

Hydraulic Fracturing and Health

What is hydraulic fracturing?

Hydraulic fracturing, or fracking, is a method used to extract natural gas and oil from deep rock formations known as shale. Using this method, drilling operators force water, sand, and a mix of chemicals into horizontally drilled wells, causing the shale to crack and release natural gas or oil.

Hydraulic fracturing is one part of a broader process known as unconventional natural gas development, which refers to all operations associated with fracked wells, from well construction to the transport of gas and oil off the site.

Does hydraulic fracturing pose health risks to the people living near drilling sites?

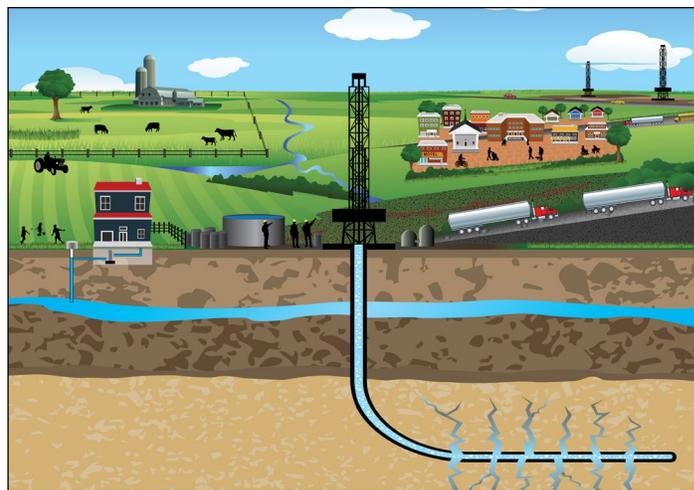
The short answer is we don't know. Although research is underway, few studies to date have provided conclusive evidence about how unconventional natural gas development affects nearby communities. Residents, environmental advocates, and some researchers have expressed concerns about potential effects on water, air, and communities.^{1,2}

Water quality

In some cases, it may be possible for natural gas and hydraulic fracturing-associated chemicals to travel through cracks in the rock into an underground drinking water source. Water contamination could also occur if a well is improperly installed, if chemicals are spilled from trucks or tanks, or if flowback is not effectively contained. Flowback is when water used in the hydraulic fracturing process flows out of the well. The extent of water contamination from these sources is currently unknown.

Air quality

Drilling sites can potentially affect local air quality in several ways. First, any process involving combustion can release toxic chemicals into the air. For example, the burning off, or flaring, of excess natural gas; the operation of heavy equipment at the well site; and the use of diesel trucks to transport materials to and from a site may all contribute to air pollution. In addition, the chemicals and sand used in the hydraulic fracturing process, as well as



(Image courtesy of the University of North Carolina at Chapel Hill Center for Environmental Health and Susceptibility, University of Rochester Environmental Health Sciences Center, and University of Cincinnati Center for Environmental Genetics.)

other chemicals that surface with the natural gas, may potentially become airborne and affect air quality. Since operators are not always required to divulge the specific chemicals used, the extent of air pollution and the potential dangers to local communities are not well understood.

Community impacts

The changes associated with building and having a drilling site can have numerous impacts on community well-being. Some of these impacts may be positive. For example, a drilling operation can increase local employment rates, and result in greater access to health care. Drilling-associated activities, and a sudden influx of a large transient workforce, can also have negative impacts on a community. These may include increased noise, light, and traffic; heavier burdens on local infrastructure and resources, such as roads and hospitals; higher rates of crime and substance abuse; and changes to community character.

Hydraulic fracturing, or fracking, is just one part of the unconventional natural gas development process.

Are there health risks to the people who work at drilling sites?

Most of what is known about the health risks from unconventional natural gas development comes from studies of workers at these sites. While studies of worker exposures and health are limited, ongoing efforts continue to gather important insights. Currently, three hydraulic fracturing-specific health risks have been identified, in addition to risks, such as accidents, that are often associated with industrial occupations involving the use of heavy equipment.

1. Silica sand inhalation: Without proper protection, workers may inhale fine particles of silica sand, the type of sand used in the hydraulic fracturing process. Inhaling these particles can cause lung diseases.³
2. Exposure to chemical spills: Accidental chemical spills may expose workers to compounds used in the hydraulic fracturing process, presenting a variety of health risks.
3. Exposure from flowback operations: Initial field studies suggest that workers performing certain operations may be exposed to high levels of volatile hydrocarbons, which can be acutely toxic. Exposures have resulted in the deaths of at least four workers involved in flowback operations, since 2010.⁴

What is NIEHS doing to increase understanding of these issues?

NIEHS provides funding for research and community outreach, to investigate and address potential health impacts related to hydraulic fracturing. Some ongoing activities include the following:

- A study examining patterns of pregnancy and asthma outcomes among more than 50,000 people in relation to Marcellus shale hydraulic fracturing. (Led by Brian Schwartz, Geisinger Clinic, Danville, Pennsylvania)
- An investigation of potential pregnancy risks experienced by women living near Barnett shale hydraulic fracturing sites. (Led by Kristina Whitworth, University of Texas Health Sciences Center, Houston)
- A study assessing markers of stress, inflammation, cardiovascular health, and quality of life among people in communities with and without hydraulic fracturing. (Led by John Adgate, University of Colorado, Denver)
- The Inter-Environmental Health Sciences Core Center Working Group on Unconventional Natural Gas Drilling Operations, which brings together NIEHS grantees to recommend research directions and approaches. (Led by Trevor Penning, University of Pennsylvania)

The value of community-engaged research

Community-engaged research promotes the active involvement of community residents in all stages of a research study, from design and data collection, to reporting and follow up. This approach has proven to be valuable in addressing a wide range of environmental health problems, and is seen as particularly beneficial for studies focused on the health impacts of unconventional natural gas development.⁵

Benefits for researchers

- Informs research questions and methods.
- Expands the type and amount of data that can be collected.
- Increases impact of research.

Benefits for communities

- Opportunity to influence what gets studied.
- Can increase the value of research in decision-making.
- Chance to participate in early and open sharing of study results.

For more information on the National Institute of Environmental Health Sciences, go to www.niehs.nih.gov.

¹ Adgate JL, Goldstein BD, McKenzie LM. 2014. Potential public health hazards, exposures and health effects from unconventional natural gas development. *Environ Sci Technol* 48(15):8307-8320.

² U.S. Department of Energy, U.S. Department of the Interior, U.S. Environmental Protection Agency. 2014. Federal Multiagency Collaboration on Unconventional Oil and Gas Research: A Strategy for Research and Development. Available: http://unconventional.energy.gov/pdf/Multiagency_UOG_Research_Strateg.pdf [accessed 5 December 2014].

³ OSHA (Occupational Health and Safety Administration). 2012. Hazard Alert: Worker Exposure to Silica during Hydraulic Fracturing. Available: www.osha.gov/dts/hazardalerts/hydraulic_frac_hazard_alert.html [accessed 5 December 2014].

⁴ Snawder J, Esswein E, King B, Breitenstein M, Alexander-Scott M, Retzer K, Kiefer M, Hill R. 2014. NIOSH Science Blog: Reports of Worker Fatalities During Flowback Operations. Available: <http://blogs.cdc.gov/niosh-science-blog/2014/05/19/flowback> [accessed 5 December 2014].

⁵ Penning TM, Breyse PN, Gray K, Howarth M, Yan B. 2014. Environmental Health Research Recommendations From the Inter-Environmental Health Sciences Core Center Working Group on Unconventional Natural Gas Drilling Operations. *Environ Health Perspect* 122(11):1155-1159.