Toxicologists outline key health and environmental concerns associated with hydraulic fracturing

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Since the rise in the use of hydraulic fracturing of shale to produce natural gas and oil, scientists, politicians, industrialists, and others have debated the merits and detractions of the practice. In a newly published paper in *Toxicological Sciences*, members of the Society of Toxicology (SOT), alongside other experts, outline how toxicological sciences can be used to determine what risks may or may not be associated with hydraulic fracturing.

"Toxicology is the study of the effects of chemical, physical, or biological agents on living organisms and the environment. As such, toxicologists should be at the forefront of discussions of hydraulic fracturing," says Society of Toxicology President Norbert E. Kaminski, PhD. "We can provide information on the potential toxicity of the chemical and physical agents associated with the process, individually and in combination."

In "The Role of Toxicological Science in Meeting the Challenges and Opportunities of Hydraulic Fracturing" (DOI: 10.1093/toxsci/kfu061), Bernard D. Goldstein, et al, identify a series of potential pathways of contamination and toxicological effects associated with hydraulic fracturing that should and are being explored by researchers:

Water pollution: There is a potential for surface or groundwater contamination by hydraulic fracturing fluids and their constituents. The

authors found that there are few confirmed cases of groundwater contamination, but that there is little research available on the chemical baselines of drinking and surface waters prior to hydraulic fracturing practices to determine contamination with toxicologically significant levels of chemicals as a result of routine hydraulic fracturing.

Air Pollution: The authors write, "A single hydraulic fracturing site is unlikely to produce significant increments of ozone precursors. However, there is concern that in aggregate hydraulic fracturing activities in regions with thousands of wells, and which already have ozone levels close to the allowable health-based standard, such as the Northeast, may be tipped into nonattainment of the standard." Potential contaminants that are being studied include methane gas, diesel emissions, volatile organic compounds, and benzene, among others.

Occupational Exposure: Workers at hydraulic fracturing sites are exposed to a series of potential hazards to their health. These potential hazards range from inhalation of gases and particulate matter to dermal exposure to these same elements. Evaluating exposure amounts, types of exposure, and lengths of exposure to various individual chemicals and the chemicals in combination is necessary to determine potential risks to hydraulic fracturing workers.

Toxicologists are well-positioned to help understand all of these issues, but the paper calls for the toxicological evaluation of hydraulic fracturing's chemical and physical agents to be accelerated. The authors caution that toxicological studies are most beneficial when conducted before an adverse event instead of being used to determine toxicity afterwards.

"Integrating toxicological research into larger public and governmental discussions of hydraulic fracturing is critical to reaching a rational and balanced outcome that protects public and environmental health while

ensuring progress for cleaner energy development," says Dr. Kaminski.

More information: Goldstein, Bernard D., Bryan W. Brooks, Steven D. Cohen, Alexander E. Gates, Michael E. Honeycutt, John B. Morris, Jennifer Orme-Zavaleta, Trevor M. Penning, and John Snawder. "The Role of Toxicological Science in Meeting the Challenges and Opportunities of Hydraulic Fracturing" *Toxicological Sciences* 139.2 (2014): 271-283. DOI: 10.1093/toxsci/kfu061