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A Colossal Fracking Mess

The dirty truth behind the new natural gas. *Related: A V.F. video look at a town transformed by fracking.*

By Christopher Bateman Photographs by Jacques del Conte



A shale-gas drilling and fracking site in Dimock, Pennsylvania.

Early on a spring morning in the town of Damascus, in northeastern Pennsylvania, the fog on the Delaware River rises to form a mist that hangs above the tree-covered hills on either side. A buzzard swoops in from the northern hills to join a flock ensconced in an evergreen on the river's southern bank.

Stretching some 400 miles, the Delaware is one of the cleanest free-flowing rivers in the United States, home to some of the best fly-fishing in the country. More than 15 million people, including residents of New York City and Philadelphia, get their water from its pristine watershed. To regard its unspoiled beauty on a spring morning, you might be led to believe that the river is safely off limits from the destructive effects of industrialization. Unfortunately, you'd be mistaken. The Delaware is now the most endangered river in the country, according to the conservation group American Rivers.

That's because large swaths of land—private and public—in the watershed have been leased to energy companies eager to drill for natural gas here using a controversial, poorly understood technique called hydraulic fracturing. “Fracking,” as it's colloquially known, involves injecting millions of gallons of water, sand, and chemicals,



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many of them toxic, into the earth at high pressures to break up rock formations and release natural gas trapped inside. Sixty miles west of Damascus, the town of Dimock, population 1,400, makes all too clear the dangers posed by hydraulic fracturing. You don't need to drive around Dimock long to notice how the rolling hills and farmland of this Appalachian town are scarred by barren, square-shaped clearings, jagged, newly constructed roads with 18-wheelers driving up and down them, and colorful freight containers labeled "residual waste." Although there is a moratorium on drilling new wells for the time being, you can still see the occasional active drill site, manned by figures in hazmat suits and surrounded by klieg lights, trailers, and pits of toxic wastewater, the derricks towering over barns, horses, and cows in their shadows.



A *V.F.* video look at a town transformed by fracking.

The real shock that Dimock has undergone, however, is in the aquifer that residents rely on for their fresh water. Dimock is now known as the place where, over the past two years, people's water started turning brown and making them sick, one woman's water well spontaneously combusted, and horses and pets mysteriously began to lose their hair.

Craig and Julie Sautner moved to Dimock from a nearby town in March 2008. They were in the process of renovating their modest but beautifully situated home on tree-canopied Carter Road when land men from Houston-based Cabot Oil & Gas, a midsize player in the energy-exploration industry, came knocking on their door to inquire about leasing the mineral rights to their three and a half acres of land. The Sautners say the land men told them that their neighbors had already signed leases and that the drilling would have no impact whatsoever on their land. (Others in Dimock claim they were told that if they refused to sign a lease, gas would be taken out from under their land anyway, since under Pennsylvania law a well drilled on a leased piece of property can capture gas from neighboring, unleased properties.) They signed the lease, for a onetime payout of \$2,500 per acre—better than the \$250 per acre a neighbor across the street received—plus royalties on each producing well.

Drilling operations near their property commenced in August 2008. Trees were cleared and the ground leveled to make room for a four-acre drilling site less than 1,000 feet away from their land. The Sautners could feel the earth beneath their home shake whenever the well was fracked.

Within a month, their water had turned brown. It was so corrosive that it scarred dishes in their dishwasher and stained their laundry. They complained to Cabot, which eventually installed a water-filtration system in the basement of their home. It seemed to solve the problem, but when the Pennsylvania Department of Environmental Protection came to do further tests, it found that the Sautners' water still contained high levels of methane. More ad hoc pumps and filtration systems were installed. While the Sautners did not drink the water at this point, they continued to use it for other purposes for a full year.

"It was so bad sometimes that my daughter would be in the shower in the morning, and she'd have to get out of the shower and lay on the floor" because of the dizzying effect the chemicals in the water had on her, recalls Craig Sautner, who has worked as a cable splicer for Frontier Communications his whole life. She didn't speak up about it for a while, because she wondered whether she was imagining the problem. But she wasn't the only one in the family suffering. "My son had sores up and down his legs from the water," Craig says. Craig and Julie also experienced frequent headaches and dizziness.

By October 2009, the D.E.P. had taken all the water wells in the Sautners' neighborhood offline. It acknowledged that a major contamination of the aquifer had occurred. In addition to methane, dangerously high levels of iron and aluminum were found in the Sautners' water.

The Sautners now rely on water delivered to them every week by Cabot. The value of their land has been decimated. Their children no longer take showers at home. They desperately want to move but cannot afford to buy a new house on top of their current mortgage.

“Our land is worthless,” says Craig. “Who is going to buy this house?”

As drillers seek to commence fracking operations in the Delaware River basin watershed and in other key watersheds in New York State—all of which sit atop large repositories of natural gas trapped in shale rock deep underground—concerned residents, activists, and government officials are pointing to Dimock as an example of what can go wrong when this form of drilling is allowed to take place without proper regulation. Some are pointing to a wave of groundwater-contamination incidents and mysterious health problems out West, in Colorado, New Mexico, and Wyoming, where hydraulic fracturing has been going on for years as part of a massive oil-and-gas boom, and saying that fracking should not be allowed at all in delicate ecosystems like the Delaware River basin.

Damascus and Dimock are both located above a vast rock formation rich in natural gas known as the Marcellus Shale, which stretches along the Appalachians from West Virginia up to the western half of the state of New York. The gas in the Marcellus Shale has been known about for more than 100 years, but it has become accessible and attractive as a resource only in the past two decades, thanks to technological innovation, the depletion of easier-to-reach, “conventional” gas deposits, and increases in the price of natural gas. Shale-gas deposits are dispersed throughout a thin horizontal layer of loose rock (the shale), generally more than a mile below ground. Conventional vertical drilling cannot retrieve shale gas in an economical way, but when combined with hydraulic fracturing, horizontal drilling—whereby a deeply drilled well is bent at an angle to run parallel to the surface of the Earth—changes the equation.

Developed by oil-field-services provider Halliburton, which first implemented the technology commercially in 1949 (and which was famously run by Dick Cheney before he became vice president of the United States), hydraulic fracturing has been used in conventional oil and gas wells for decades to increase production when a well starts to run dry. But its use in unconventional types of drilling, from coal-bed methane to shale gas, is relatively new. When a well is fracked, a small earthquake is produced by the pressurized injection of fluids, fracturing the rock around the well. The gas trapped inside is released and makes its way to the surface along with about half of the “fracking fluid,” plus dirt and rock that are occasionally radioactive. From there, the gas is piped to nearby compressor stations that purify it and prepare it to be piped (and sometimes transported in liquefied form) to power plants, manufacturers, and domestic consumers. Volatile organic compounds (carbon-based gaseous substances with a variety of detrimental health effects) and other dangerous chemicals are burned off directly into the air during this on-site compression process. Meanwhile, the returned fracking fluid, now called wastewater, is either trucked off or stored in large, open-air, tarp-lined pits on site, where it is allowed to evaporate. The other portion of the fluid remains deep underground—no one really knows what happens to it.

Fracking is an energy- and resource-intensive process. Every shale-gas well that is fracked requires between three and eight million gallons of water. Fleets of trucks have to make hundreds of trips to carry the fracking fluid to and from each well site.

Due in part to spotty state laws and an absence of federal regulation, the safety record that hydraulic fracturing has amassed to date is deeply disturbing. As use of the technique has spread, it has been followed by incidents of water contamination and environmental degradation, and even devastating health problems. Thousands of complaints have been lodged with state and federal agencies by people all over the

country whose lives and communities have been transformed by fracking operations.

In Dimock, where more than 60 gas wells were drilled in a nine-square-mile area, all kinds of ugly things transpired after Cabot came to town. A truck turned over and caused an 800-gallon diesel-fuel spill in April 2009. Up to 8,000 gallons of Halliburton-manufactured fracking fluid leaked from faulty supply pipes, with some seeping into wetlands and a stream, killing fish, in September 2009. Many Dimock residents were having the same problems as the Sautners. A water well belonging to a woman named Norma Fiorentino blew up while she was visiting her daughter. Reports of the havoc appeared in the local press and then gradually trickled into the national media. Reuters and ProPublica were on the story early on; later, everyone from NPR to *The New York Times* was coming to Dimock.

Over a six-month period Cabot was fined \$360,000 by the D.E.P. for contaminating Dimock's groundwater and failing to fix the leaks that caused the problem. It was also ordered to suspend drilling in Dimock until the situation was resolved. The Sautners are one of more than a dozen Dimock families now suing the company for negligence, breach of contract, and fraudulent misrepresentation, among other charges. Other plaintiffs in the lawsuit include Ron and Jean Carter, who were evacuated after methane levels in their home reached emergency levels, and Victoria Switzer, a schoolteacher who has compiled a grim photo album of spills and leaks around Dimock, including a creek turned Kool-Aid red with diesel fuel. (In a written statement to *Vanity Fair*, Cabot declined to comment on the lawsuit but said that while it operates its facilities "in full compliance with environmental and oil and gas drilling regulations ... the accidental release of materials has occasionally occurred" during its operations. The company also said that it had created more than 300 full-time jobs in Susquehanna County, where Dimock is located, and that it was working with both the Pennsylvania D.E.P. and the affected families to remediate the situation.)



From left: Damascus Citizens for Sustainability activists Joe Levine, Pat Carullo, and Jane Cyphers at Levine and Cyphers's home in Damascus, Pennsylvania, which serves as the group's headquarters.

Even as Dimock was experiencing this series of disasters, Pennsylvania officials assured

the public that shale-gas extraction was safe and benefitting the state, providing jobs and millions of dollars in tax revenue. “What do you have to be afraid of? It’s only sand and water,” said Ron Gilius, the director of the Pennsylvania D.E.P.’s Bureau of Oil and Gas Management, in 2008. “There has never been any evidence of fracking ever causing direct contamination of fresh groundwater in Pennsylvania or anywhere else,” said Scott Perry, another Oil and Gas Management official, as recently as April 2010. (John Hanger, secretary of the Pennsylvania D.E.P., now admits that fracking fluid is “nasty, nasty stuff,” and the department has announced plans to regulate fracking more closely.)

With natural gas being heavily promoted in TV ads and by politicians and proponents such as oilman and hedge-fund manager T. Boone Pickens, many Americans have come to see the resource in a positive light. Natural gas burns more cleanly than coal and oil do, we are told, and there’s an abundance of it right there, under our soil, making it a logical and patriotic energy source for America. We are told that it can help wean us off our dependence on foreign oil as we make the transition to renewable energy. Yet our supplies of natural gas are ultimately finite, and, increasingly, they must be accessed via hydraulic fracturing. In fact, more than 90 percent of natural-gas wells today use fracking.

Shale gas has become a significant part of our energy mix over the past decade. From 1996 to 2006, shale-gas production went from less than 2 percent to 6 percent of all domestic natural-gas production. Some industry analysts predict shale gas will represent a full half of total domestic gas production within 10 years.

It’s not just the oil-and-gas industry that’s excited about the possibilities. Last year, even a progressive, Washington, D.C.–based think tank, the Center for American Progress Action Fund, desperate for solutions to global warming, touted natural gas as “the single biggest game changer for climate action in the next two decades.” President Obama has been supportive of shale gas and says he wants to see an increase in domestic natural-gas production.

But shale gas and hydraulic fracturing haven’t needed much help from the Obama administration. That’s because they already got a huge helping hand from the federal government under the Bush administration. Although fracking was never regulated by the federal government when it was a less prevalently used technique, it was granted explicit exemptions—despite dissent within the E.P.A.—from the Safe Drinking Water Act, the Clean Air Act, and the Clean Water Act by the Energy Policy Act of 2005, the wide-ranging energy bill crafted by Dick Cheney in closed-door meetings with oil-and-gas executives. While the average citizen can receive harsh punishment under federal law for dumping a car battery into a pond, gas companies, thanks to what has become known as the Halliburton Loophole, are allowed to pump millions of gallons of fluid containing toxic chemicals into the ground, right next to our aquifers, without even having to identify them.

Claiming that the information is proprietary, drilling companies have still not come out and fully disclosed what fracking fluid is made of. But activists and researchers have been able to identify some of the chemicals used. They include such substances as benzene, ethylbenzene, toluene, boric acid, monoethanolamine, xylene, diesel-range organics, methanol, formaldehyde, hydrochloric acid, ammonium bisulfite, 2-butoxyethanol, and 5-chloro-2-methyl-4-isothiazotin-3-one. (Recently, in congressional testimony, drilling companies have confirmed the presence of many of these chemicals.) According to Theo Colborn, a noted expert on water issues and endocrine disruptors, at least half of the chemicals known to be present in fracking fluid are toxic; many of them are carcinogens, neurotoxins, endocrine disruptors, and mutagens. But Colborn estimates that a third of the chemicals in fracking fluid remain unknown to the public.

While the E.P.A. under Obama is finally undertaking a new review of fracking—a 2001

review commissioned by the Bush administration was tainted by conflicts of interest and suppression of science—that report is not expected to be completed until the end of 2012. Congressional hearings held by the House Energy and Commerce Committee have been taking place since 2009, but proposed legislation to get rid of the Halliburton Loophole has made little progress on Capitol Hill.

All of this is mind-boggling to activists like Pat Carullo. A 56-year-old graphic designer, Carullo is a member of Damascus Citizens for Sustainability, a group that opposes hydraulic fracturing in the Delaware River Watershed. Tan and animated, with a white beard, he has an earthy quality and is wearing an eagle medallion around his neck when I meet him in Damascus.

Carullo and other members of Damascus Citizens have homes in this area. They created the group when it became clear that drilling was poised to begin on leased land in the watershed and were galvanized in 2008 when a large oil-and-gas company, Chesapeake, drilled an exploratory well in their county and signs of a spill—dying trees and vegetation—appeared at the site. (After Damascus Citizens filed a complaint about the matter, the Pennsylvania D.E.P. served Chesapeake a notice of violation, saying that traces of petrochemicals had been detected in the soil around the well site. While Chesapeake director Brian Grove states that “a detailed review of our operations reveals no events or operational deficiencies that would have negatively impacted the environment,” Pennsylvania D.E.P. official Tom Rathbun told *Vanity Fair* that chlorides from the shale returned as wastewater seem to have been responsible for killing the vegetation.”) At the time, the position the group took was radical: no fracking in the Upper Delaware watershed, period. Since then, others have come around to it. Damascus Citizens is now at the center of efforts around the country to spread awareness about the hazards of fracking, study its effects more thoroughly, address the gaping lack of regulation, and slow down the rush of leasing and drilling that has swept so much of the country. A documentary about natural-gas drilling and fracking, *Gasland*, which won the Special Jury Prize for Documentary at this year’s Sundance Film Festival and debuts on HBO this month, is dedicated to the group.

Still, Carullo and the other activists of Damascus Citizens face an uphill battle because of the corporate and political interests stacked against them, the vast amount of money at stake, and the dynamics of our nation’s energy-policy debate. “What it is we’re doing here is trying to dismantle the whole propaganda machine that the industry is involved in,” says Carullo. “For example, ‘natural gas is the bridge to the future.’ That’s the industry’s claim. Only problem is, there’s nothing natural about this, because it’s the most unnatural thing you can imagine—hauling around tons of chemicals, taking pure water and turning it into the worst industrial waste on the planet!”

To bolster his argument, Carullo points to decisions by the local governments of New York City and Syracuse, New York, to protect their watersheds from fracking, even though large tracts of state and private land in them have already been leased to drillers. Indeed, a New York City study concluded that the risks posed by fracking could be “catastrophic” to the area’s prized water supply, one of only four unfiltered major-metropolitan water systems in the country. If New York City and Syracuse have (for the time being, at least) taken their watersheds off the table, why is the Delaware Watershed not off limits, too? “This watershed is even grander than those,” Carullo says. “It provides water to even more people.”

As a New York City–based architect who has worked on infrastructure and water issues for years, 55-year-old Joe Levine, another member of Damascus Citizens, is amazed by the scope of the drilling that could invade the Delaware River Basin as soon as New York State settles on some sort of regulatory framework to allow fracking to go forward. (There is currently a statewide ban on the technique, and a bill has been proposed in the state senate to extend the ban until after the E.P.A. finishes its review, but the Paterson

administration has expressed a strong interest in obtaining the tax revenues that drilling would generate.) “If you take the industry model, there could be more than 40,000 wells in the Marcellus,” says Levine, who founded a nonprofit advocacy group, NYH₂O, dedicated to protecting New York City’s water from gas drilling. “That’s what the industry aspires to.” Levine provides some perspective as to what that would entail: Two hundred billion gallons of water. The clearing of hundreds of thousands of acres and hundreds of millions of trees.

Levine remembers when the offering price for an acre of Marcellus Shale land was just \$25. That changed quickly as word spread that an old-fashioned gold rush had hit the area, just like the oil booms of the 19th and early-20th centuries. “It was a big deal when it went up to \$200,” Levine says. “Now it’s about \$5,000 an acre.” (The Indian materials and energy conglomerate Reliance Industries recently paid Pennsylvania-based Atlas Energy about \$1.7 billion for 120,000 acres, or more than \$14,000 per acre, to get in on the action.) Many landowners in the Delaware Watershed remain eager to cash in on the royalties they stand to receive, and resent efforts by their neighbors to stop drilling from happening. But Damascus Citizens has found allies such as fishing and hunting advocates in the region, and continues to influence the debate as the Delaware River Basin Commission (the governing body with officers from New York, New Jersey, Pennsylvania, and Delaware that regulates the entire river system) examines the issue and decides how to proceed.

Reports of environmental degradation have come out of many places where natural-gas drilling and fracking are going on. The full extent of the problem is difficult to determine because much of the evidence is anecdotal and because drilling companies have been known to buy people off when things go wrong. In Silt, Colorado, a woman named Laura Amos no longer talks about the adrenal-gland tumor and other health complications she developed after her water was contaminated by a gas well drilled less than 1,000 feet from her home. (A state investigation into the matter concluded that a drilling failure had likely led to intermingling between the gas and water strata in the ground.) She signed a non-disclosure agreement as part of a deal to sell her tainted land to EnCana, the large Canadian gas company that drilled the well. But perusing newspapers from towns where fracking is going on reveals how the issue refuses to die, with headlines like “Fears of Tainted Water Well Up in Colorado,” “Collateral Damage: Residents Fear Murky Effects of Energy Boom,” and “Worker Believes Cancer Caused by Fracking Fluids” appearing regularly.





A pump vacuums runoff from a spill in Dimock.

A macro look at the way oil and gas drilling has transformed entire landscapes out West, carving them up into patterns resembling those of a transistor board, can be seen by typing “San Juan Basin, New Mexico” into Google Maps and clicking on the satellite view. In Colorado, some 206 chemical fluid spills from oil and gas wells, connected to 48 cases of suspected water contamination, happened in 2008 alone. In New Mexico, toxic fluid had seeped into water supplies at more than 800 oil and gas drilling sites as of July 2008. Clusters of unusual health problems have popped up in some of these drilling hot spots. Kendall Gerdes, a physician in Colorado Springs, tells me of how he and other doctors in the area saw a striking number of patients come to them with chronic dizziness, headaches, and neurological problems after drilling began near their homes. One of Dr. Gerdes’s patients, 62-year-old Chris Mobaldi, developed idiopathic hemorrhaging, or spontaneous bleeding, as well as neuropathy, a pituitary gland tumor, and a rare neurological speech impediment after alleged frequent exposure to noxious fumes from drilling. Although her health improved after she moved to another part of Colorado, she continues to have trouble speaking and walking to this day.

And with drilling in the Marcellus Shale, the complaints have spread East. Despite making more than a million dollars in royalties from drilling on his 105-acre farm, Wayne Smith, a farmer in Clearville, Pennsylvania, wishes he’d never signed a lease. Some of his livestock mysteriously dropped dead after having motor-skill breakdowns; a veterinarian said the deaths could be attributed to arsenic, high levels of which were found in water on Smith’s property. (Smith also worries about health problems he has developed, such as frequent headaches, abscessed teeth, and other mouth problems.) In Avella, Pennsylvania, a wastewater impoundment caught fire and exploded on George Zimmermann’s 480-acre property, producing a 200-foot-high conflagration that burned for six hours and produced a cloud of thick, black smoke visible 10 miles away. An E.P.A.-accredited environmental-testing company sampled the soil around the well sites on Zimmerman’s property and found arsenic at 6,430 times permissible levels and tetrachloroethene, a carcinogen and central-nervous-system suppressant, at 1,417 times permissible levels. (In January, the state of Pennsylvania fined the company that is drilling on Zimmerman’s land, Atlas Energy, \$85,000 for environmental violations related to fracking—a drop in the bucket for a corporation that brought in \$1.5 billion in revenue last year. As of press time, Atlas had not provided *Vanity Fair* with a comment on the matter.)

These are a number of the ways that fracking can conceivably go wrong. Weston Wilson, a former E.P.A. official who blew the whistle on the agency’s flawed report on fracking by writing a letter to Congress, likes to talk about the difference between “bad wells” and “good wells gone bad.” “Bad wells” are ones that leak because of poor construction or an accident; “good wells gone bad” refers to the possibility that fracking may pose a more fundamental, generalized risk to water supplies, through seepage of the wastewater that remains in the ground. While shale formations are thousands of feet below groundwater levels, geological studies have shown that the Earth is full of cracks at these depths, and no one has ruled out the possibility that fracking may open up arteries for the toxic fluid to seep into groundwater in a more insidious way.

That’s not to mention the risks posed by the above-ground handling of return wastewater and the airborne pollution endemic to natural-gas processing. Leaks and spills have occurred at the on-site pits where wastewater is allowed to fester. And the city of Fort Worth, Texas, which sits atop the country’s most productive shale-gas formation, demonstrates the dangers that natural-gas processing poses to “airsheds.” Chemical

emissions from natural-gas processing in and around Forth Worth now match the city's total emissions from cars and trucks, leading to alarming levels of volatile organic compounds and other pollutants in the air.

Facing increasing lawsuits and scrutiny, the gas industry no longer stands by the position it took for years that there's nothing unsafe in fracking fluid. But it still says that shooting fracking fluid into the ground is a safe and sensible practice. (In a written statement to *Vanity Fair*, American's Natural Gas Alliance, an industry lobbying group, said that the current federal regulation of fracking is adequate.) It continues to hammer home the notion that natural gas is cleaner than its fossil-fuel relatives, coal and oil, and produces lower levels of greenhouse gases.

But a new preliminary assessment by Cornell ecology and environmental-biology professor Robert Howarth of the emissions generated throughout the fracking process suggests that, when the thousands of truck trips required to frack every single well are counted, natural gas obtained by fracking is actually *worse* than drilling for oil and possibly even coal mining in terms of greenhouse-gas production. While Howarth explains that his estimates are subject to uncertainty because of the lack of complete, concrete data about fracking, he concludes, "There is an urgent need for a comprehensive assessment of the full range of emission of greenhouse gases from using natural gas obtained by high-volume, slick water hydraulic fracturing.... Society should be wary of claims that natural gas is a desirable fuel in terms of the consequences on global warming."

Yet the shale-gas boom, driven by fracking, continues on a global scale. Shale land is already being leased in Western and Central Europe while foreign companies buy up land in the Marcellus Shale. A May 25 memorandum of economic and strategic dialogue between the U.S. and China prominently lists an initiative to help China assess and extract its own shale gas as an item of agreement. In Australia, where fracking has been sweeping the Queensland countryside and where landowners have little or no control over their mineral rights, a furor has been growing over the water contamination happening around drilling locations.

At the same time, the people who have been burned badly by their firsthand experience with what you might call the New Natural Gas, and who have not gone silent, are spreading their message of acute disillusionment, ecological destruction, land-value decimation, and serious health concerns. As I sit and talk with the members of Damascus Citizens for Sustainability, news reports from the tragic *Deepwater Horizon* leak in the Gulf pop up from time to time on their computers. The disaster serves as a grim backdrop to our conversation, reinforcing the hazards of pushing forward with experimental forms of drilling whose risks are not well understood.

At one point, we see a news alert revealing the likely cause of the *Deepwater* explosion: a methane bubble. It's a complication also encountered in land-based gas drilling, and it's just one of the things Carullo fears could precipitate a catastrophe in the Delaware watershed. "This is exactly what we're trying to prevent here," Carullo tells me. "This is exactly what we've been talking about."

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