

What are the impacts of fracking operations on local water quality?

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Margaret (95, UK) asks Dr Jennifer Harkness how pollution from fracking can impact local water quality.

Factors that can impact water quality

Hydraulic fracturing, or fracking, is used to collect natural gas from underground to make electricity, heat buildings or supply stoves for cooking. Fracking operations use high-pressure water to break apart rocks deep underground that store oil and natural gas. Underground, natural gas is dissolved in groundwater (like how gas is dissolved in soda, making it fizzy). Both the natural gas and groundwater are then pumped back above ground. The fracking of deep rocks itself does not change local water quality, but the wastewater from fracking can get into water resources. The wastewater is a mixture of the deep groundwater and fracking water and contains high levels of salts, naturally occurring radioactive materials, metals, hydrocarbons, and natural or man-made organic compounds.

Most wastewater is pumped back underground deep enough to protect drinking water sources. However, accidental spills or leaks of wastewater into rivers or lakes – from storage tanks, storage ponds, well blowouts, or during transport by truck or pipeline – can impact the quality of local waterways and shallow groundwater used for drinking (Fig. 1). Spills can be as small as a few gallons to over a million gallons. In most cases, local water quality near fracking operations is only impacted at levels below human health concerns. However, there have been a few cases where large spills or leaks of fracking wastewater have increased the salinity of local water sources or detections of organic compounds in surface and groundwater.

Stray gas contamination

About 37% of hydraulically fractured wells are within 1.25 miles of a domestic drinking water well¹. Migration of methane from hydraulic fracturing operations, or stray gas, is the most reported impact on groundwater resources^{2,3}. While methane does not pose a health risk,


accumulation in groundwater wells can cause explosions. Additionally, stray gas alters the chemistry of groundwater, leading to changes in the concentrations of some potentially toxic chemicals like sulfide³.

Over geological time, gases and brines from deep sources can migrate naturally into shallow drinking water aquifers, making it difficult to distinguish these naturally occurring fluids from stray gas⁴. Upward leakage of stray gases into shallow aquifers occurs from damaged, compromised or abandoned oil and gas production wells, with an estimated 4.5% of production wells leaking into groundwater resources⁵. Advances in noble gas tracing techniques allow stray gas in drinking water wells to be distinguished from naturally occurring methane, confirming that the presence of stray gas in some groundwater wells is from fracking-related activities⁵.

However, there have been no observations of a similar migration of fracking fluids or highly saline brines from hydraulic fracturing operations into groundwater resources⁴, and the main risk from wastewater is accidental leaks or spills at the surface^{2,5}. Research on the environmental impacts of fracking is ongoing and regulations around the management and storage of fracking wastewater can change in response to research². For example, in Pennsylvania, USA, fracking wastewater is no longer sent to publicly owned treatment plants, after it was found that untreated wastewater 10 times saltier than seawater was being released into local rivers².

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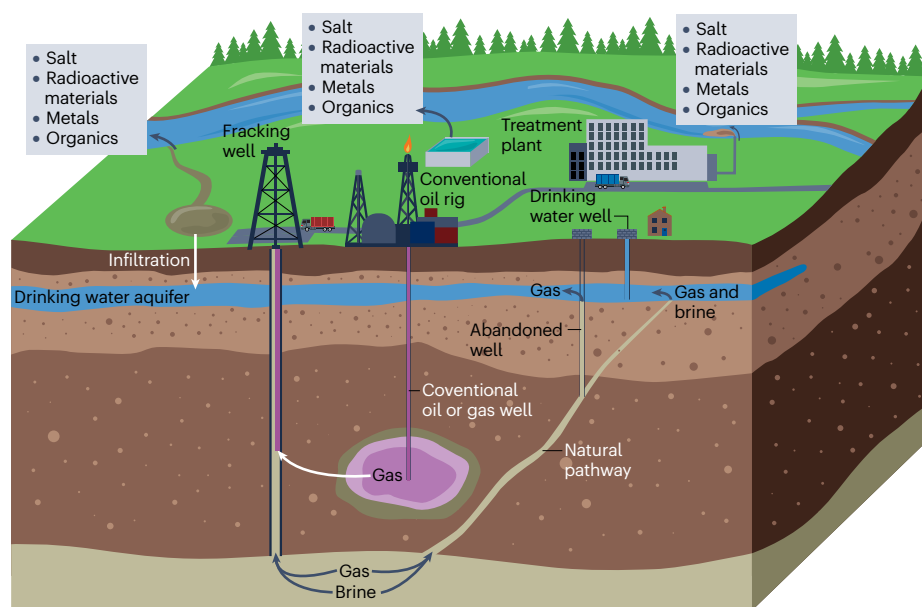


Fig. 1 | Fracking impacts on water quality. Surface and subsurface processes that can release gas and contaminants from fracking-related fluids into water resources.

Ask an expert

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Competing interests

The author declares no competing interests.