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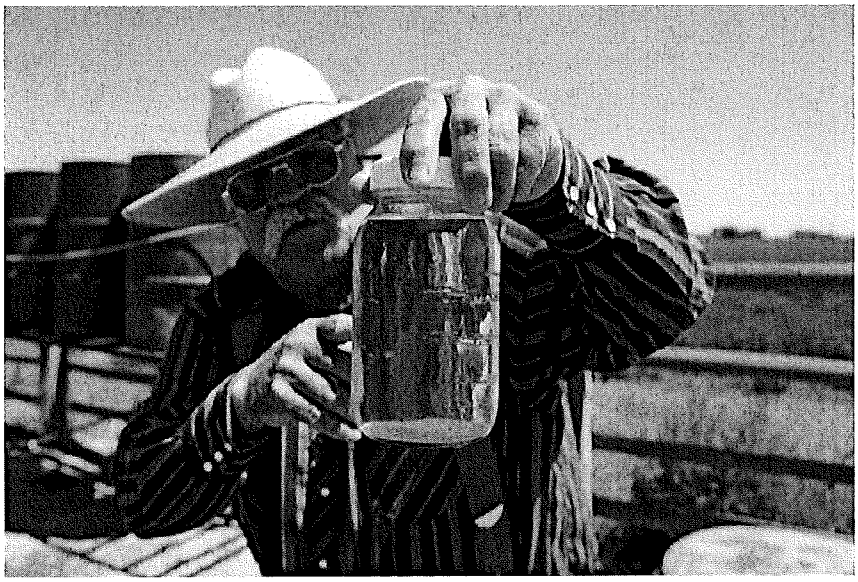
Fracking
Gas Drilling's Environmental Threat

Hydrofracked? One Man's Mystery Leads to a Backlash Against Natural Gas Drilling



Louis Meeks' well water contains methane gas, hydrocarbons, lead and copper, according to the EPA's test results. When he drilled a new water well, it also showed contaminants. The drilling company EnCana is supplying Meeks with drinking water. (Abrahm Lustgarten/ProPublica)

by Abrahm Lustgarten
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There are few things a family needs to survive more than fresh drinking water. And Louis Meeks, a burly, jowled Vietnam War hero who had long ago planted his roots on these sparse eastern Wyoming grasslands, was drilling a new well in search of it.

The drill bit spun, whining against the alluvial mud and rock that folds beneath the Wind River Range foothills. It ploughed to 160 feet, but the water that spurted to the surface smelled foul, like a parking lot puddle drenched in motor oil. It was no better — yet — than the water Meeks needed to replace.

Meeks used to have abundant water on his small alfalfa ranch, a 40-acre plot speckled with apple and plum trees northeast of the Wind River Mountains and about five miles outside the town of Pavillion. For 35 years he drew it clear and sweet from a well just steps from the front door of the plain, eight-room ranch house that he owns with his wife, Donna. Neighbors would stop off the rural dirt road on their way to or from work in the gas fields to fill plastic jugs; the water was better than at their own homes.

But in the spring of 2005, Meeks' water had turned fetid. His tap ran cloudy, and the water shimmered with rainbow swirls across a filmy top. The scent was sharp, like gasoline. And after 20 minutes — scarcely longer than you'd need to fill a bathtub — the pipes shuttered and popped and ran dry.

Meeks suspected that environmental factors were to blame. He focused on the fact that Pavillion, home of a single four-way stop sign and 174 people, lies smack in the middle of Wyoming's gas patch. Since the mid 1990's, more than 1,000 gas wells had been drilled in the region — some 200 of them right around Pavillion — thousands of feet through layers of drinking water and into rock that yields tiny rivulets of trapped gas. The drilling has left abandoned toxic waste pits scattered across the landscape.It has also disturbed the earth itself. One step in the drilling cracks and explodes the earth in a physical assault that breaks up the crust and shakes the gas loose. In that process, called hydraulic fracturing, a brew of chemicals is injected deep into the earth to lubricate the fracturing and work its way into the rock. How far it goes and where it ends up, no one really knows. Meeks wondered if that wasn't what ruined his well.

Meeks couldn't have foreseen it when he began raising questions about his water, but hydraulic fracturing was about to revolutionize the global energy industry and herald one of the biggest expansions in U.S. energy exploration in a century. Although the basic technique was developed decades ago, technological advances had made it possible to frack deeply buried rock formations long thought to be inaccessible.

That meant a vast stockpile of domestic energy was suddenly available to help loosen the grip of foreign oil on the U.S. economy. It also meant that gas — which burns cleaner than coal — would become a pillar of the government's campaign to address climate change.

As a result, drilling was about to happen in states not typically known for oil and gas exploration, including Michigan, New York and even Maryland. It would go from rural, sparsely populated outposts like Pavillion to urban areas outside Dallas, Denver and Pittsburgh. Along the way, a string of calamitous accidents and suspicious environmental problems would eventually make hydraulic fracturing so controversial that it would monopolize congressional hearings, draw hundreds in protests and inspire an Academy-Award-nominated documentary produced for Hollywood.

Louis Meeks, unintentionally, would be a part of that fight from the very beginning. His personal fight began with something simple: the energy industry's insistence that fracturing couldn't contaminate water.

If the earth were an apple, the argument goes, Meeks' drinking water was drawn from the thin skin, while the gas drilling happened far deeper, close to the seeded core. The environment is also protected by the meticulous construction of the gas well itself, with layers of cement poured around redundant layers of steel to contain whatever happens inside the pipe and shield the fresh water around it from contamination.

"You've got about a mile of rock between the areas you are fracturing and the drinking water," says Doug Hock, a spokesperson for the U.S. Division of EnCana, which owns several hundred gas wells around Pavillion. With its Canadian division, EnCana is the fifth largest oil company in North America.

Still, the circumstances near Meeks' property in Pavillion all pointed to drilling.

Three months before his water went bad, EnCana had laid pipe down into a gas well about 500 feet from Meeks' front door. The well, called Tribal Pavillion 24-2, had "circulation" problems during its construction — meaning that the cement may not have filled all the space between the well and the earth, and that its walls had to be strengthened. EnCana says the problems were minor and had nothing to do with the deterioration of Meeks' water. "There is no evidence to suggest the well bore integrity was in any way or at any time compromised," Hock said. But over time Meeks' water had become undrinkable. His neighbors stopped filling up their bottles with it. Soon they were afraid to touch it.

Meeks started calling state environmental officials, but he got little help. They said his water met national standards, so it was still safe to drink. The taste, they said, was probably from rare iron bacteria that can't easily be removed.

EnCana vehemently denied responsibility. The company's engineers explained to Meeks that the layer of natural gas EnCana was mining was some 3,200 feet — more than half a mile — below the bottom of Meeks' water well. It would be like a drop of poison seeping its way through the granite massif of El Capitan for drilling fluids to wind up in his water. "Activity in the natural gas well did not contaminate the surrounding soil or groundwater," Hock stated.

In the spring of 2005, however, EnCana began bringing Meeks a tanker full of fresh water each month as a "good neighbor" gesture. A 5,000-gallon cistern full of fresh water was connected via a long black plastic pipe to the plumbing in his home and refilled every month. But EnCana made it clear that the tank was temporary, and Meeks decided he had to drill a new hole from scratch. This one, he decided, would need to be deeper than his old well and a football field's length further from the gas wells. He paid a contractor $13,000 to drill it, taking the money from his retirement savings. He felt he had no choice. He'd settled on the land intending to spend the rest of his life there.

"It's a nice little place," Meeks said. "We raise our own lamb, raise our own beef, eggs, we put a garden in. It's pretty hard to just start over."

Meeks was born in Riverton, a ranching and drilling town 26 miles from Pavillion, in 1950. In the spring of 1969, he was stationed with the 34th Engineer Battalion in Vietnam when his base was attacked in the middle of the night. Rockets rained down on the barracks, and a piece of shrapnel sliced through his buttocks and into his gut. He received medals for his service, including the Purple Heart, but he also spent the next two years in hospitals — in Tokyo and then Germany and finally at Fitzsimmons Veterans facility in Denver, where a colostomy reconstructed his intestinal tract. After the Army he came home to Wyoming, where he found day work tying wool for a sheep shearing crew, and then on the drill rigs. He was part of a cementing crew and a workover crew — the team that goes back to an old well and re-stimulates it to get it to produce more oil or gas. But when he complained of stomach pain his VA doctor said he shouldn't lift more than 25 pounds. "In the oil field you've got to lift more than that," he says, "so they got rid of me."

Before Meeks retired he learned a thing or two about drilling. He knew that cementing a well was crucial to holding in the gas and contaminants and that sometimes — more often than people liked to say — it failed. After all, there was no way to know for sure that every little crevice and cavern in the earth surrounding a well bore had been completely sealed. The best measure of the strength of that barrier was the circulation process, which works on the assumption that when excess cement comes back up the sides after being pumped down the middle, it has filled everything in between. And that was the very process that EnCana had trouble with on 24-2.

So, there Meeks was on Dec. 19, 2005, watching his contractor drilling deeper, puncturing one layer after another of clay, shale and sandstone bedrock interspersed with overlapping aquifers that trapped fresh water beneath the ground like a giant natural filter. The drill bit hit 340 feet, but the water was still bad. At 440 feet, it wasn't any better. Geologists say that 30 rock formations containing fresh water may lie beneath Pavillion — layers that supply drinking, irrigation and cattle water for almost all the rural residents in that part of the state. How many of those layers were no longer clean?

At 540 feet the new well still wasn't drawing water suitable for the cattle trough, and Meeks' contractor, Louis Dickinson, shut down the engines and brought the drill bit to a rest. But before Dickinson could finish the job, a distant rumbling began echoing from below. It grew steadily louder, like some paranormal force winding its way through the earth. "Then, holy mackerel," says Meeks, "it just came on us."

An explosion of white foam and water, chased by a powerful stream of natural gas, shot out of the ground where Meeks had drilled his well. It sprayed 200 feet through the air, nearly blowing the 70-foot-tall drilling derrick off its foundation, crystallizing in the frigid winter air and precipitating into a giant tower of ice.

A Suspicious Correlation

The blowout, roaring like a jet engine, continued for 72 hours, until a judge ordered EnCana engineers to use their equipment to control it. In that time, according to one estimate a gasfield worker gave Meeks, 6 million cubic feet of natural gas shot out of his 540-foot-deep water well, more than many gas wells in that part of Wyoming produced in an entire month.

Meeks suspected the 24-2 well was to blame, so he hired an environmental engineer to examine the gas production records of surrounding wells. The engineer found a curious correlation — but it was with well 14-2, which was 1,000 feet away from 24-2 and had been drilled in 1980, more than 23 years before EnCana bought the operations in that area. On the week Meeks' water well was being drilled, gas production in 14-2 fell off by about 25 percent. But on the day Meeks' rogue water well was plugged, gas production at 14-2 more than tripled.

Meeks is no scientist. He has an eighth-grade education. But based on circumstantial evidence — the proximity of the gas wells to his water and the timing of when his water turned bad — he was convinced that the energy industry was to blame. EnCana's Hock said that the company was working on 24-2 to optimize its gas flow, but that no one had done much at all on 14-2 since it was drilled. He called the apparent correlation "merely coincidental." The sharp variation in the 14-2 well, Hock said, was part of the normal variation of the well's production over time.

Hock hypothesized that Meeks struck a natural pocket of gas with his water well. Hock also said that Meeks' well was illegal, because he had a permit to drill it only to 300 feet. But Dickinson, who drilled the water well for Meeks — and has also drilled a water well for EnCana — said that while the allegation is technically accurate, permit depth is considered more of a guideline and is not normally enforced. "It is your best guess," confirmed Lisa Lindemann, administrator of the groundwater division that issues permits for the Wyoming state engineer's office. Lindemann said the state would have allowed Meeks to drill deeper than his permit and had no reason for concern.

Convinced he now had tangible evidence tying EnCana's wells to his water problems, Meeks set out to build a case and get the company to help him. He wanted clean water restored to his property or enough money to buy another ranch. He hired and fired lawyers and sent missives to the press. He spent almost all of his savings — more than $100,000 — and armed himself with data culled from thousands of hours of painstaking technical research. In his living room, where two buffalo hides cover couches that sit beneath the mounted bust of a large bull, file boxes full of well records and scientific reports gradually rose in a teetering tower against the wall.

Meeks began developing a theory. The contamination could have come from leaky old waste pits or from a crack in a well pipe. But the more he learned, the more he suspected it had something to do with hydraulic fracturing.

Thousands of pounds of pressure from fracking, he believed, could exploit tiny cracks or flaws in a well's cement casing. What else could possibly force contaminants through long distances underground, through layers of solid rock? The 14-2 gas well drew gas from more than 1,200 feet lower than his water well. Given the apparent correlation in the gas production and the distance between the wells, he thought something had to be connecting them underground. Since fracturing is designed to crack open the rock, and since no one knows for sure how far those cracks go, such a connection seemed logical.

"If this well is producing at 1,700 feet and that gas is coming up to 500 feet, there is a void in there or something that's making it come all that way," he says. "How else would it come up? Fracking is a problem out here because they don't know where it's going."

Dickinson, who drilled the well, said he had never experienced anything like it. "I've had a few blow outs," he said. "It was definitely coming from that lower formation."

When Meeks began his research in the mid-2000s, there was little factual basis for his suspicions. Outside the industry, not much was known about fracking. All he had was his own logical, but subjective, interpretation of the curious set of circumstances before him.

In fracturing, between 200,000 and 6 million gallons of water are mixed with a cocktail of solvents, surfactants and acids that make up about 1 percent by volume and are pumped into the well under enough pressure to bore a hole in a sidewalk. The fluids are mixed with sand, so they can lodge deep in the cracked earth, prop open the fissures they create and keep the gas and fluids flowing freely.

Exactly how far these man-made cracks reach, or whether they can connect with other faults and fissures to create a pathway toward the surface, is unclear. That 1,000 feet of solid rock and layers of steel pipe should be an effective barrier between the gas well and his water well sounded plausible enough to Meeks, but then someone needed to explain to him how his blowout happened.

EnCana's Hock said the company never injected enough fluid into the 24-2 well or any other well in the area to make its way all the way back to the surface. Hock insisted the industry had proved such a connection was impossible.

But Meeks couldn't find a single independent or peer-reviewed study of fracturing's effects on water resources; the reports he found were mostly drafted by or paid for by the oil and gas industry. The Environmental Protection Agency had said fracturing was safe, but it had based its conclusion in part on a review of many of the same industry materials Meeks had studied. The EPA never tested water wells itself.

And scientists say that sort of testing — both before and after drilling takes place — is essential to a sound scientific analysis of the impacts of drilling.

"The critical thing that has to be done is a systematic sampling of the background prior to drilling activity, during and after drilling activity," said Geoffrey Thyne, a geologist and former professor at the Colorado School of Mines and an environmental-engineering consultant with expertise in drilling and fracturing. "Ideally we would go out, we would put monitoring wells in and surround an area that was going to be fractured as part of normal operations."

The budget for that kind of project would run to a ballpark of $10 million, which Thyne said would be a relatively small project for the U.S. Geological Survey or the EPA to undertake. But such a study had never been done.

The thing that kept bugging Meeks — a nagging lesson from his own days on the rigs — had to do with the cement and casing. To protect shallow water aquifers, the regulations say that oil and gas wells have to be encased in concrete far deeper than residents usually drill for water. But some of the records Meeks gathered showed that many of the wells had never been cemented that far. And he couldn't get any of the regulators he talked to to do anything about it.

"I was doing anything I could to get help," says Meeks. "I'd try to tell them there was a problem here but nobody would listen to me."

For one, nobody could agree that anything was actually wrong with his water. There was little debate that it looked brown, smelled like fuel and tasted awful. But by the standard commonly used to decide if water is safe to drink — the sort of test a homebuyer would require before signing a mortgage — Meeks' water was fine. It didn't contain heavy metals or arsenic or any of the handful of obvious contaminants that drinking-water specialists look for. But the tests didn't look for the vast array of obscure compounds that can come from industrial processes like drilling, many of which are unknown, even to the scientific community.

EnCana also took samples of Meeks' water, had them tested, and said that it found nothing.

Wyoming state officials, including Mark Thiesse, then the West District groundwater supervisor for the Department of Environmental Quality, told him they didn't have the inspectors or money to conduct a scientific analysis. "I don't know how many times Thiesse told me 'we don't have a smoking gun and we don't have any money, so what do you want us to do?' " Meeks said.

Thiesse, who has since moved to a different part of the DEQ, said he tested Meeks' well five times. "We have not found hydrocarbons. We have not found fracking chemicals. We have found nothing out of the ordinary. So it's pretty circumstantial."

Each agency Meeks contacted — including the Bureau of Indian Affairs, which is partially responsible for regulating drilling on the Wind River Reservation lands — treated him as if his story were the first time they had heard the suggestion that drilling fluids could wind up in drinking water.

By this time, Meeks' neighbors, loyal to an oil and gas industry that pumps billions of dollars into Wyoming's economy and is a significant employer, thought he was a hothead threatening to dismantle their livelihoods more than a victim defending the region's water. As many people saw it, there was nothing to win by complaining. At best, Meeks would be proved right, and the natural landscape around Pavillion would forever carry a stigma. At worst, he would discredit the industry, hurt their business and put everyone's jobs at risk.

One afternoon Meeks was down by the road, tearing out a section of fence. "There's a preacher works a mile down. He stopped and said, 'You are the worst neighbor I could ever have,' " Meeks said. " 'Every time I see you you've got a jar of water in your hand or you are in the newspaper. What if one of these days I want to sell my land? You're making it so I can't.' "

Nearly two years after his water first turned bad, Meeks found himself alone, an aging near-bankrupt war vet facing off against one of the more powerful corporations on the continent.

The Feds Grow Alarmed

As Meeks continued his quest, hydraulic fracturing was transforming the energy industry and unfurling a wave of drilling that rippled quickly across the country. The fracturing technology that was first used commercially by Halliburton in 1949 had been reworked until a sweet spot combination of chemicals and pressure was derived that made it possible to reach gas far deeper in the earth than energy companies had previously been able to.

In 1995 hydraulic fracturing was used in only a small fraction of gas wells, and the nation's gas reserves were around 165 trillion cubic feet. The United States was so desperate for energy that energy companies were scrambling to secure foreign oil and building $300-million ports to import liquefied natural gas from Russia, Qatar and elsewhere.

By late 2008, however, fracturing was being used in nine out of 10 of the roughly 33,000 wells drilled in the United States each year, and estimates of the nation's gas reserves had jumped by two thirds. Drilling was taking place in 31 states, and geologists claimed the United States contained enough natural gas to supply the country for a century. Russia's president (and former chairman of its state gas company, Gazprom), Dmitri Medvedev, said he would curtail his own nation's gas drilling efforts because he thought the United States might have so much gas that it wouldn't buy more from Russia.

"Hydraulic fracturing is one of the U.S. oil and gas industry's crowning achievements," said Lee Fuller, vice president of government affairs for the Independent Petroleum Association of America and an influential lobbyist who helped shape federal policy on fracturing. Fracturing, Fuller said, takes place "with surgical precision and unrivaled environmental safety records."

As the gas rush spread from central Wyoming, Montana and New Mexico to Colorado, Texas, Arkansas and Pennsylvania, the wells got closer and closer to peoples' homes — not just in rural towns like Pavillion, but in downtown Ft. Worth and within 150 miles of Manhattan. Forests were checkered with five-acre pads cleared for wells and compressor stations. Tens of thousands of trucks delivered water and removed hazardous waste. In Pennsylvania at least one well was being drilled on an elementary school grounds. In Texas and New Mexico, gas rights were leased beneath city parks. Some states mandated that the typical 15-story, 1,200-horsepower drilling rigs be set up at least 150 feet from homes — not out of any environmental concern, but because that was the distance that would keep the house safe if the rig toppled over.

Erik Schlenker-Goodrich, director of the climate and energy program at Western Environmental Law Center, describes it as "a landscape-scale industrial process." Think of it, he said, as "a gigantic factory, spread across thousands, if not hundreds of thousands of acres, just without a roof."

As more wells were drilled, however, more reports began to emerge from people who had similar experiences to that of Louis Meeks.

In Clark, a small northern Wyoming town, benzene was detected in an aquifer after a well blowout. In central Colorado, near the town of Silt, a water well exploded, sending its cap shooting off into the sky. A few miles away, methane gas was found bubbling up out of a placid eddy in a tributary to the Colorado River; then high levels of benzene were detected. It was difficult to say what led to each of these accidents — the latter two of which were also connected to EnCana wells — but drilling and the close proximity of hydraulic fracturing operations was a common thread.

Even in Pavillion, it turned out, Meeks wasn't the only one with problems. Central Wyoming is a private place, where pride stifles complaints and the miles of space between homes are emblematic of the privacy between people. So, it wasn't until Meeks' wife, Donna, a bookkeeper at the Fremont County School District, was chatting with co-worker Rhonda Locker that she learned that the Lockers had also lost their clean water. Rhonda was battling illnesses that she and her husband suspected were caused by contamination. The gas drilling company Tom Brown had paid to have a water-filtration system installed in the Lockers' house years ago, before Tom Brown was bought by EnCana.

Although the Lockers lived just a short way down the road from the Meeks, the two families had never spoken about their problems. "We weren't real open about our concerns," Jeff Locker said. "It's kind of like talking about your medical conditions."

Even as a pattern began to emerge, state and federal environment regulators viewed these cases as extraordinary exceptions. If they were addressed at all, they were taken on as isolated problems, not symptoms of a larger threat. Regulators in different states rarely compared notes, and anecdotal stories were confined to local press reports and never thoroughly investigated. The dots were not connected.

Not, that is, until a problem began to emerge 90 miles west of Louis Meeks' home, in Sublette County, Wyoming, a wind-raked, sparsely populated valley with a deeply buried dome of gas-rich sandstone known as the Pinedale Anticline. In 1999 there had been fewer than 35 producing wells in the Pinedale drilling field, which had hitherto seen little activity aside from ranchers running cattle and the nearby crossing of the Oregon Trail. By 2008, there were more than 1,100, and EnCana, Shell, BP and other companies were lining up to participate in the drilling of 4,400 more Sublette County wells on the ocean of sagebrush.

Much of the land in Sublette County is owned by the federal government, which meant that the Environmental Protection Agency — not just state regulators — was charged with conducting an environmental review before drilling is allowed. As part of that review, in 2007 EPA hydrologists sampled a pristine drinking water aquifer that underlay the region. What they found was a show-stopper: frighteningly high levels of benzene, a known carcinogen, in 88 separate samples stretching across 28 miles.

"It was like, holy shit, this is huge," said Greg Oberley, a groundwater specialist at the EPA's Region 8 headquarters in Denver. "You've got benzene in a usable aquifer and nobody is able to verbalize well, using factual information, how the benzene got there. Nobody understood what caused this."

One thing was clear: There was little industrial activity in the Pinedale area other than drilling, and few other potential causes for the pollution.

In the past, water contamination in drilling fields had been blamed on outdated practices — the messy mistakes of the 1950s. But drilling in Pinedale was relatively new. In this modern field, any contamination linked to drilling also had to be linked to contemporary practices.

For perhaps the first time, federal officials charged with watching over the nation's drinking water in the oil and gas fields were alarmed. "I had to change my paradigm on how the industry was operating," Oberley said. "That's kind of where I said, 'This needs a better look.' "

Oberley was among a small group of EPA scientists — mostly based out of the Denver offices — who wanted to begin fresh research into what was causing water pollution near drilling fields. The biggest question, of course, was whether drilling posed a significant threat to water resources.

The stakes were potentially high. Policy makers — and even prominent environmental groups like the Sierra Club — were championing natural gas as a viable new energy supply, because it burns 50 percent cleaner than coal at the power plant and because it offers the opportunity to make headway against climate change.

If the EPA's scientists concluded that modern drilling did indeed endanger water on a large scale, and the rate of drilling in the United States continued to skyrocket in regions that relied heavily on aquifers and were concerned about water shortages, then research from Wyoming could have broad implications. Much of the Dust Belt, from the Dakotas down to Texas, relies on groundwater aquifers for water,

as do many other rural areas across the United States. Fifteen percent of Americans rely on private wells — the kind Louis Meeks drilled in his yard — for their water. Not that the enormous underground reservoirs were likely to become polluted all at once — they contain way too much water — but the sheer size of the population dependent on groundwater illustrated the risks. These resources are not routinely tested for pollutants from drilling or any other industry, and there are no federal regulations to ensure that they remain safe to drink.

Contaminants could also affect surface water supplies.

The Colorado River, which supplies drinking water to one in 12 Americans, is fed from the drainage that runs through the Pinedale Anticline and is vulnerable to pollution from gas development not just in Wyoming, but throughout the most intensive drilling regions in western Colorado and Utah.

As drilling activity moved east, to cramped and populated areas, the water resources that could potentially be at risk grew even larger. Between Pennsylvania's Delaware and Susquehanna River basins and the Catskill watershed in New York — an area that lies in the heart of the eagerly sought Marcellus Shale gas deposits — drinking water is supplied to New York City , Philadelphia, Baltimore and Trenton, NJ, another 5 percent of the U.S. population. Add those segments together, and a significant percentage of the U.S. water supply — not to mention at least 15 percent of the country's agriculture — could potentially be affected if it turns out that drilling for natural gas leads to significant pollution over a long period of time.

"Are the problems we're seeing an anomaly? Or is the current regime with new fields and new practices compromising ground water quality on a wide-spread, wide scale basis?" asked one senior EPA staff person, who declined to be named because the issue is so politically charged. "That's a question that we really don't have answers to. We have anecdotal reports. The weight of evidence, it's adding up."

To chisel into these issues, Oberley knew the studies he wanted to do would have to be done deliberately, objectively and would take a long time. After all, the EPA's de facto policy had been to allow most of the new drilling that was taking place.

"For EPA to walk into industry's offices and say, 'You need to change this,' we have to have some pretty good data to back that up," Oberley said. "Because they're not going to respond to innuendo or insinuation that there's a problem."

Obstacles to Research

It wasn't at all clear that the EPA had the budget, the political fortitude or the impetus to pursue the thorough study that Oberley and other scientists thought was needed.

The agency had looked, briefly, at hydraulic fracturing before. In 2004 it published a report examining how it affected water supplies in a type of geologic formation, called coalbed methane, which is different from the rocks being drilled in most of the nation's new gas fields. The report detailed numerous concerns about the potential for dangerous fluids to migrate underground. But then, in an abrupt turn, it concluded that hydraulic fracturing "poses little or no threat" and "does not justify additional study." The one exception, it found, was when diesel fuel was used in fracturing fluids. But the industry insisted that it was discontinuing that practice.

The EPA's findings were criticized in some scientific circles at the time, and by an EPA whistleblower, Wes Wilson, for bending to Bush administration dictates and ignoring scientific methods for analyzing contamination complaints.

Wilson, a recently retired environmental engineer who spent 36 years overseeing oil and gas industry impacts in the Rocky Mountain Region for the EPA, called it "a bogus study" because it relied on a peer committee with industry ties, excluded the agency's own best experts and failed to follow its own protocol.

The study included complaints from a handful of people with water problems, but the EPA never tested their water or investigated their cases, instead trusting answers it received from a series of questions sent to state regulators. The final version of the study was reviewed by a peer board that included former oil and gas industry employees from BP, Halliburton and other energy companies. Documents ProPublica obtained through the Freedom of Information Act show that the agency even negotiated a side agreement with Halliburton, exchanging a promise of leniency toward oilfield service companies for a gentleman's agreement to stop using diesel fuel in fracturing.

Oil-state politicians had been trying for years to win an exemption for hydraulic fracturing from the Safe Drinking Water Act, the 1974 law that regulates the injection of waste and chemicals underground, and the EPA's 2004 report was used to justify that effort. The next year, President George W. Bush's landmark energy legislation, the 2005 Energy Policy Act, included a provision that specifically prohibited the EPA from regulating fracturing under the Safe Drinking Water Act. Regulation would now fall to each individual state, many of which had underfunded departments, looser standards and more limited manpower than the federal government.

There was at least subtle pressure on the EPA scientists to go along with what the administration wanted, according to the EPA's assistant administrator for water at the time.

"The administration did not want us to take a formal position of opposition to the exemption," says Ben Grumbles, the EPA's former assistant administrator for water, who is now president of the Clean Water America alliance. "I know EPA was stating concerns about the overly broad language [in the study]. We never construed it as a clean bill of health."

The energy industry began parading the EPA's 2004 report around like a hard-won trophy, as proof that water contamination couldn't be linked to the drilling process. "It shows there is no need for concern," said Doug Hock, the EnCana spokesman. Case closed: Fracturing was safe, and the "Halliburton Loophole," as the exemption came to be called, effectively tied the hands of anyone in the EPA with an inclination to consider what fracturing might be doing to the environment in the gas patch.

"That door was nailed shut," says Oberley. "We absolutely do not look at fracking as an injection activity under the Safe Drinking Water Act. It's not done."

Other obstacles also blocked the EPA from starting new research. The chemicals used in fracking — the names of the compounds that scientists would have to look for if they were to test water for contamination — are kept secret. Industry claims the information is proprietary, akin to Coke keeping its recipes secret from Pepsi. It discloses trade names — like ZetaFlow — of the various concoctions of chemicals the drillers used, along with a statement of health risk meant for worker safety, called a Material Safety Data Sheet. But the exact chemicals and proportions that go into ZetaFlow, for example, remain a mystery.

"These operations are ones the companies have spent millions of dollars developing. From their perspective it is the mechanism by which they have a competitive advantage over other people in their industry," says Lee Fuller. "I would fully expect that they would try to protect that right as long as they possibly can."

But that protection left the scientists to do a lot of guesswork. "We don't really know what those things that we should be looking for are," says Oberley. "That's been kind of an issue all along. ... The service companies haven't been fully disclosing to EPA what those constituents are."

When Louis Meeks learned that the chemicals used in hydraulic fracturing were kept secret he was dumbfounded. Why was everyone so confident that drilling hadn't ruined his water if no one really knew what contaminants came from the drilling in the first place? Trying to find the truth was like shooting at a target, blindfolded, in the middle of the night.

Yet that's what Meeks tried to do. In October 2007 he hired a private engineering firm to take samples of his water. The glass vials were shipped to a lab in Virginia — "The local labs never find anything," Meeks says — and analyzed for an array of pollutants. The tests cost Meeks $4,400, but the results gave him a boost. In addition to abnormal levels of chloride, iron and total dissolved solids, the lab found glycols, a chemical often used to keep fluids flowing in cold conditions. "Glycols are commonly used in antifreeze," testing hydrogeologist Bill Newcomb wrote in the lab report, "and with regard to natural gas production, in dehydration processes."

For the first time in three years Louis Meeks could fall asleep without wondering if he was crazy. It was a start.

A Crack in the Conventional Wisdom

Still, the energy industry's certainty about the safety of hydraulic fracturing seemed to many people unassailable. The process had been used reliably for more than 60 years, industry spokespeople said, during which time few complaints had been raised relative to the nearly 1 million frack jobs that had been done in the United States. Oil and gas companies employ some of the brightest geological scientists, and the papers that emerged — either directly from industry sources or from government agencies that contracted industry consultants to write them — shaped the opinions of regulators and policymakers who read them.

"35,000 wells are hydraulically fractured annually in this country with close to one million wells having been hydraulically fractured in the United States since the technique's inception with no documented harm to groundwater," wrote the Interstate Oil and Gas Compact Commission in a white paper it submitted to Congress.

"The technology has proven to be a safe and effective stimulation technique," said a report contracted by the U.S. Department of Energy, titled "Modern Shale Gas Development in the U.S.: A Primer."

The fact that over the years fracturing technology evolved to use more chemicals and vastly larger quantities of water, and go thousands of feet further into the ground, was usually left out of the conversation.

Faced with so much official momentum against him, Meeks felt he had reached a dead end. He and EnCana reached a settlement through arbitration. EnCana paid him money — he says he can't discuss the amount — and promised to clean up his water. Hock said EnCana had already spent more than $170,000 trying to solve Meeks' water challenge.

Meeks' frustration was apparent to his family. By the end of 2007 his son, Louis Jr., decided to see what he could do to get his father some support. "They just felt like they were up in a corner and that they couldn't do anything," says Meeks Jr., who grew up on the Pavillion ranch and now manages a call center in the Philippines. "I wanted to find an advocate for my parents, somebody that could give advice."

Meeks Jr. called a northern-Wyoming-based environmental group, the Powder River Basin Resource Counsel, which was fighting coal- and gas-related issues. Through them, his father was introduced to Deb Thomas, an organizer of an offshoot group that had been battling extensive aquifer contamination from drilling in northern Wyoming.

Thomas came to Pavillion and met with Meeks. "When I got down there and saw what was going on, it was the same story," she says. "So I knew it was going to be really hard to get the state to act on their issues just like it had been on ours. You aren't heard, because the state's main priority is the money that they get from the oil and gas development."

Thomas helped coordinate the Lockers, the Meeks, and others for the first time, and the little group began digging deeper into reports of fracturing-related problems in Colorado and elsewhere. Fueled in large part by their persistence, an avalanche of questions — from environmental groups across the country — began to rain down on regulators and drillers. And people began spotting cracks in the conventional wisdom put forth by the energy industry that said that hydraulic fracturing was safe.

For example, despite the industry's explanation that thick bedrock safely separates the fracturing target from water sources, evidence began to emerge suggesting that contaminants from gas wells were somehow making their way into groundwater. Perhaps the tiny fissures

that radiate through the bedrock from hydraulic fracturing really were, as Meeks had suspected, allowing the chemical solution to escape into groundwater aquifers. Or maybe contaminants could travel through pre-existing natural cracks, or through a connection of underground passageways, or by the pathway carved by the well itself.

In Colorado, methane showed up frequently in water wells, and researchers thought it might be originating from the same gas reservoirs being drilled deep underground. In Ohio, gas seepage from a natural gas well blew up a house. In Pennsylvania, a vast underground gas injection cave, where gas is put for long-term storage, had somehow leaked into water supplies over 50 square miles. But these incidents were never linked, in part because the state agencies handling them remain separate and uncoordinated.

Dennis Coleman, a leading international geologist and expert on tracking underground migration, says more data must be collected before anyone can say for sure that drilling contaminants have made their way to water or that fracturing is to blame. But Coleman also says there's no reason to think it can't happen. Coleman's Illinois-based company, Isotech Laboratories, has both the government and the oil and gas industry as clients. He says he has seen methane gas seep underground for more than seven miles from its source. If the methane can seep, the theory goes, so can the fluids.

"There is no such thing as impossible," Coleman says. "Like everything else in life it comes down to the probability."

So, is seepage what made Meeks' water well explode with gas?

"This is a field where there is almost no research," said Geoffrey Thyne, the geologist and former professor at the Colorado School of Mines and an environmental engineering consultant. Thyne has found methane and drilling wastewater in dozens of water samples, including from domestic wells, in Colorado and thinks it could have traveled through underground fractures. "It is very much an emerging problem."

Meeks says that when he was working on well construction and fracturing jobs, there were many times when confusion reigned on the muddy flats of a well pad about what, exactly, the conditions were underground and where all the fluid and cement pumped down there had gone. Well cementing and construction techniques might provide the first and most important line of defense against water contamination and the forces of fracturing, but he knew from experience that they were not always practiced and that even when they were the outcome was far from predictable.

A well is constructed in telescoping sections that become increasingly thinner as the well extends deeper into the earth. The first section is wide, maybe seven inches, and each succeeding section is narrower yet. The sections are supposed to be encased in layers of steel pipe to contain the fracture fluids and the gas that runs through them. Like caulk pumped into a window frame, concrete is then used to fill the void — called an annulus — left between the pipe layers and the earth.

"With respect to groundwater, that's pretty much the holy grail," said Mike Paque, director of the Ground Water Protection Council, a group made up of state oil and gas regulators that has examined a number of complaints of groundwater contamination near drilling. "In almost all those cases where there was any indication that there were problems it's been tagged back to poor casing and cementing."

At some point the well's casing layer ends altogether, and from that point downward the drill pipe runs naked through hundreds, sometimes thousands of feet of earth and bedrock. The assumption is that the solid rock layers function like the cement, sealing in all the fluid that is pumped down. Between the lower bare sections and the upper portions encased by cement, nothing is supposed to be able to escape.

A foremost expert on fracturing supports Meeks' theory that things often don't go according to plan. Dale Henry, a retired petroleum engineer, said that as many as a third of the wells he worked on over his career "lose circulation." That means that during hydraulic fracturing the pressure didn't build up the way it should have, because fluids seeped out somewhere on the way down, like a garden hose losing pressure because of punctures. According to Henry, the question is more like, how often does it work properly?

For three decades Henry was responsible for cementing and hydraulic fracturing jobs around the world — including in central Wyoming — as an employee of Dow Chemical, and then Dowell-Schlumberger, a company that was later bought entirely by Schlumberger, now a leading competitor to Halliburton. In 2006 and again in 2008 he ran unsuccessfully for the top job at the Texas Railroad Commission, one of the nation's largest oil and gas regulatory agencies, in part because he wanted to reform the laws that protect water. "I can guarantee you that 90 percent of the time you do not have cement behind the pipe for several thousand feet down at the bottom that keeps your fluids, whether it is produced fluids or frack fluids, where you want them to be," Henry says.

Even if the deep rock layers can seal chemicals from the aquifers above the well, he says, the well itself creates an opening where fluids and gas can be pushed through — especially under the thousands-of-pounds-per-square-inch pressure from fracturing.

Henry's not a scientist, and he's never tracked exactly where his fracture fluids end up. But he firmly believes that fluids can travel outside the well. "Over time they will migrate to the surface," he said. "Fracturing jobs make that more possible because of the excessive pressures."

Other Wyoming gasfield workers have reiterated Meeks' accounts of problems he witnessed as a rig hand. Although the hole in the seal created by the gas well is supposed to be filled with cement — especially near the surface, where wells often run straight through aquifer layers — they say cement jobs are inconsistent.

"It is common knowledge that the lower layers are full of irregularities," said Patrick Jacobson, a rig worker who manages drilling-fluid pumps on gas rigs. The concrete can crack as it dries and expands, Jacobson says, or it can slip into cavities eroded by the turbidity of the injected drilling fluids or into large natural gaps or cracks in the earth, never filling the well annulus at all. Although fracturing is not

supposed to take place until the cement integrity is confirmed and it has had time to dry, rig workers often rush on to the next stage right away. "I think anybody who works in the oil fields, if they tell you the truth, would tell you the same thing," Jacobson said.

EnCana's Hock said the company is meticulous about casing its wells to the proper levels, and about fixing the casing when something goes wrong. "No exceptions have ever been made to that practice," he said. He said the company allows 12 to 24 hours for the cement to dry before any well is fractured.

As Meeks continued collecting records, he focused hard on cementing records. Based on his own experience and on what he had gathered, he still suspected that faulty cementing might be the root cause of his water problem. Using well construction records he painstakingly culled from public files in state drilling offices, he examined documents showing how far down the cement was run on wells near his property. Wyoming drilling regulations — the default law for that area — require cementing to be at least 150 feet below the deepest permitted water wells nearby. Engineers that Meeks hired to examine the records found that cement on the 24-2 well was run only to 562 feet, and the 14-2 was cased to 599 feet. Others were run to as little as 400 feet. The EPA says that water wells in the area are drilled to 750 feet, sometimes deeper.

The contamination of his water well, he began to think, could have been prevented if the drillers had made different choices about how to build the wells near his home.

But when Meeks looked at the broader laws governing drilling in Wyoming and elsewhere to see how the problems might have been detected before they reached his water, he found that few states explicitly required the sort of well pressure monitoring or cement testing that ensure the fluids stay where they are supposed to. There were, simply, few public records documenting the effectiveness of the cement in gas wells or the frequency and success of hydraulic fracturing jobs.

It had been three years since Meeks began his quest, and the more he learned, the more he felt trapped at a dead end. Even with the help of Thomas and with the circumstantial evidence they had gathered and the questions that were now being asked nationally, Meeks still had no scientific evidence connecting his clouded water with gas drilling.

He'd made hundreds of phone calls and written dozens of letters to his governor and to Congress. But no one seemed ready to do anything for this stubborn man in a tiny town in the middle of nowhere.

For the first time, he and Donna began to seriously consider selling the ranch. All the efforts to fix his water were failing, and his settlement with EnCana was falling apart. He knew they would eventually take away the cistern of fresh water.

It was a painful turning point. "It's a place that he bought and struggled to pay for with his VA loan and worked for 30 years to build into a place that he wanted," says his son, Louis Jr. "It has crumbled."

But selling proved to be impossible. In January 2006, Meeks' property was appraised at $239,000. But in May 2008, Jane Rainwater, a local realtor, sent Meeks a coldly worded letter saying his place was essentially worthless and she could not list his property. "Since the problem was well documented ... and since no generally-accepted reason for the blowout has been agreed upon," she wrote, "buyers may feel reluctant to purchase a property with this stigma."

Not sure where to turn next, Meeks pored through the original environmental impact statement conducted for drilling near Pavillion. The document contained the names of scientists who had commented on the potential risks to water supplies. In what would turn out to be a lucky coincidence, he fixated on one.

"I saw Greg Oberley's name in there," Meeks said. "So I said, 'well, I'm going to call him.' "

An Investigation Begins

On May 14, 2008, at Greg Oberley's invitation, Louis Meeks drove six hours to Denver to tell his story to EPA officials in person. With him was a small entourage: Jeff Locker, Meeks' neighbor down the road; John Fenton, another neighbor; and Deb Thomas, from Northern Wyoming. They had recently formed the Pavillion Area Concerned Citizens and had begun organizing a political and advocacy campaign around the pollution fears.

The group gathered in the agency's regional headquarters, an airy glass building a few blocks from Coors Field and the historic Union Station. From these offices the EPA oversees Colorado, Wyoming, North and South Dakota, Utah and Montana — states that account for a large portion of the oil and gas drilling in the United States. EPA representatives from many of the region's divisional offices — water, air quality, Superfund, National Environmental Policy Act compliance — were there, as well as representatives from the Wyoming Department of Environmental Quality.

Thomas opened with a PowerPoint presentation about documented problems in Clark, WY, a small town just outside of Yellowstone National Park. In August 2006 a gas well had blown out, leading to the temporary evacuation of 25 homes and contaminating groundwater aquifers and soil in the area. Benzene was detected in at least one person's drinking-water supply.

One by one, the others followed with their personal stories. John Fenton described how his mother, and six months later his wife, had both lost their sense of smell. The county assessor told him that his property had also lost half its value because of the water concerns. Jeff Locker described his wife's health problems, including intense neuropathic nerve damage.

"She would scream in pain, like someone was running knives through the bones in her shins," Jeff Locker says about Rhonda's condition. "Then it worked through her spine, and now it will start and move up through her whole body. She just turns grey when it happens." Rhonda had been to the best doctors in the West, including the Mayo Clinic in Phoenix, Ariz., and no one could diagnose her problem.

Meeks recounted the research he had done, the doors he had knocked on and the eventual coalescing of his neighbors. What had begun as one man's lonely quest for environmental justice had turned into a community fighting together. Now here he was, backed by a chorus of voices begging the federal government to step in and help protect them. The state regulators, each speaker told the EPA, had failed them. They needed the federal government to do something.

"You could tell that people were frustrated, scared," said Luke Chavez, an EPA Superfund investigator who attended the meeting. Chavez had heard stories like this before, and in most cases they turned out to be nothing. So, he was skeptical. But still, the emotional presentation tugged at him and the others in the room. "You take what you hear with a grain of salt. But I went back and said, 'OK, so, can we at least get some information for these people?' "

Moved by the stories they had heard, Chavez, Oberley and others at the meeting persuaded their bosses to at least let them find out whether Pavillion's water was safe to drink. The agency found some money in its Superfund cleanup program to pay for the project, and Chavez was assigned to help lead it.

But by then fracturing had become a flashpoint for political controversy, and the EPA proceeded with caution. While Oberley and others were concerned about the stories they heard, they didn't consider their Pavillion research to be an investigation into hydraulic fracturing. In fact, they weren't ready to draw conclusions that the contamination had anything to do with drilling at all.

"Hydrofracking is a risk activity," says Oberley. "But so is drilling, so is pit location, so are all these other things. So, I've got a lot of things I want to look at."

There was a theme, however, linking each of those concerns to the fracturing chemicals. The chemicals are a substantial part of the hazardous water from underground that is dumped into waste pits from drilling. It's the fracturing pressure that can exploit a weakness in the well casing. It's the fracturing process that puts the chemicals underground in the first place, where, if they stay in the cracked rock thousands of feet below, they may leak out somewhere higher in the system.

When these aspects of the drilling cycle are including, fracturing becomes about much more than the moment of high-pressure injection. But that's not how the industry tends to see it.

The industry's definition boiled down to lawyerly semantics. It meant that fracturing couldn't be blamed unless the high pressure inside the well at the moment it was fractured directly caused the contamination. "Hydraulic fracturing related contamination would result if the hydraulic fracturing stimulation is the sole cause of the well integrity to fail," explained Lee Fuller, the lobbyist for the Independent Petroleum Association of America. According to Fuller's definition, fracturing would not be the cause if the fracturing fluids were spilled on the surface, or if the fracking waste was improperly disposed of, or even if the cement casing in a well split apart after the enormous pressure of fracking, as has happened in several of the most egregious incidents.

An EPA fracturing expert, Nathan Wiser, put it this way when considering the drilling industry's limited definition of what constitutes hydraulic fracturing: "You can certainly characterize fracturing as an event that happens on a Tuesday," he said. "It's a singular event in that well's life. But it can expose other weaknesses, and through the extra pressure that is exerted on the well at that time it sort of shakes loose that problem."

For the time being, however, the EPA study wasn't about fracturing, and it wasn't about opposing the development of a natural resource that could help secure the nation's energy future. The agency was simply responding to a community in need of help, a public health issue that needed attention.

"These are not people who complain," said Oberley. "The oil and gas industry has been out there since the mid-seventies, and they've coexisted with them. So, it's not that they were having a problem with the industry. They were having a problem with their wells being contaminated."

It took 10 months for the EPA to send its team to Pavillion. But in February 2009, Luke Chavez arrived at Louis Meeks' house on Powerline Road to have a look for himself. It was a frigid day, snowless but blustery. They walked the property together, through the leafless apple trees. Chavez was bundled up, with a camera and notebook in hand. Meeks wasn't. No matter what the weather, he always seemed to wear the same thing: jeans, suspenders, a flannel shirt over his thick shoulders, and a straw cowboy hat covering his mop of grey hair.

At a steel feed trough, Meeks turned on the hose that was connected to his problem well. The water shot out strong, splashing against the base of the bin and creating a froth of small bubbles. On the surface, Chavez could see the sheen, a subtle oil slick. Meeks filed a mason jar and held it to the sun — it was murky. Grasping it like a football in his calloused, working man's hands, he shook it, then opened the lid and sniffed the bottle. Curling his nose and turning aside, he offered the jar to Chavez to smell for himself. Chavez recoiled.

"It was what they said it was," he said. "I was like, yeah, that's definitely worth at least doing some analysis."

Chavez, a stout, gregarious guy who is prone to understatement and comes across more as a chatty neighbor than a federal investigator, knew a thing or two about the gas patch and about farming, as well. He grew up on a farm in New Mexico's San Juan basin, where some of the nation's most intensive drilling takes place. There were two wells on his father's property, and Chavez saved for college by working as a

roustabout on a drilling rig. He identified with the alfalfa and the hay, and he understood the local residents' instinctive distrust of the government. He worked hard to build a rapport.

But Chavez also understood that while gas drilling seemed to be the predominant industrial activity in the area, and thereby a likely cause of the contamination, that didn't mean a thing without systematic research. Was fertilizer used nearby? Did Meeks overhaul truck engines and spill diesel on the property? There was already known water contamination from several old waste pits in the area, and EnCana had a cleanup program under way — maybe the pollution Meeks and the others were finding in their water came from those sources.

"We try to brainstorm what else it could be," Chavez says. "A lot of times reality is crazier than even your imagining."

In March 2009, six weeks after President Obama's inauguration and four years after Meeks first had trouble with his water, a team from the EPA's Superfund program began collecting 39 water samples from properties around the Pavillion area. It was the first formal investigation into complaints of water pollution in Pavillion after many years of letter writing and phone calls and visits to the governor's office and even a couple of lawsuits. Across the mountains in Pinedale, Oberley had also continued to collect water samples from the aquifer underneath the Anticline drilling fields — where he'd found the benzene the year before — and was carefully assembling a broader body of data. The EPA scientists preferred to keep a low profile and dodge the political canon fire that was bound to be returned from any perceived assault on the oil and gas industry. But, in effect, the EPA had begun its first robust scientific examination of the environmental effects of natural gas drilling on the nation's water supply.

By this time, complaints about water contamination in drilling areas had become a national issue.

New Mexico state officials had released a report detailing that contaminants from oil and gas waste pits — the same kinds of dirt ditches that surround Pavillion — and other drilling byproducts had leaked into groundwater in more than 700 cases. Colorado regulators had tallied more than 300 similar cases — not just the conspicuous well blow-ups in Silt but also an underground leak of fracturing fluids that seeped out of a cliff side and formed a 200-foot toxic icefall. A hospital nurse in Colorado had nearly died of organ failure after treating a rig worker who had spilled fracturing fluids on his clothing.

Louis Meeks felt validated, but also sad, as he read the news. Accounts of contamination seemed to be tracking the drilling boom as it swept across the country, from the Barnett Shale in Texas to the Marcellus Shale in Pennsylvania and New York.

In Louisiana, 16 cattle dropped dead after drinking fracturing fluids from a puddle in a field. In Ohio, a house exploded, nearly killing the elderly couple who lived there, after hydraulic fracturing exploited a crack in the cement casing of a nearby gas well, allowing methane to seep underground and fill the couple's basement. In Pennsylvania, news emerged that a couple and their 17-month-old grandson had been killed after a similar accident in 2004. Like the earliest complaints in Wyoming, the news media didn't connect that tragedy with drilling until it became clear that similar problems were happening across the state.

Worst, to Meeks, was what seemed to be unfolding in Dimock, PA. First, an elderly woman's water well blew up on New Year's Day. Then her neighbors began complaining of milky, methane-rich water just like Meeks had. Then another landowner was able to light his tap water on fire. Soon at least 13 households in that one small town had severe water problems that state regulators said were caused by casing and cementing problems at wells drilled by Texas-based Cabot Oil and Gas Corporation. Within a few years of the drilling boom hitting Pennsylvania, regulators had counted more than 50 cases where methane and other contaminants had exploded out of wells or leaked underground into drinking water supplies.

In New York, which was bracing for a similar onslaught of drilling, residents began holding protests to keep hydraulic fracturing out of New York City's watershed, the county's largest unfiltered municipal water supply, serving 9 million people. The state began a multiyear comprehensive environmental analysis of the new fracturing technology, and an upstate congressman, Maurice Hinchey, brought the issue to Washington. Along with Colorado Congresswoman Diana DeGette and Colorado Congressman Jared Polis, Hinchey proposed the FRAC Act, a bill that would undo hydraulic fracturing's exemption from the Safe Drinking Water Act and require oil and gas companies to disclose the names of the chemicals in the fracturing solutions they used.

In the face of this tornado of worry, the drilling industry remained steadfast in its insistence that fracturing and all the drilling processes related to it were completely safe. They continued to spend tens of millions of dollars lobbying against regulation and peppered websites and publications with pro-gas advertisements. Industry trade groups pointed out that drilling development brings jobs and economic bounty to ailing communities and painted critics as unpatriotic heretics working against U.S. energy independence. They drew support from local businesses and residents whose communities needed the money and needed the jobs.

The industry also continued repeating a stubborn claim that by this time seemed almost absurd to Meeks, given the mounting evidence to the contrary: "As far as frack fluids getting into water there's never been a proven case of that happening," says EnCana's Doug Hock. "There has never been a documented case."

The industry's claim was repeated before Congress, in court and to anyone else who asked. It was part of the reason the EPA hesitated to dig further.

The ambiguous identity of the fluids also clouded the issue. States and environmental groups had identified more than 600 chemical compounds that could be used in drilling and fracturing, but they weren't confident the list was complete or accurate. When a regulator suspects fracturing may have led to contamination, Fuller says, they simply have to go out and test the water for fracturing chemicals. "If they don't find them, then the source of the problem is elsewhere," he said.

Joyel Dhieux, an EPA environmental scientist, agrees. But, like Oberley, she says the industry's logic is backward. First the EPA needs to know the names of the chemicals. Then it can examine contaminated water for fracking chemicals. "If you don't know what's in it I don't think it's possible."

Adding insult, the industry continued to suggest that the troubling stories emerging across the country, including from Louis Meeks, are "anecdotal," implying that no science or investigation has ever verified the contamination as true.

The dearth of hard science on the matter, however, cut both ways. In a spring 2009 conference call with reporters, American Petroleum Institute senior policy adviser Richard Ranger — an industry expert who has spoken frequently on the fracturing issue — was asked to produce evidence that fracturing is without environmental risk.

"Have there been any recent studies done on the safety of this?" a reporter asked.

"I'm just not sure that that study is out there," Ranger replied.

"To be clear, we are saying this is a totally safe technology but we can't point to any recent studies that say this is a safe technology?" a reporter pressed.

"Or that says it is unsafe," Ranger replied.

Contamination Confirmed

Late that summer Meeks was told that the EPA was ready to reveal its first findings. On August 11, 2009, eager to finally hear what was in his water, Meeks got in his red 1994 Nissan pickup and drove the five miles to Pavillion's community center, a corrugated steel building with bare walls and poured-concrete floors at the end of one of the two roads that cut through town. He had been anticipating the meeting for six months.

Along with 80-some other residents, some who had driven from as far as Riverton, 26 miles away, Meeks took a seat on one of the wooden benches that were lined up facing a folding table and a projection screen, eager to hear the preliminary findings from the EPA's first round of water testing.

With the room quiet and tense, Luke Chavez, the EPA Superfund investigator, started off tentatively. He was shy and non-committal. But he proceeded to make headlines.

Of the 39 water samples his team had taken from a smattering of properties around Pavillion, Chavez said 11 were contaminated with chemicals, including some with strong ties to hydraulic fracturing. The EPA found arsenic, methane gas, diesel-fuel-like compounds and metals including copper and vanadium. Of particular concern were compounds called adamantanes — a natural hydrocarbon found in gas — and an obscure chemical called 2-butoxyethanol phosphate. 2-BEp is a compound closely related to 2-BE, a substance known to be used in hydraulic fracturing solutions, and that is known to cause reproductive problems in animals. It was a chief suspect when Colorado regulators investigated the well explosion in Silt.

Meeks' well contained traces of petroleum hydrocarbons, bisphenol A, the adamantanes, and methane. John Fenton's water, which tasted good and hadn't even been suspected to have been contaminated, had methane and bisphenols. And Jeff Locker's water, even after filtering with a reverse osmosis system, contained arsenic, methane and metals.

It seemed like the worst news anyone could get, but to the people whose water was bad, it was almost liberating. For the first time, an objective scientific inquiry had confirmed that the groundwater in Pavillion, WY was contaminated.

Suddenly it didn't matter to Meeks what the preacher had told him that day by his mailbox, or how skeptical some of his neighbors had been about his incessant complaints. He wasn't crazy. His water actually was bad. So was the water on several other Pavillion ranches.

"Everybody's been calling me a liar since day one," Meeks says. "Finally we've got some proof. Now they know it wasn't just me, I thought. We can push on now."

The room buzzed as the Pavillion community tried to process what the information meant. Meeks, a man of few words, kept his thoughts to himself. "Sometimes the way I put things people don't like it," he said. "So, I like to wait and think about it and try to put it in the right words later."

Sanchez cautioned that the findings were still tentative. Because the EPA didn't have a complete list of chemicals to work from, it had to go through the exhaustive process of scanning water samples for spikes in unidentified compounds and then running those compounds like fingerprints through a massive criminal database, hoping to find matches in a vast library of unregulated and understudied substances.

EnCana had sent a spokesman, Randy Teeuwen, to the meeting, and he stood saying that "we are as concerned as you are, and we want to find the source of these compounds too." The comment drew jeers from the crowd that had once glared skeptically at Meeks and his public battle.

Jim Van Dorn, a local water professional, turned back to Chavez. "If they'd tell us what they were using then you could go out and test for things and it would make it a lot easier, right?" he shouted.

"Exactly," Chavez shot back.

But Chavez tried to put the information in context. The compounds weren't exclusive to fracturing fluids, he said. Some of them could also be found in common household cleaners.

The EPA's findings set off a firestorm of accusations. Environmentalists issued a press release pointing out that chemicals used in fracturing had been found in Pavillion's water. A prominent EPA scientist with expertise in the Safe Drinking Water Act enforcement said the results pointed more and more to fracturing. Pressure mounted on the EPA's Denver offices. It began to field phone calls from pro-drilling representatives of Congress, questioning the research.

The EPA held steady, rowing hard through the rapids and trying to keep its distance from the politics and maintain its objectivity. The scientists stressed that no conclusions would be drawn until the agency completed yet another round of research, this time with more water tests and extensive lab work. They wanted get a better grasp of the quantity of contaminants in the water, and test more samples.

Chavez tried to temper both environmentalists' and the industry's expectations and keep the relatively small Pavillion project from taking on outsized national significance.

"We're not ever going to say, 'yeah, we know for sure.' I think there will be a certain amount of preponderance of evidence," he said. "The hydraulic fracturing picture seems to be in the national spotlight. But we are trying to be as broad as possible. Even if we find risks or something ... again, it's Pavillion. It's Wyoming. It's one little small spot that has totally different geology than the Marcellus shale."

But it was difficult for Meeks and the environmentalists tracking this issue to ignore the deep controversy the agency was slowly wading into. All they could do was hope the agency would broaden its examination of drilling before the political currents against it became paralyzing.

No More Water

In the fall of 2009, Meeks got a call to meet Randy Teeuwen, the EnCana representative, at the Holiday Inn in Riverton.

The company had warned him months earlier that it would stop paying for his water supply and had given him the option to continue the service and pay for it himself. Meeks declined. There was no way he could afford the payments. He was still hoping that a broader settlement might be reached and EnCana would buy him out. If his property was worthless, Meeks wanted them to pay for his entire loss.

A real estate holding company called Pavillion Land Development, which shares an office address with EnCana in Denver, had bought the home in Silt, CO where the water well blew up, and at least one other Pavillion property with contamination problems, a 300-acre ranch. Meeks didn't see why they shouldn't do the same for him.

"We're asking them to drill a new well, get us good water, or get us out of here," he said.

In the meantime he was gambling that the tanker of water would stay put.

Meeks drove to the Holiday Inn and sat with Teeuwen in the motel's café. There was small talk. Teeuwen asked him whether his granddaughter was still spending a lot of time out at the ranch, Meeks says. Then Teeuwen told him that by Sept. 15 EnCana would remove the water tanker that had been parked in front of his house.

Meeks was stunned into silence, unsure what to do. "That tank is costing $70 a day to site there — plus it cost them $280 a week to bring me a load of water. That's over $3,000. ... Now how could people like us pay $3,000 for water? And especially for something we did not do wrong."

The 26-mile drive home was one of the longest of his life. He would have to tell Donna. And they were almost out of money.

For the first time in this long fight, Meeks had no idea what would happen next.

"I didn't know what we were going to do or what to tell my wife," he says. "It makes you feel less like a man. You don't have no answer, and you can't get no answers. What are you going to do? I didn't have anything I could tell her."

Meeks Jr. said that the turn of events nearly broke his father. "My dad feels like he has let us down as a family and that all that he has worked to give us and to leave us — which is by no means huge, but it's his accomplishment — is no longer there," said Louis Meeks Jr. "It's like having the last 30 years of your life taken away from you. My parents aren't quitters, and they don't give up that easily."

Meeks, feeling boxed in, called local news reporters to witness the water being removed.

On September 14, HB Rentals, the global oilfield services supplier EnCana had hired to supply Meeks with water, sent Scott Farrell with a truck to remove the tanker of water from Meeks' home. Farrell found himself facing a cluster of television crews and reporters. But Meeks, for all his blustery anger, was uncharacteristically quiet. After all these years the wind seemed to have been sucked out of his lungs, and he had nothing to say.

He fought tears, and his voice quivered as he told his story to the TV cameras. Taking the water was like issuing a life sentence. Once it was gone, there was no way he would be able to replace it.

"I can't believe someone would do something like that," he told the reporters.

Farrell was visibly affected. "We decided that we were not going to leave Mr. Meeks without any water," he said, when the cameras turned to him. "We're going to leave the tank and everything here at no charge."

But a few hours later, HB returned, loaded the tanker, and finally took Louis Meeks' water away.

It's difficult to know exactly what happened and why. Meeks said that EnCana told Farrell, "You get that god damn tank outta there or EnCana will give them (HB) no more work." But an EnCana spokesman said that's not the way it happened. According to EnCana, HB was welcome to make its own decision — but EnCana wasn't going to foot the bill.

HB had recently bid on two major contracts with EnCana, which was planning to double its gas production over the next five years. "If we land them they would be one of our largest onshore customers," says Tim Murphy in HB's Houston office.

"A good deed was turning bad in a hurry," says Andy Davidson, HB's local manager in Riverton. "We got caught in a very ugly — in the middle of a situation. I know Louis Meeks personally, and we do business with EnCana also."

October turned to November, and like it does in Wyoming, winter set its claws in early. For weeks Meeks drove to town for water, carting it back in 5-gallon jugs and using it to cook and to drink. There was no bathing, no heat. Meeks worried it wasn't safe for his granddaughter to visit, and it was a humiliating way for his wife to live. At his suggestion, she moved in with their daughter, who had a house in town. He would visit them there and take showers.

Meeks was too proud, too stubborn, and too in love with the wild acreage of Wyoming to leave the ranch. And he had his cattle and sheep to care for. "Everything is invested in this place. I just can't leave it," he said. "How are you going to just walk away?"

As winter approached, Meeks found himself huddled around the pellet stove in the living room, having shut off the side rooms to block in the warmth. Now that his home had no water supply, he couldn't use his hot-water heating system.

By Christmas 2009, nearly four years after his water well blew out and his war against the drillers began in earnest, Meeks had given up. Against the advice of the EPA, the Centers for Disease Control, and his own friends and family Meeks stomped out into his front yard with a wrench and a box of tools and reconnected his fouled water well to the house's plumbing system, restoring his heat and shower and washing water with a certifiably contaminated, water supply. According to the EPA records, his water contained traces of xylene, toluene and diesel fuel, which were common in fracturing fluids, and other derivatives of petroleum hydrocarbons, including benzene, a chemical believed to cause aplastic anemia and leukemia.

"It's really easy to say you should just get out of this situation," says Deb Thomas, Meeks' friend and the environmental organizer from Clark. "But they are not young. Everything that they have is wrapped up in that place — not just in their home. They've got animals and a life here. It's pretty hard to leave that."

Meeks didn't drink the water but used it to bathe and clean his dishes. By January he was complaining of ill effects on his health. He suffered of shortness of breath and described lesions and sores on his arms and legs. At the veterans hospital, he was told he had a respiratory infection and prescribed prednisone and moxifloxacin — but the doctors couldn't say whether it was the water, the stress, or his persistent medical problems that were to blame.

While he suffered, EPA took its biggest step on the fracturing issue in more than six years.

In March 2010, EPA administrator Lisa Jackson announced that the EPA would undertake a major national study of risks to water supplies from hydraulic fracturing far bigger than the Pavillion study. This time, scientists would broaden their definition of fracturing beyond the energy industry's version, and examine every aspect of the process, from the transportation and disposal of the chemicals to the water supplies needed to make the process happen.

In New York, Gov. Paterson issued an executive order banning one type of hydraulic fracturing until July 1, 2011, by which time he hoped environmental officials would have thoroughly examined its safety. And in several states — including Wyoming — laws were passed to require drilling companies to disclose the chemicals they pump into the ground. A group of Democratic members of Congress ratcheted up the debate by revealing that fracking companies had continued to inject tens of millions of gallons of diesel fuel and diesel mixtures into the ground as part of the fracturing process long after they promised not to in 2005.

In Pavillion, the EPA's research continued.

A few months after the agency announced its national study, Chavez, Oberley and the others returned to announce the results of a second round of water testing. Residents, including Louis Meeks, were told not to drink their water under any circumstances and to open windows for ventilation when they showered or washed clothes to avoid building up enough methane to cause an explosion. The agency found the worst contamination in test wells it drilled near the abandoned pits, raising fresh questions about whether the pits might be the source of the groundwater contamination in Pavillion, or whether, as Meeks remained convinced, the damage might also be coming from the gas wells.

The tension in Washington, however, has sharpened. Last fall the EPA received an enraged call from a staff member to James Inhofe, the conservative senator from Oklahoma known as a staunch defender of — and leading campaign finance recipient from — the oil and gas industry. Inhofe then sent a letter to EPA administrator Lisa Jackson questioning the EPA's motives in Pavillion and characterizing its Region 8 staff as insubordinate and uninformed.

Whatever the EPA does, its environmental research is guaranteed to go slower than the pace of drilling development. In 2010, another 14,324 new gas wells were drilled in the United States, including in Wyoming. "If things don't change now it's going to be just a big polluted dump," said Meeks Jr.

Meanwhile Meeks is still living on his ranch, still tracking the latest national developments in the hopes of finding more clues to the mystery of what happened to his water. The state is considering proposals to pipe municipal water through a public system out to his neighborhood. Until then, he and Donna, who is back home again, and at least 20 other Pavillion families are drinking bottled water paid for by EnCana through an intermediary. His granddaughter eats on paper plates, and Meeks won't let her wash her hands before dinner. There is still no clean water to bathe in, or to water the vegetables or to feed the animals. In November, he had a heart attack. His doctors tell him it was probably caused by stress.

"I think a lot of people look at me and think what did I end up with after five years," Meeks says. "I'm stupid for going up against a billion-dollar company."

"There is no end in sight," he adds. "But at least they are listening now."

ProPublica's Nicholas Kusnetz contributed to this story.

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