Paul R. Easley is environmental manager for the Fort Smith Utility, Fort Smith, Ark.

Controversy surrounds the current implementation of hydraulic fracturing technology in the United States. Environmental safety and health concerns are being debated at state and national levels. BY PAUL R. EASLEY

HYDROFRACKING IS IT WORTH THE RISK?

HYDRAULIC FRACTURING, also known as "hydrofracking" or "fracking," is the use of high-pressure fluids to force open seams in natural gas-rich rock to allow gas to be extracted (see figure, page 12). Although it's an old technique, hydrofracking has increased in the last few years as a way to extract gas from sizable but hard-to-reach deposits.

Hydrofracking is used in 90 percent of the nation's oil and natural gas wells and has been instrumental in accessing huge new natural gas deposits trapped in shale formations. Large shale-gas formations where hydrofracking is used include the Barnett (Texas), Fayetteville (Arkansas), Haynesville (Louisiana), and Marcellus (the Northeast) formations.

Environmental and human health concerns associated with hydraulic fracturing include the contamination of groundwater, risks to air quality, the migration of gases and hydraulic fracturing chemicals to the surface, and potential mishandling of waste. The potential costs associated with possible environmental cleanup processes, loss of land value, and human and animal health concerns are undetermined. However, the process introduces hundreds of tons of fracturing chemicals into a watershed over a period of several decades and could be accompanied by gradual dispersion of low levels of toxic chemicals into the environment and water supplies through multiple pathways.

PHOTOGRAPH: CITIZENS CAMPAIGN FOR THE ENVIRONMENT

Hundreds of people from a broad coalition of organizations descended on the New York State Capitol April 11, 2011, to call on state leaders and elected officials to safeguard vital water resources from hydraulic fracturing.

THE HYDROFRACKING PROCESS

Hydrofracking uses vast quantities of water and could intensify drought during dry periods. However, as shown in the table on page 13, the real hazard is the mix of numerous toxic chemicals and materials that can be used in the hydrofracking process. A cocktail of an estimated 260 to more than 500 chemicals is used for natural gas fracking. Most drilling companies are reluctant to disclose the exact mix and quantities of chemicals used in the process, because they consider the information proprietary.

Despite the risks, the US Congress in 2005 exempted hydraulic fracturing, except fracturing with diesel fuel, from Safe Drinking Water Act (SDWA) regulations. Diesel fuel used for fracking is the only substance for which drillers must seek a permit. Technically, fracturing can be done using just water and sand, but doing so costs more and is inefficient. According to the drilling industry, hydrofracking works much better when chemicals such as diesel fuel, methanol, hydrochloric acid, and formaldehyde are added to the mix.

However, current protective measures usually fail to consider potential harmful effects of the hydraulic fracturing process and associated fluids. Because of relatively new, widespread use of hydraulic fracturing, there's a regulatory void in most states. Also, regulatory difficulties are further complicated by mineral rights and split estates.

Site Management. The problem with natural gas drilling isn't necessarily the drilling of wells and distribution of the gas; it's managing the site and fate of drilling fluids that cause concern. Improper disposal of recoverable drilling fluids and mismanagement of wastes in "tank farms" has led some state environmental agencies to develop additional measures to prevent unnecessary surface discharge of these contaminants.

Environmental Exposure. Because hydrofracking's main purpose is to force open channels in rock to facilitate upward movement of liquids and gases, it's no surprise that hydrofracking chemicals can enter the environment. That's bad under any circumstances, but it can be particularly harmful when the chemicals enter the environment in or near a water source or watershed. High-volume hydraulic fracturing and horizontal drilling can pose unacceptable threats to the water supplies of many people. The problem will persist because much of the natural gas reserves discovered in the last few years require hydrofracking for exploitation.

Hydrofracking Details

Hydrofracking causes seismic-like activity, breaking up rock and opening many veins in the earth, thus releasing the gas.

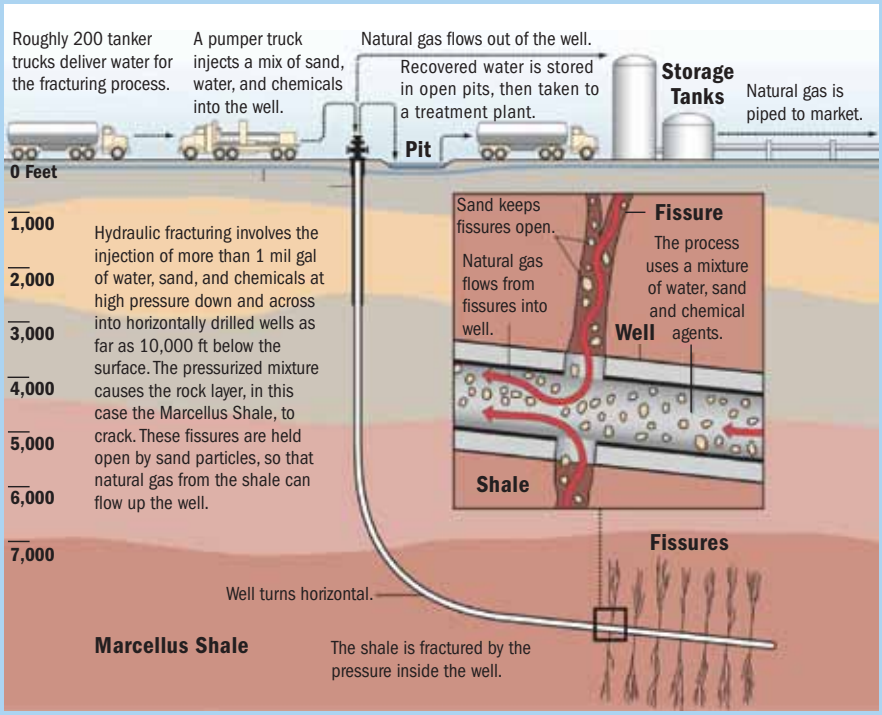

FIGURE: PROPUBLICA

WIDESPREAD DAMAGE

Hydrofracking concerns include

- Withdrawals of water to support hydraulic fracturing during dry periods could increase the duration of drought.
- The process can produce an industrial-strength waste stream characterized by exceptionally high concentrations of a wide range of substances with possible adverse health and water quality effects.
- Chronic and persistent occurrence of small-scale surface spills and contamination incidents may accompany the hydrofracking process and reduce public and regulatory agency confidence in the quality and safety of a water supply.
- Hydrofracking waste can be expected to exceed existing treatment and assimilative capacities.
- There's a lot of uncertainty as to whether current treatment processes effectively remove these waste components and whether sufficient treatment capacity will be available in the future.

Hydrofracking has been linked to drinking water contamination and property damage in Colorado, Ohio, Pennsylvania, Wyoming, and other states. In Pennsylvania, gas well drilling contamination of water wells has forced people from their homes. In West Virginia, Dunkard

A water utility with a groundwater or surface water supply and associated watersheds located in a shale-gas formation should be concerned about potential effects natural gas drilling projects can have on its water supply.

Creek was used to dispose of gas well fluids. This disposal caused golden algae, which thrives on salt, to bloom, killing most of the creek's aquatic life. Near some hydrofracking sites in Colorado and Canada, people have set fire to gas contaminated well water as it pours from their taps or bubbles up out of the earth.

REGULATORY ACTION

Although specific problems have been reported in some states, hydrofracking is a nationwide concern.

For example, after several exploration companies purchased leases and applied for permits, many New York water suppliers expressed concern about the impact of hydrofracking on water quality and watersheds. That concern prompted the New York State Department of Environmental Conservation (DEC) to issue an 802-page draft Supplemental Generic Environmental Impact Statement (SGEIS) about how to regulate natural gas drilling. The draft language was presented for public comment. The full text of the draft impact statement is available at www.dec.ny.gov/energy/58440.html.

In response, the US Environmental Protection Agency (USEPA) submitted 14 pages of comments to the New York DEC, in which USEPA recommended that New York's proposed rules for high-volume hydrofracking be expanded significantly and include greater emphasis on potential health effects that could be associated with natural gas drilling. USEPA officials urged DEC to partner with other state agencies to more thoroughly analyze the cumulative and indirect effects of gas drilling. Federal regulators were particularly concerned about the potential risks of gas drilling in watersheds for New York City and across New York state.

In view of increased hydrofracking and concerns raised by the public, the media, and Congress, USEPA announced in March 2010 that further study of the topic may be warranted and requested scoping materials for initial design of a USEPA research study on potential relationships between hydraulic fracturing and drinking water resources. The study is being conducted through USEPA's Office of Research and Development. Additional information about the project and hydrofracturing can be viewed at www.epa.gov/safewater/uic/wells_hydrofrac.html.

Potential Hydrofracking Chemicals (not inclusive)

Many chemicals identified in fracturing fluid may cause health risks that range from rashes to cancer.

2,2-Dibromo-3-Nitrilopropionamide	Glycol Ethers
2-butoxyethanol	2-methyl-4-isothiazolin-3-one
5-chloro-2-methyl-4-isothiazotin-3-one	Isopropanol
Acetic Acid	Polyglycol
Acetic Anhydride	Alphatic Acid
Alphatic Alcohol	Ammonia Persulfate
Aromatic Hydrocarbon Mesh Sand	Aromatic Ketones
Boric Acid	Mineral Spirits
Boric Oxide	Monoethanolamine
Butan-1-01	Citric Acid
Cristobalite Polyethoxylated Alkanol (1)	Sodium Bicarbonate
Crystalline Silica	Polyethoxylated Alkanol (2)
Dazomet	Dazomet Polyethylene Glycol Mixture
Diatomaceus Earth	Diesel (use discontinued)
Ethane-1,2-diol	Ethoxlated Alcohol Prop-2-yn-1-01
Ether	Isopropyl Alcohol
Ethoxylated Alcohol	Ethoxylated Alcohol Propan-2-01
Ethoxylated Octylphenol	Propargyl Alcohol
Ethylene Glycol	Ethylhexanol
Ferrous Sulfate Heptahydrate	Formaldehyde
Glutaraldehyde	Sucrose
Guar Gum	Hemicellulase Enzyme
Hydrochloric Acid	Hydrotreated light distillate
Mesh Sand (Crystalline Silica)	Methanol
Monoethanolamine	Petroleum Distillate Blend
Polyethylene Glycol Mixture	Polysaccharide
Polysaccharide	Propylene
Potassium Carbonate	Potassium Hydroxide
Sodium Chloride	Sodium Hydroxide
Tetramethylammonium Chloride	Magnesium Nitrate

CAUSE FOR CONCERN

A water utility with a groundwater or surface water supply and associated watersheds located in a shale-gas formation should be concerned about potential effects natural gas drilling projects can have on its water supply. It's worth additional effort by water utility managers and government regulators to make decisions based on sound scientific practices and economic benefits.

Communities stand to benefit enormously from profits associated with natural gas exploration. However, the wealth may come at the cost of one of the most precious commodities on earth—clean, safe drinking water.