Fracking wastewater is mostly brines, not man-made fracking fluids

October 17 2016, by Avner Vengosh

An unconventional shale gas well on the Fort Berthold Reservation in North Dakota. (Photo Credit: Avner Vengosh)

Naturally occurring brines, not man-made fracking fluids, account for most of the wastewater coming from hydraulically fractured unconventional oil and gas wells, a new Duke University study finds.

"Much of the public fear about fracking has centered on the chemical-laden fracking fluids—which are injected into wells at the start of production—and the potential harm they could cause if they spill or are disposed of improperly into the environment," said Avner Vengosh, professor of geochemistry and water quality at Duke's Nicholas School of the Environment.

"Our new analysis, however, shows that these fluids only account for

between 4 and 8 percent of wastewater being generated over the productive lifetime of fracked wells in the major U.S. unconventional oil and gas basins," Vengosh said. "Most of the fracking fluids injected into these wells do not return to the surface; they are retained in the shale deep underground.

"This means that the probability of having environmental impacts from the man-made chemicals in fracking fluids is low, unless a direct spill of the chemicals occurs before the actual fracking," he said.

More than 92 percent of the flowback and produced water—or wastewater—coming from the wells is derived from naturally occurring brines that are extracted along with the gas and oil.

These brines carry their own risks, Vengosh stressed. They contain varying levels of salts, heavy metals and naturally occurring radioactive elements, and their sheer volume makes disposing of them a challenge.

"But with proper treatment, they potentially could have beneficial reuses," he said, "especially out West, where our study shows most brines being produced by fracked wells are much less saline than those in the East. These Western brines, which are similar in salinity to sea water, could possibly be treated and re-used for agricultural irrigation or other useful purposes, especially in areas where freshwater is scarce and drought is persistent."

The Duke team published its findings Oct. 14 in the peer-reviewed journal *Science of the Total Environment.*

The researchers used three statistical techniques to quantify the volume of wastewater generated from unconventional oil and gas wells in six basins nationwide: the Bakken formation in North Dakota; the Marcellus formation in Pennsylvania; the Barnett and Eagle Ford formations in

Texas; the Haynesville formation in Arkansas, Louisiana and East Texas; and the Niobrara field in Colorado and Wyoming.

Using multiple statistical techniques "helped us more accurately account for changes in each well's wastewater volume and salinity over time, and provide a more complete overview of the differences from region to region," said Andrew J. Kondash, a doctoral student in Vengosh's lab at Duke's Nicholas School, who led the study.

"This makes our findings much more useful, not just for scientists but for industry and regulatory agencies as well," he said.

Among other findings, the new study shows that the median volume of wastewater produced by an unconventional oil or gas well ranges from 1.7 to 14.3 million liters per year over the first five to 10 years of production. The volume of produced water coming from these wells declines over time, while its salinity increases.

"The salt levels rise much faster than the volume declines, resulting in a high volume of saline wastewater during the first six months of production," Vengosh said. After that, the volume of wastewater produced by a well typically drops, along with its hydrocarbon output.

Elizabeth Albright, assistant professor of the practice of environmental science and policy methods at the Nicholas School, co-authored the study with Kondash and Vengosh.

More information: Andrew J. Kondash et al, Quantity of flowback and produced waters from unconventional oil and gas exploration, *Science of The Total Environment* (2017). DOI: 10.1016/j.scitotenv.2016.09.069

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