



# WILL WE SACRIFICE OUR WATER FOR GAS?

**New technology and interest in new sources of domestic fuel make the Marcellus shale gas field attractive to investors. But this “boom” for investors may not be good news for fish and wildlife.**

BY TRACY CARLUCCIO

Betty Wiley had a bad feeling when she woke up that September day in 2009. One look out her front door to the banks of Dunkard Creek confirmed her feeling: The fish in Dunkard Creek were dying. Over the following days, mounds of dead mussels washed up on the banks. Fish and salamanders were strewn about like trash. Neighbors could do nothing but watch, appalled, as everything with gills in 43 miles of the creek died. “It was like having a family member die,” says Wiley about the waterway around which her community was built.

The destruction of Dunkard Creek is one of the worst ecological disasters in West Virginia and Pennsylvania, where the storied stream winds back and forth across state lines. Once one of the most ecologically diverse waterways in the region and a popular warm water fishery, Dunkard Creek had become a salt water environment choked by an invasive golden algae that is particularly deadly to fish and bivalves. At least 16 species of freshwater mussels, including two endangered species, and 18 species of fish were wiped out by the event. While environmental agencies continue to investigate the cause, both residents and scientists lay the blame on wastewater discharged from a gas drilling process that employs “fracking.”

## **Shale Gas: A New Energy “Boom”**

The Marcellus shale formation is a vast natural gas reserve a mile or more beneath the Earth’s surface that stretches over 48,000 square miles from West Virginia and Ohio, touching Maryland and Virginia, up through Pennsylvania and into New York. Various “unconventional gas” plays – an industry term for natural gas that is either difficult or potentially expensive to extract – are scattered throughout the United States, but the Marcellus shale formation has the largest geographic expanse of any natural gas reserve in the nation. Interest in new domestic fuels and the use of new extraction methods have made the Marcellus shale field attractive to investors, who now view the 350-million-year-old shale gas as a new “boom” for the petroleum industry.

Natural gas is extracted from these shale formations using a process called hydraulic fracturing or “fracking.” Water and sand are mixed with a cocktail of chemicals – many of them hazardous, carcinogenic, or toxic – and injected into the rock formation under very high pressure, cracking open fissures in the rock

to release the natural gas trapped within. Technology developed in the early 1990s for drilling rigs off the Gulf Coast allows a drill bit to move straight down and then turn 90 degrees to drill horizontally. This combination of fracking and horizontal drilling made it possible to access enough natural gas in the Marcellus shale formation to make this “unconventional gas” play worth exploring.

Geologists estimate that more than 500 trillion cubic feet of natural gas might be trapped in the Marcellus formation. Gas companies may be able to extract 10 percent of that gas — which could be valued at one trillion dollars and meet the nation’s natural gas needs for more than a decade.

Hundreds of thousands of acres atop the Marcellus formation in Pennsylvania, Ohio, and West Virginia have been leased for natural gas drilling and, since 2008, thousands of wells have been drilled. In Pennsylvania, where 64 percent of the state sits on the Marcellus shale formation, shale wells are being permitted in the thousands. Lease prices range from hundreds to several thousand dollars per acre, paying 12 to 20 percent royalties on extracted gas, offering hopes of economic prosperity for landowners. Unfortunately, this boon to landowners is not a boon for fish and wildlife.

### **No Gas Without Water**

Shale gas extraction consumes large volumes of water. Between two and nine million gallons of water is used to frack one gas drilling well — exactly how much water depends on the depth and length of the well (which can be up to two miles long) and the specific conditions. Billions of gallons of water may be used in the near future for Marcellus gas development.

Few states require permits for the withdrawal of water or have minimum flow requirements to protect their waterways. This leaves rivers at risk of losing adequate flow, putting drinking water supplies as well as habitat for fish and wildlife at risk.

Don Garvin, legislative coordinator for the nonprofit West Virginia Environmental Council, says, “We need a regulatory framework covering withdrawals, or a lot of our headwater streams will be depleted.” The Council and the West Virginia Surface Owners Rights Organization are pushing for legislation to address water withdrawal and water quality concerns posed by hydraulic fracturing.

None of the water used in fracking returns to its original source. An average of 75 percent of the water is lost underground. The remaining 25 percent that returns to the surface is a hazardous liquid waste that must be collected, stored onsite, and shipped by truck to an approved wastewater treatment facility.

### **What’s On Tap?**

Hydraulic fracturing was exempted from the Safe Drinking Water Act by the 2005 Energy Policy Act. This exemption allows the practice, which normally would have to follow underground injection rules that protect drinking water, to be used without oversight by the Environmental Protection Agency. It also allows fracking chemical formulas to be kept secret, which contractors favor to protect their proprietary recipes. A New York draft environmental impact study on gas drilling identifies 260 “unique chemicals” used in fracking formulas in Pennsylvania and West Virginia. The list includes carcinogens, toxic substances, and chemicals that disrupt reproduction.

## **BETWEEN TWO AND NINE MILLION GALLONS OF WATER IS USED TO FRACK ONE GAS DRILLING WELL. BILLIONS OF GALLONS OF WATER MAY BE USED IN THE NEAR FUTURE FOR MARCELLUS GAS DEVELOPMENT.**

Fracking fluids and the natural gas extracted using the fracking process can pollute groundwater in several ways. They can leak out through fissures and fractures in the ground. They can leak out through poorly constructed well casings (metal tubes in the drilled hole that are used to strengthen the hole and ensure gas or fluids do not leak out). And mistakes in well construction can cause unintended release of the fluids and gas.

In Dimock Township, located in the northeast corner of Pennsylvania, a residential drinking water well exploded near a shale gas well in January 2009. The Pennsylvania Department of Environmental Protection concluded that methane gas had leaked from Cabot Company’s gas well, polluting 13 water wells and several square miles of aquifer. One year later, residents are still forced to drink water from temporary tanks.

In north-central Pennsylvania’s McKean County, the Pennsylvania Department of Environmental Protection found Schreiner Oil and Gas responsible for contaminating nine private wells; pollutants included methane and ethane gas, total dissolved solids, chlorides, iron, and manganese. Seventy miles east in Tioga County, Pennsylvania, Fortuna Energy Co. has been blamed for polluting a water well and stream with methane. Forty miles south of Tioga, an East Resources gas well in Lycoming County, Pennsylvania, leaked methane into at least 4 wells, and another 18 wells are still being monitored.

### **Wasted Water**

Shale gas wells in Marcellus states produce wastewater in overwhelming volumes. The Pennsylvania Department of Environmental Protection estimates that demand for gas drilling wastewater treatment in Pennsylvania alone will reach approximately 16 million gallons per day in 2010 and 19 million gallons per day in 2011.

The long, horizontal well bores used for hydraulic fracturing cut laterally into the shale formation, exposing more of the rock’s surface to frack stimulation and extraction. This means that there is expanded opportunity for substances and salty groundwater found in these deep formations to be disturbed and mix with the frack fluids.

# Shale Gas Plays, Lower 48 States



Source: Energy Information Administration based on data from various published studies  
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When the fluids erupt back up the well bore after fracking, the water (called “flowback”) carries to the surface contaminants from these deep formations — such as chloride (salt), sulfate, heavy metals, arsenic, benzene, and naturally occurring radioactive materials.

The level of total dissolved solids in this “flowback” is so high that the resulting wastewater can turn fresh water streams into salt water environments, wreaking havoc on stream life and endangering water supplies. In fact, the U.S. Department of Energy estimates that the waters discharged by natural gas operations are about 10 times more toxic than those from offshore oil wells.

The Pennsylvania Department of Environmental Protection says gas drilling wastewater contributes to the overload of total dissolved solids and salts in many Pennsylvania streams and rivers. A water quality emergency occurred in fall 2008 and twice again in 2009 on the Monongahela River from an overload of total dissolved solids — in part from gas drilling wastewater discharged by upstream wastewater treatment plants — that led to a bottled water advisory for 325,000 people.

Although the Clean Water Act requires fracking wastewater disposal at an approved facility, there are no wastewater facilities in the Marcellus region that can remove all the pollutants from shale gas wastewater. Moreover, none of the Marcellus states have standards in place to safeguard waterways and drinking water sources from this toxic wastewater. The Pennsylvania Department

of Environmental Protection has begun developing standards for total dissolved solids, chloride, and sulfate to be applied to liquid waste in the future, but these standards are not in place yet and do not address the full array of toxins and dangerous chemicals present in the wastewater, including residual frack fluid ingredients.

Despite the lack of treatment and storage standards, a new wastewater treatment facility recently came online in West Virginia, and Pennsylvania is processing permit applications for new and retrofitted plants. The New York State Department of Environmental Conservation suggested sending the state’s wastewater to Pennsylvania because there are no approved facilities in New York.

Instead of treating the shale gas wastewater, some companies in Ohio are using underground injection wells to dispose of it, and Pennsylvania is considering exporting its wastewater to those wells. West Virginia also uses injection wells for disposal and at least one abandoned coal mine. Other Marcellus states are investigating injection wells, and there is new interest in reusing wastewater for fracking other wells. However, the lack of oversight and regulation of re-injecting “flowback” wastewater is a concern for environmental organizations. “Without the requirement to treat the recycled wastewater to standards, waste that would otherwise be regulated is being injected into the ground without any rules; this is a huge regulatory loophole that could be a significant source of pollution,” says Maya van Rossum, the Delaware Riverkeeper.





PHOTO COURTESY OF BETTY WILEY

**Betty Wiley, President of the Dunkard Creek Watershed Association, photographed her grandchildren Sidney (left) and Dylan (right) with muskees killed in the September 2009 disaster. Residents and scientists blame the disaster on “fracking” wastewater.**

## In the Air

Based on the experience in western states — where shale gas extraction has been going on for years — air pollution is also a concern. Air quality tests show that levels of nitrous oxide have tripled since natural gas development began in the Pinedale Anticline and the Jonah Field natural gas regions in Wyoming. Mule deer and other wild animals that use these lands as habitat are showing negative population impacts.

In Texas, Barnett shale drilling began slowly in the 1980s, picked up in the 1990s, and was booming by 2005. Some cities have experienced dramatic increases in air pollution due to emissions from gas compressor stations (which move the gas through gas lines) and significantly increased truck traffic around the gas wells. A health study in Dish, Texas, calculates that 61 percent of the health problems reported by residents in a survey are associated with these toxic air emissions; recent blood and urine test results confirmed that pollutants found in the air are showing up in residents there. A Texas Commission on Environmental Quality report released in January 2009 found high levels of benzene at drilling sites in rural areas around Fort Worth. Two of the 94 sites tested had what the commission called “extremely high” levels of benzene; 19 others had benzene levels above the state’s recommended level for long-term exposure. Industry representatives say the pollution is not from gas drilling, but the Fort Worth City Council may rewrite the city’s gas drilling ordinance in response to the test results.

Similar emissions may occur in the Marcellus shale region. The New York State Department of Environmental Conservation’s draft environmental impact statement projects that methanol, a hazardous air pollutant often used in fracking, can enter the air from the open pits on gas drilling sites in major quantities. The agency also expects that dangerous particulate matter would be released from drilling sites at levels that violate New York state standards.

## From Landscape to Industrial-Scape

Considering the tremendous amounts of gas that can be accessed through each well, well spacing is expected to be as close as possible in the Marcellus region to retrieve as much gas as possible. In the areas where the formation is most prolific, this will mean more wells in production over a longer period of time, multiplying the potential adverse impacts.

Close spacing of wells will translate into leveling and removing forests and other natural vegetation over large areas, transforming what is now broad swaths of forest and stream — in most Marcellus states — into industrial conditions. Roads also must be built to get to the well sites, feeder pipelines installed to get the gas out, pits and storm basins dug, and well pads of up to 5 acres or more in size constructed. Up to 12 horizontally drilled wells will be placed on each pad, radiating out like the spokes of a wheel. As Wes Gillingham of Catskill Mountainkeeper sees it, “This will dramatically change the places we love in Pennsylvania and New

York into an industrial zone. Anyone who cares will be horrified in 20 years if we let industry have their way with the landscape.”

This immense land use change will bring with it polluted and increased volumes of stormwater runoff, degrading streams and the fish and wildlife habitats they provide. It will also increase flood levels downstream.

While gas wells are being constructed and gas extracted, communities bear the brunt of the impact, including increased truck traffic (thousands of truck trips per well to move water, equipment, and fuel) and battered roads; air pollution from diesel-fueled equipment and vehicles; 24/7 construction during fracking and extraction, bringing light, noise, and air pollution for weeks at a time; and the not-uncommon occurrence of accidents, fires, emergencies, spills, and leaks in municipalities that rely on volunteers and donations to operate emergency response units.

Hugh Kimball, conservation chair of the Central New York Chapter of the Izaak Walton League, says that the intensity of development will challenge the state because “there are only 17-20 staff in place now at the Minerals Division of the New York State Department of Environmental Conservation to handle the thousands of [vertical] wells that already exist, exposing the state’s outdoors to great risk.”

The Izaak Walton League’s Central New York Chapter and other local conservation organizations are working to protect New York from adverse shale gas drilling impacts. “The trout streams of the Catskills and Delaware River watershed are world renowned and have a history of angling dating back more than 100 years,” says John Barone, vice president of Theodore Gordon Flyfishers. “One of the most unique, culturally rich regions for anglers is in serious jeopardy and must be preserved.”

Fracking recently commenced in Pennsylvania’s only national forest. “Marcellus shale gas drilling poses significant threats to water quality, wildlife habitat, and public recreation in the Allegheny National Forest,” says Ryan Talbott of the Allegheny Defense Project. “The Pennsylvania Department of Environmental Protection and the Forest Service are ill-equipped to monitor the more than 12,000 oil and gas wells that



PHOTO BY EARL HOWER

## EYES ON DRILLING

The U.S. Environmental Protection Agency has created an “Eyes on Drilling” tip line for citizens to report non-emergency suspicious activity related to oil and natural gas development. Call toll-free at (877) 919-4EPA (4372) or e-mail reports to [eyesondrilling@epa.gov](mailto:eyesondrilling@epa.gov).

In the event of an emergency, such as a spill or release of hazardous material, call the National Response Center at (800) 424-8802. EPA asks that you report the location, time, and date of such activity as well as the materials, equipment, and vehicles involved and any observable environmental impacts. Tips can be provided anonymously.





**Pristine areas like this in New York's Catskills Mountains may be at risk if hydraulic fracturing is permitted without water quality and wastewater treatment guidelines in place.**

already exist on the Allegheny. Marcellus shale gas drilling will only exacerbate this problem and increase the possibility of spills and accidents.”

According to the West Virginia Department of Environmental Protection Web site, shale drilling has concentrated in the northwest and central part of that state, with a marked increase in permits for shale gas wells. “Leasing, permitting, and drilling began here in 2007 and 2008,” says Julie Archer of the West Virginia Surface Owners Rights Organization, “but we are working to get studies done and protective regulations in place before horizontal drilling and fracking of shale wells really takes off in the Marcellus.”

### **If Coal is King, Natural Gas is Queen**

Despite the legacy of pollution from mining “King Coal” in the Marcellus region, natural gas development has been given the royal treatment as well. Permits are being issued at breakneck speed and regulation is severely lacking. The Pennsylvania Department of Environmental Protection expects to issue 5,200 new Marcellus shale permits in 2010 — almost three times the number issued in 2009. “Companies are ruthlessly drilling, and we’ve got a mess,” says Ken Dafallo, president of the Izaak Walton League’s Harry Enstrom Chapter in southwestern Pennsylvania. “If they want to get the gas out, fine. But they can’t destroy everything to get it.”

The water pollution risks, water resource consumption, toxic wastewater produced, polluting air emissions, community impacts, and massive land use transformation involved all add up to an indelible imprint on the natural world.

In March, the U.S. Environmental Protection Agency (EPA) announced that it will conduct a comprehensive research study to investigate the impact of hydraulic fracturing on water quality and public health. EPA is in the very early stages of designing a hydraulic fracturing research program and will begin the process by defining research questions and identifying data gaps, conducting a process for stakeholder input and research prioritization, developing a detailed study design, and implementing research studies. It may be two years before the results of these studies are available.

In the meantime, Congress is working on multiple fronts to address fracking hazards. The House Energy and Commerce Committee is looking into chemicals used by hydraulic fracturing companies and may require full disclosure of each company’s chemical list.

The Fracturing Responsibility and Awareness of Chemicals Act (FRAC Act) was introduced in the House and Senate in June 2009 to eliminate fracking’s exemption under the Safe Drinking Water Act. This would mean that hydraulic fracturing operations would have federal safe-practice regulations, like other industries that inject fluids into the ground, while providing considerable flexibility to states to develop their own programs, with oversight from EPA. The bill also requires public disclosure of the chemicals used in fracking operations.

Out of 34 drilling states, only 21 have laws specifically regulating fracking, only 10 require some sort of disclosure, and none require the amount of fluid left underground to be recorded. In most states, companies do not have to monitor water quality, even when there are



**In September 2009, three spills of fracturing fluid occurred in Dimock, Pennsylvania; two spills entered Stevens Creek and wetlands, causing a fish kill. Three spills of diesel fuel from trucks servicing gas wells — totaling 1,000 gallons — also occurred in that area of Susquehanna County.**

drinking water formations in close proximity to areas where fracking occurs. The FRAC Act is a critical first step in protecting our water resources. But until the EPA study is completed and other guidelines are in place, new shale gas well permits should be on hold.

Residents of coal mining states, where much of the Marcellus shale resides, know very well the environmental and community costs that come when wholesale resource development is allowed at the expense of the world to which it is inextricably connected. A broad array of people — anglers, hunters, outdoorsmen, nature buffs, town council members, scientists, and members of unions such as the United Mine Workers, AFL-CIO, and Affiliated Construction Trades — are speaking up to get better regulations in place and strict enforcement of the law. “It’s not just the tree huggers anymore,” says Don Garvin. “People want top priority to be our future economic and environmental

health, and to do that we need to protect our irreplaceable water resources.”

Shale gas development cannot be allowed to run ahead of protective regulations and careful planning. Marcellus shale drilling should be halted until adequate environmental standards and wastewater treatment facilities are in place to ensure our natural resources are protected.

— Tracy Carluccio is Deputy Director of the Delaware Riverkeeper Network ([www.delawariverkeeper.org](http://www.delawariverkeeper.org)). Established in 1988, the Delaware Riverkeeper Network works throughout the entire Delaware River watershed (including portions of Pennsylvania, New Jersey, Delaware, and New York) to champion the needs of the Delaware River — and the communities that depend on it — through environmental advocacy, volunteer monitoring programs, stream restoration projects, and public education.

## SUPPORT THE FRAC ACT

Legislation has been introduced in both the U.S. House of Representatives and U.S. Senate — the Fracturing Responsibility and Awareness of Chemicals Act (FRAC Act) — to overturn the exemption of hydraulic fracturing from the Safe Drinking Water Act and to require public disclosure of what is in fracking fluids. These bills (H.R. 2766 / S. 1215) are sponsored by Senators Robert Casey, Jr. (D-PA) and Charles Schumer (D-NY) and Representatives Maurice Hinchey (D-NY), Diana DeGette (D-CO), and Jared Polis (D-CO).

**Contact your Senators and Representative today and urge them to help protect water quality by co-sponsoring the FRAC Act. Visit [www.iwla.org/advocacy](http://www.iwla.org/advocacy) to get started.**