

EPA's Study of Potential Impacts of Hydraulic Fracturing for Oil and Gas on Drinking Water Resources: Hydraulic Fracturing Wastewater Source Apportionment Research

Background

EPA scientists evaluated sources of bromide and other inorganic pollutants impacting drinking water intakes on the Allegheny River in Pennsylvania to examine the potential impacts related to the treatment and disposal of oil and gas well produced wastewater.

It is important to understand bromide concentrations in drinking water sources because bromide can react during water treatment with organic material and disinfectants in drinking water to form disinfection byproducts which may pose human health risks. Disinfection byproducts are regulated under the Safe Drinking Water Act, which limits the amount of these contaminants that can be present in drinking water. Previous research has identified centralized water treatment facilities for oil and gas wastewater, power generating plants, industrial manufacturing facilities, municipal and industrial wastewater treatment plants and mining wastes as potential sources of bromide and other inorganic pollutants. Additionally, coal burned in this region of the U.S. has naturally high levels of bromine which is converted to bromide in the combustion process.

In this study, EPA researchers measured concentrations of bromide and other chemicals such as chloride, sulfate, and nitrate in river water samples collected in western Pennsylvania at two public drinking water intakes along the river, and upstream and downstream of potential discharge sources. Sources included centralized water treatment facilities (that treat oil and gas wastewater), coal-fired power plants (with and without flue-gas desulfurization), industrial manufacturing facilities, municipal and industrial wastewater treatment plants, active coal mine runoff, and acid mine drainage. Researchers collected samples in Pennsylvania along the Allegheny River and the Kiskiminetas River, which intersects with the Allegheny.

The river water samples were used to develop chemical source profiles, or fingerprints, which could be used in EPA's Positive Matrix Factorization (PMF) Model to identify the sources of bromide and other inorganic pollutants and to quantify the relative contributions from those sources. This PMF Model has been used previously to apportion sources of air pollutants.

Results

Study results demonstrate that multiple sources contributed bromide concentrations to public drinking water intakes on the Allegheny River in Pennsylvania, with the major sources being centralized oil and gas wastewater treatment facilities that treat wastewater from hydraulic fractured wells, and coal-fired power plants that use flu-gas desulfurization. NOTE: The bromide levels found in source drinking waters, including those in this study, do not pose any direct health risk.

This research study is also significant in demonstrating the application of source apportionment techniques to evaluate a complex array of source impacts on public drinking water system intakes. This is the first time that this approach has been used. An EPA Report summarizing study findings is titled *"Sources Contributing Inorganic Species to Drinking Water Intakes During Low Flow Conditions on the Allegheny River in Western Pennsylvania"* (EPA Report: EPA/600/R-14/430).

Study Limitations

- This analysis focused on one large river system (the Allegheny) and one small river system (the Kiskiminetas) in western Pennsylvania, and therefore is not representative of the country at large.
- Sampling for this study was conducted during low flow river conditions when discharge impacts are greatest.
- Most oil and gas operations (both vertical wells and horizontal wells) in western Pennsylvania use hydraulic fracturing. However, a small portion of vertical oil and gas wells do not use hydraulic fracturing. It was not possible to determine with certainty the precise mix of hydraulic fracturing and non-hydraulic fracturing oil and gas wastewater treated by the centralized wastewater treatment facilities during the specific sampling period in this study. This adds uncertainty regarding the contaminant contributions of hydraulic fracturing wastewater alone.

Overview of the EPA's *Assessment of the Potential Impacts of Hydraulic Fracturing for Oil and Gas on Drinking Water Resources*

EPA is conducting [an assessment](#) of the potential impacts of oil and gas hydraulic fracturing activities on drinking water resources in the United States. The assessment is based upon extensive review of literature, results from recently completed EPA research projects, and technical input from state, industry, non-governmental organizations, the public, and other stakeholders. Part of this effort includes evaluating the possible impacts of treated hydraulic fracturing wastewater on drinking water resources.

For more information, visit: www.epa.gov/hfstudy

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