



Fracking Can Be Done Safely, but Will It Be? A Complex answer from reporter David Biello.

Fracking for natural gas doesn't have to be an environmental disaster, says a new report.

**FRACK WATER:** A new review looks at the impacts of the fracking boom in Pennsylvania on the state's water. Image: Flickr / Penn State Outreach

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Out of sight (and smell), natural gas slowly bubbled up into Norma Fiorentino's private water well near the town of Dimock in northeastern Pennsylvania—in the heart of the new fracking boom in the U.S. Then, on New Year's Day 2009, when a mechanical pump flicked on and provided the spark, Fiorentino's backyard exploded. She and many others blame the blast on fracking—the colloquial name for the natural gas drilling process that combines horizontal drilling and the fracturing of shale deep underground with high-pressure water to create a path for gas to flow back up the well. The fracking revolution has freed up previously inaccessible natural gas in shale formations like the Marcellus, which underlies states from New York down to West Virginia and has been heavily tapped in Pennsylvania. On May 16 the U.S. Department of Interior released its new guidelines for such fracking on public lands. And a new review article funded by the National Science Foundation and published in *Science* on May 16 examines what fracking may be doing to the water supply. "This is an industry that's in its infancy, so we don't really know a lot of things," explains environmental engineer Radisav Vidic of the University of Pittsburgh, who led this review. "Is it or isn't it bad for the environment? Is New York State right to ban fracking, and is Pennsylvania stupid for [allowing it]?" According to the review, the answer is no. "There is no irrefutable impact of this industry on surface or groundwater quality in Pennsylvania," Vidic says. That's not to say there haven't been problems. That's because there are many ways for things to go

wrong with a natural gas well during the fracking process. A new well—or the 100,000 or so existing but forgotten wells—can allow natural gas from either the Marcellus or shallower deposits to migrate up and out of the rock and into water or basements. Leaking methane, in addition to being a potential safety hazard, is also a [potent greenhouse gas that exacerbates climate change](#), although that environmental impact was not examined in this study. The key environmental safety factor is the casing, the industry term for the sheath of cement that surrounds a newly drilled well. If improperly made, gas can migrate along the outside of this sheath. The gas can also itself leave cracks in the sheath if it is poorly made, freeing yet more gas. According to citation records from the Pennsylvania Department of Environmental Protection (DEP), from 2008 to 2013, 6,466 wells were issued 219 violation notices for well construction problems, suggesting that such problems afflict roughly 3 percent of all wells. The DEP is "not seeing any evidence for groundwater contamination from methane leaks," Vidic adds, noting that government and industry are working on better ways to ensure [cement integrity in fracked wells](#). But problems persist. For example, a test well drilled this past October near Owego, N.Y., continues to leak. At the same time, wells in New York State where there has been no fracking show similar concentrations of methane to those in Pennsylvania [where fracking is abundant](#). Northeastern Pennsylvania—where Dimock is located—seems to be a hotspot for such methane contamination, even compared with other parts of the same state. "These formations in northeastern Pennsylvania are, for whatever reason, more problematic," Vidic says, adding that in the future a more precise understanding of the constituents in natural gas from various regions may allow accurate identification of where any contamination comes from, whether the Marcellus or shallower coal seams. "But there's no irrefutable, sustained evidence of contamination going on continuously, so [the gas industry] must be doing something right." One reason there is no such irrefutable evidence is because of a lack of publicly available baseline data for the condition of groundwater prior to any [drilling and fracking](#). That data is collected, often by the gas companies themselves, but not shared due to privacy issues. (For example, it may affect the potential sale value of property found to have existing contamination.) And Pennsylvania also lacks good groundwater monitoring because it is not required by law. "If we forced Pennsylvania to enact that rule, that would be a good outcome," Vidic says. A study in 2011 found levels of [methane contamination were higher closer to fracking](#) among 60 wells tested, although Vidic suggests that the levels were close to the background levels published by the U.S. Geological Survey (USGS). Not all experts share that interpretation—or the generally [rosy outlook of the new \*Science\* review](#). "I don't agree that the levels we found were similar to background levels found by USGS," argues environmental scientist Robert Jackson of Duke University, who lead that study and was not involved with this one. "This review is a mixed bag. Its call for additional monitoring makes perfect sense. Its dismissal of all environmental concerns doesn't." Another particular concern is the potential for the [fracking fluid](#) itself to contaminate water. The exact fracking fluid cocktail is kept secret, although it can range over some 750 secret ingredients, such as

coffee grounds or methanol. Each well requires some 7.5 million to 26.5 million liters of water for the fracking operation itself. Such tainted water has been found outside the Marcellus shale zone deep underground, although still more than a kilometer beneath groundwater supplies. And shallow wells fracked in other regions, such as West Virginia and Wyoming, have contaminated the groundwater. But as of yet, fracking fluid has not yet fouled Pennsylvania's groundwater. "I'll take my chances on winning the lottery over the chances of frack fluid in the groundwater," Vidic says, noting that water from specific formations could also be tracked like the gas itself. Another potential environmental problem comes from all the wastewater that flows back up the well and has to be properly disposed of. At present, Marcellus shale wells are mostly absorbing the water pumped in to them. But at some point in future, all of these wells will begin to produce water that carries toxic and even radioactive contaminants leached from the surrounding rock along with lots and lots of salt. That is already happening; contamination seems to be showing up in the state's rivers, streams and other waterways, according to the review. And if Pennsylvania were to decide to deal with such water by evaporating it, Vidic notes, they will have to figure out how to get rid of the 10 million metric tons of sodium chloride left over. "The entire U.S. uses maybe 15 million tons for de-icing," he adds, "and you can't put it in a landfill because it will just dissolve." Other states use disposal wells to dump the water back down deep underground where it came from, but that's not an option in Pennsylvania due to the underlying geology and regulations. As a result, drillers and gas companies in the state increasingly reuse the water in new wells. In fact, in the first six months of 2012 they achieved a reuse rate of 90 percent. "The best thing to do with wastewater is to recycle or reuse it," Duke's Jackson says. "Industry deserves credit for increasingly doing this." But that won't last forever. Ultimately, the question becomes: What will be the long-term legacy of these wells? After all, the now-moribund coal industry left the Keystone State a toxic legacy it is still coping with today. Although some provisions have been put in place to deal with future abandoned wells, there is not enough money set aside to deal with these future liabilities. "Do we leave them or plug them up, and what are the potential impacts?" Vidic asks. "Now's the time to think about who's going to pay for it when the wells have run their course."