment plant chlorine disinfectants to create potentially cancer-causing chemicals called trihalomethanes.[196] Wastewater facilities have not been able to treat or remove trihalomethanes.[197]

Drillers have tried to mitigate this problem by recycling wastewater. Almost two-thirds (66 percent) of fracking waste was recycled in the six months before March 2011, up from 20 percent the previous year.[198] However, reusing water does not make it go away; it still needs to be disposed of eventually.[199] Some wells sell the waste to nearby communities that use it for dust suppression or road de-icing, where it can run off into surface water.[200]

Economic Costs

The shale gas rush is not just a danger to public health, but also to local economies. While industry promotes job creation and local investment, proponents typically do not account for the long-term economic damage and the significant erosion of communities' quality of life that can outweigh any benefits.[201] Many economic benefits may be a mirage — distant energy companies typically do not buy from local businesses and out-of-town roughnecks fill short-term jobs.

New wells bring fleets of trucks that crowd and damage rural roads and carry potentially hazardous wastewater. Cacophonous drilling rigs operate 24 hours a day, 7 days a week.[202] Scenic vistas are replaced with a landscape of gas wells, which lowers property values and harms tourism and recreation industries like hunting and fishing. In Wise County, Texas, properties with gas wells have lost 75 percent of their value.[203] Natural gas rigs not only devalue the property where they are located, but also the value of neighboring properties.[204]

Every energy boom comes with a bust. Most economic gains are short-lived — employment, construction, housing demand and even royalty payments are large at first, but diminish quickly after the initial investment.[205] Locals do not always fill drilling jobs. In Pennsylvania, 70 percent of drill rig workers are from out of state.[206] In New York state, the top gas-producing counties have lower household incomes and higher levels of poverty than nearby non-gas-producing counties.[207]

During construction and drilling, gas wells significantly increase heavy truck traffic, and locals bear the cost of repairing wear and tear on local roads. Pennsylvania Department of Environmental Protection estimates that building and fracking a well requires 1,000 heavy truck trips.[208] Increased truck traffic damages local infrastructure and can increase the risk of truck accidents on small, rural roads.[209] Fracking also requires pipelines to transport the gas, which can pose safety hazards from explosions.[210] In 2011, a pipeline explosion in Allentown killed five workers; other explosions have occurred in Ohio, Pennsylvania, California, Michigan and Texas, some fatal.[211]

Farmers, whose livelihoods depend on the health of the land, face especially stark choices. Persistently low milk prices have threatened dairy farms in Pennsylvania and New York, and the prospect of gas royalty payments is tempting. Farmers lease their land to gas companies with the promise of minimal impact.[212] However, livestock have died from drinking water tainted with spilled fracking fluids. In 2009, 16 cattle died after apparently drinking fluid that escaped from a Louisiana fracking well.[213] In 2010, Pennsylvania quarantined 28 cows that may have consumed water tainted by a fracking spill that could contaminate their meat.[214] Organic farmers could lose their premium prices if industrial fracking fluid pollutes their crops or livestock.[215] Farm sales could be destroyed if pollution threatens livestock, crops or farmland.

Conclusion and Recommendations: Fracking Is a Step in the Wrong Direction

The rapid expansion of horizontal hydraulic fractured drilling for natural gas has been disastrous. Federal and state regulators have been asleep at the switch as gas companies pollute the air and water of communities living in the path of the fracked gas rush. Even if the laws on the books were strengthened, fracking poses too severe a risk to public health and the environment to entrust effective and rigorous regulatory oversight to overwhelmed regulators. Both state and federal regulators have a poor track record of protecting the public from the impacts of fracking. Congress, state legislators and local governmental bodies need to ban shale gas fracking.

Rather than taking a strategic pause in the face of the demonstrable problems with fracking, President Barack Obama's administration is pursuing fracked natural gas full speed ahead.

In an April 2011 speech, President Obama said that "the potential for natural gas is enormous" and promoted proposed legislation to shift from oil to natural gas — the same legislation endorsed by T. Boone Pickens to subsidize natural gas vehicles.[216] The public opposition to fracking prompted the administration to launch a committee to figure out how to make fracking safe.[217] This attempt is misguided — fracking is not safe.

The energy industry is spending more private money to develop controversial sources of fracked gas than the U.S. government and private sector are investing to transition to a clean energy economy.[218]A 2011 Intergovernmental Panel on Climate Change report found that with sufficient development, renewable fuels could deliver almost 80 percent of the world's power needs by 2050.[219] More than a bridge fuel, renewable energy is a bridge with a destination. Nonetheless, London's *Guardian* reports that, "senior executives in the fossil fuel industry have launched an all-out assault on renewable energy, lobbying governments and business groups to reject wind and solar power in favor of gas."[220]

Many municipalities around the country are already banning fracking to protect their citizens from the consequences from this type of drilling, but we need a national ban to protect the entire country.

Activists in New York protest fracking in their state, including (from left to right) actor Mark Ruffalo, Sane Energy Project Co-Founder Denise Katzman, Food & Water Watch Executive Director Wenonah Hauter and Frack Action Executive Director Claire Sandberg. Photo by Food & Water Watch.

America's fracking fad is poised to go global. China fracked its first horizontal shale gas well in April 2011 and some European countries are considering following suit.[221] But South Africa and Quebec, Canada, have imposed fracking moratoriums, and popular opposition in France and the United Kingdom have slowed development.[222]

Shale gas fracking poses unacceptable risks to the American public. Today, many municipalities around the country are banning fracking to protect their citizens from the negative consequences of this type of drilling. These local resolutions are a good idea, but they won't protect the entire country. Shale gas fracking should be banned on the national level. It is time to stop destroying public air and water in the interest of oil and gas company profits, and instead seek energy solutions that will provide a long term, renewable energy future for the United States.

Recommendations

- Ban shale gas fracking in the United States.
- Close loopholes that exempt fracking from key federal air and water environmental regulations.
- Aggressively invest in energy efficiency and renewable energy sources that would result in a sustainable energy future for the country.

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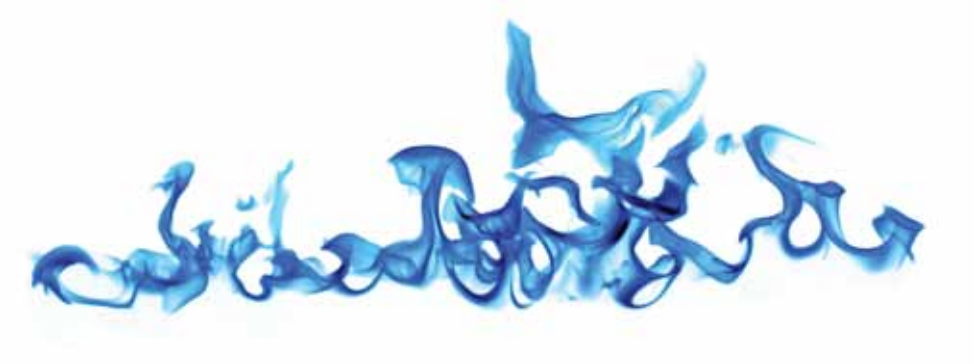

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