'Fracking' wastewater that is treated for drinking produces potentially harmful compounds

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Concerns that fluids from hydraulic fracturing, or "fracking," are contaminating drinking water abound. Now, scientists are bringing to light another angle that adds to the controversy. A new study, appearing in the ACS journal *Environmental Science & Technology*, has found that discharge of fracking wastewaters to rivers, even after passage through wastewater treatment plants, could be putting the drinking water supplies of downstream cities at risk.

William A. Mitch, Avner Vengosh and colleagues point out that the disposal of fracking wastewater poses a major challenge for the companies that use the technique, which involves injecting millions of gallons of fluids into shale rock formations to release oil and gas. The resulting wastewater is highly radioactive and contains high levels of heavy metals and salts called halides (bromide, chloride and iodide). One approach to dealing with this wastewater is to treat it in municipal or commercial treatment plants and then release it into rivers and other surface waters. The problem is these plants don't do a good job at removing halides. Researchers have raised concern that halide-contaminated surface water subsequently treated for drinking purposes with conventional methods, such as chlorination or ozonation, could lead to the formation of toxic byproducts. Mitch's team set out to see if that was indeed the case.

The researchers diluted river-water samples of fracking wastewater discharged from operations in Pennsylvania and Arkansas, simulating real-world conditions when wastewater gets into the environment. In the lab, they then used current drinking-water disinfection methods on the samples. They found that even at concentrations as low as 0.01 percent up to 0.1 percent by volume of fracking wastewater, an array of toxic compounds formed. Based on their findings, the researchers recommend either that fracking wastewater should not be discharged at all into surface waters or that future water treatment include specific halide-removal techniques.

More information: "Enhanced Formation of Disinfection By-Products in Shale Gas Wastewater-Impacted Drinking Water Supplies" *Environ. Sci. Technol.*, Just Accepted Manuscript
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Abstract
The disposal and leaks of hydraulic fracturing wastewater (HFW) to the environment pose human health risks. Since HFW is typically characterized by elevated salinity, concerns have been raised whether the high bromide and iodide in HFW may promote the formation of disinfection byproducts (DBPs) and alter their speciation to more toxic brominated and iodinated analogues. This study evaluated the minimum volume percentage of two Marcellus Shale and one Fayetteville Shale HFWs diluted by fresh water collected from the Ohio and Allegheny Rivers that would generate and/or alter the formation and speciation of DBPs following chlorination, chloramination and ozonation treatments of the blended solutions. During chlorination, dilutions as low as 0.01% HFW altered the speciation towards formation of brominated and iodinated trihalomethanes (THMs) and brominated haloacetonitriles (HANs), and dilutions as low as 0.03% increased the overall formation of both compound classes. The increase in bromide concentration associated with 0.01%-0.03% contribution of Marcellus HFW (a range of 70 to 200 μg/L for HFW with bromide = 600 mg/L) mimics the

increased bromide levels observed in western Pennsylvanian surface waters following the Marcellus Shale gas production boom. Chloramination reduced HAN and regulated THM formation; however iodinated trihalomethane formation was observed at lower pH. For municipal wastewater-impacted river water, the presence of 0.1% HFW increased the formation of N-nitrosodimethylamine (NDMA) during chloramination, particularly for the high iodide (54 ppm) Fayetteville Shale HFW. Finally, ozonation of 0.01%-0.03% HFW-impacted river water resulted in significant increases in bromate formation. The results suggest that total elimination of HFW discharge and/or installation of halide-specific removal techniques in centralized brine treatment facilities may be a better strategy to mitigate impacts on downstream drinking water treatment plants than altering disinfection strategies. The potential formation of multiple DBPs in drinking water utilities in areas of shale gas development requires comprehensive monitoring plans beyond the common regulated DBPs.

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