

## THE WHOLE FRACKING ENCHILADA

*Violating the bedrock, the atmosphere, and everything in between*

I HAVE COME TO believe that extracting natural gas from shale using the newish technique called hydrofracking is *the* environmental issue of our time. And I think you should, too.

Saying so represents two points of departure for me. One: I primarily study toxic chemicals, not energy issues. I have, heretofore, ceded that topic to others, such as Bill McKibben, with whom I share this column space in *Orion*.

Two: I'm on record averring that I never tell people what to do. If you are a mother who wants to lead the charge against vinyl shower curtains, then you should. If the most important thing to you is organic golf courses, then they are. So said I.

But high-volume slick water hydrofracturing of shale gas—fracking—is way bigger than PVC and synthetic fertilizer. In fact, it makes them both cheaply available. Fracking is linked to every part of the environmental crisis—from radiation exposure to habitat loss—and contravenes every principle of environmental thinking. It's the tornado on the horizon that is poised to wreck ongoing efforts to create green economies, local agriculture, investments in renewable energy, and the ability to ride your bike along country roads. It's worth setting down your fork, pen, cellular phone—whatever instrument you're holding—and looking out the window.

THE ENVIRONMENTAL CRISIS can be viewed as a tree with two trunks. One trunk represents what we are doing to the planet through atmospheric accumulation of heat-trapping gasses. Follow this trunk along and you find droughts, floods, acidification of oceans, dissolving coral reefs, and species extinctions.

The other trunk represents what we are doing to ourselves and other animals through the chemical adulteration of the planet with inherently toxic synthetic pollutants. Follow this trunk along and you

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find asthma, infertility, cancer, and male fish in the Potomac River whose testicles have eggs inside them.

At the base of both these trunks is an economic dependency on fossil fuels, primarily coal (plant fossils) and petroleum (animal fossils). When we light them on fire, we threaten the global ecosystem. When we use them as feedstocks for making stuff, we create substances—pesticides, solvents, plastics—that can tinker with our subcellular machinery and the various signaling pathways that make it run.

Natural gas is the vaporous form of petroleum. It's the Dr. Jekyll and Mr. Hyde of fossil fuels: when burned, natural gas generates only half the greenhouse gases

of coal, but when it escapes into the atmosphere as unburned methane, it's one of the most powerful greenhouse gases of them all—twenty times more powerful than carbon dioxide at trapping heat and with the stamina to persist nine to fifteen years. You can also make petrochemicals from it. Natural gas is the starting point for anhydrous ammonia (synthetic fertilizer) and PVC plastic (those shower curtains).

Until a few years ago, much of the natural gas trapped underground was considered unrecoverable because it is scattered

throughout vast sheets of shale, like a fizz of bubbles in a petrified spill of champagne. But that all changed with the roll-out of a drilling technique (pioneered by Halliburton) that bores horizontally through the bedrock, blasts it with explosives, and forces into the cracks, under enormous pressure, millions of gallons of water laced with a proprietary mix of poisonous chemicals that further fracture the rock. Up the borehole flows the gas. In 2000, only 1 percent of natural gas was shale gas. Ten years later, almost 20 percent is.

International investors began viewing shale gas as a paradigm-shifting innovation. Energy companies are now looking at shale plays in Poland and Turkey. Fracking

is underway in Canada. But nowhere has the technology been as rapidly deployed as in the United States, where a gas rush is underway. Gas extraction now goes on in thirty-two states, with half a million new gas wells drilled in the last ten years alone. We are literally shattering the bedrock of our nation and pumping it full of carcinogens in order to bring methane out of the earth.

And nowhere in the U.S. is fracking proceeding more manically than Appalachia, which is underlain by the formation called the Marcellus Shale, otherwise referred to by the *Intelligent Investor Report* as “the Saudi Arabia of natural gas” and by the *Toronto Globe and Mail* as a “prolific monster” with the potential to “rearrange the continent’s energy flow.”

In the sense of “abnormal to the point of inspiring horror,” *monster* is a not inappropriate term here. With every well drilled—and thirty-two thousand wells per year are planned—a couple million gallons of fresh water are transformed into toxic fracking fluid. Some of that fluid will remain underground. Some will come flying back out of the hole, bringing with it other monsters: benzene, brine, radioactivity, and heavy metals that, for the past 400 million years, had been safely locked up a mile below us, estranged from the surface world of living creatures. No one knows what to do with this lethal flowback—a million or more gallons of it for every well-head. Too caustic for reuse as is, it sloshes around in open pits and sometimes is hauled away in fleets of trucks to be forced

under pressure down a disposal well. And it is sometimes clandestinely dumped.

By 2012, 100 billion gallons per year of fresh water will be turned into toxic fracking fluid. The technology to transform



it back to drinkable water does not exist. And, even if it did, where would we put all the noxious, radioactive substances we capture from it?

HERE, THEN, are the environmental precepts violated by hydrofracking: 1) Environmental degradation of the commons should be factored into the price structure of the product (full-cost accounting), whose true carbon footprint—inclusive of all those diesel truck trips, blowouts, and methane leaks—requires calculation

(life-cycle analysis). 2) Benefit of the doubt goes to public health, not the things that threaten it, especially in situations where catastrophic harm—aquifer contamination with carcinogens—is unremediable (the Precautionary Principle). 3) There is no away.

This year I’ve attended scientific conferences and community forums on fracking. I’ve heard a PhD geologist worry about the thousands of unmapped, abandoned wells scattered across New York from long-ago drilling operations. (What if pressurized fracking fluid, to be entombed in the shale beneath our aquifers, found an old bore hole? Could it come squirting back up to the surface? Could it rise as vapor through hairline cracks?) I’ve heard a hazardous materials specialist describe to a crowd of people living in fracked communities how many parts per million of benzene will raise risks for leukemia and sperm abnormalities linked to birth deformities. I’ve heard a woman

who lives by a fracking operation in Pennsylvania—whose pond bubbles with methane and whose kids have nosebleeds at night—ask how she could keep her children safe. She was asking me. And I had no answer. Thirty-seven percent of the land in the township where I live with my own kids is already leased to the frackers. There is no away. »

*Biologist Sandra Steingraber is touring with the documentary film, Living Downstream, adapted from her book of the same title.*