Tougher arsenic standard shows desired effect: Public's drinking water is safer

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Toughening the federal standard for arsenic in 2001 has led to fewer violations by the public systems that supply more than 80 percent of the United States' drinking water, research led by Oregon State University

shows.

Researchers found that despite lower allowable arsenic levels, the percentage of public water systems in violation fell from 1.3% in 2008 to 0.55% in 2017, with most of the violations occurring in a handful of counties in California and Texas. In terms of number of people drinking out-of-arsenic-compliance water, the figure fell nationally by more than 1 million, dropping to about 450,000.

"This reinforces the point that safety regulations do work, especially when they come with a carrot-and-stick approach, like increasing resources for systems to comply and giving them flexibility to choose what works best for their community," said the study's corresponding author, Molly Kile, associate professor in OSU's College of Public Health and Human Sciences.

Findings were published today in *Environmental Science and Technology*.

Sprinkled throughout the Earth's crust, arsenic is a naturally occurring element also found in air, food and water. In the United States, it's particularly common in the West and Southwest, as well as the Northeast and the Great Lakes area.

The International Agency for Research on Cancer categorizes arsenic, which in water is tasteless, odorless and colorless, as a Group 1 human carcinogen, the most severe category that also includes compounds such as asbestos, formaldehyde and mustard gas.

Chronic ingestion of arsenic increases the risk of cancer in the lungs, bladder, liver, kidneys and skin. Arsenic has been federally regulated as a drinking water contaminant since 1942.

Arsenic can leach into ground water through rocks and soil, and has been

used in the manufacture of pesticides and wood preservatives. Mining processes, volcanic activity, erosion and forest fires can also cause arsenic to reach the environment.

In ground water used for drinking, arsenic is a widespread problem. Arsenic levels tend to be higher in drinking water that comes from ground sources like wells rather than from surface sources like lakes and reservoirs.

"You can't know whether it's there unless you test for it," Kile said.

Once in the body, arsenic disrupts the cellular process that produces ATP, the molecule responsible for storing and transporting the energy needed for life. In both blocking and competing with the chemicals that form ATP, arsenic affects a broad range of organs and systems.

Kile, Oregon State graduate student Stephanie Foster and collaborators from the U.S. Environmental Protection Agency, which partially funded the research, analyzed 12 years of data from the Safe Drinking Water Information System; the system is a public EPA database, established by the 1974 Safe Drinking Water Act, of drinking water contamination violations.

The first year of the tracking period, 2006, was five years after the EPA reduced the maximum contaminant level for arsenic with the release of the Final Arsenic Rule, or FAR.

Prior to 2001, drinking water distributed by U.S. public systems—which number greater than 150,000—could contain up to 50 micrograms of arsenic per liter. The FAR cut the allowable concentration to 10 micrograms per liter.

The FAR, which also mandated better detection and monitoring, went

into effect in January 2006; as expected, the number of municipal water systems in violation immediately spiked, since many systems that had been compliant under the old rule no longer were.

But it didn't take long for things to turn around.

"And smaller suppliers showed the most improvement," Kile said. "Part of the controversy around lowering the standard was the economic impact it would have on small systems, but this study shows those systems can adapt and overcome."

Foster noted that after the initial upswing when the new maximum contaminant level went online, arsenic violations in public water systems have consistently happened less frequently. Efforts to reduce the use of arsenic in industry likely are contributing to less public arsenic exposure as well, Kile said.

"Improvements were seen in both ground water and surface water systems," Foster said. "It was also great to have our findings supported by another recently published article by OSU graduate Barrett Welch. He found that urinary arsenic levels among public-water users across the United States also significantly decreased during the time period we studied. This shows that people really are ingesting less arsenic."

The violations found in this research tended toward the western and southwestern regions of the United States, which have geological conditions that lend themselves to elevated arsenic. In the states where violations ran higher, there were usually a small number of counties responsible, suggesting highly localized reasons for the violations.

Kile stresses that this research covered only public drinking water supplies, not wells or any other private sources.

"Those are the responsibility of the owner, and there are many resources available to help people test for arsenic, and if you use a private water supply, you definitely should test for arsenic, along with bacteria and nitrates," she said. "When people drink city water, they do so under the assumption that it is safe. Delivering on this promise requires constant vigilance. It also requires revising regulations and making sure they reflect the best available science. This means regulations change over time to protect our health, and this study demonstrates that with proper support, organizations can comply and will comply with tougher regulations to protect the public's health."

Kile adds that the institution of the Final Arsenic Rule, which included financial assistance to water systems for treatment improvements and gave water systems flexibility on how they would meet the new standards, began with Bill Clinton in the White House and concluded with George W. Bush as president.

"It's an example of presidents continuing to work on important programs that started before they took office and not rolling them back," she said. "The FAR took concerted political effort and will, and it's working."

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