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Arsenic Exposure from Private Wells — Fairbanks Area, 2016

Background

Inorganic arsenic occurs naturally in the Earth's crust and can be toxic to humans. When acted on by microbes, inorganic arsenic can be changed into a less toxic organic form, which can accumulate in seafood. Acute exposure to high levels of inorganic arsenic can cause gastrointestinal irritation and decreased blood cell production. Chronic exposure can cause peripheral neuropathy, cardiovascular disease, darkened skin patches, and certain types of cancer.¹

Soils in some parts of Alaska have high concentrations of inorganic arsenic, which can leach into groundwater and render private well water unsafe for consumption. For example, arsenic in private wells is a known problem in some communities in the Fairbanks North Star Borough (FNSB).² While private wells are not subject to the Environmental Protection Agency's (EPA) 10 parts per billion (ppb) standard for arsenic in public drinking water systems,³ this standard is still helpful for assessing well water safety.

In January 2016, the Alaska Section of Epidemiology (SOE) was notified of an elevated urine arsenic level from a FNSB resident (Resident A) whose well water had an arsenic level of 960 ppb, almost 100 times the EPA standard. This report prompted a public health response.

Methods

The Section of Public Health Nursing (SOPHN), the Alaska Departments of Environmental Conservation (DEC) and Natural Resources (DNR), and SOE held a community meeting on March 16 to inform residents about their potential exposure to arsenic and its associated health effects. On March 17–18, SOE and SOPHN staff visited a convenience sample of homes near the community where Resident A lived, conducted household surveys on drinking water sources, and collected data on use of home water treatment systems. Staff collected tap water and urine from willing residents in the community to assess arsenic exposure. Water and urine samples were tested for total arsenic (i.e., organic and inorganic) concentration at the Alaska State Public Health Laboratory in Anchorage.

Results

Staff met with residents in 21 homes with private wells, and collected 40 urine samples from household members, unfiltered water samples from each home, and filtered water samples from four homes that were equipped with filtration systems. Of the 21 homes visited, 4 (19%) had elevated water arsenic levels (range: 190–1140 ppb; Table). Of the 40 residents that provided a urine sample, four (10%) had urine arsenic levels that exceeded the reference level of 35 ppb total arsenic (range: 124–613 ppb; Table).⁴

The water tested from Home #1 contained 191 ppb arsenic. The residents of this home did not drink their well water and had normal urine arsenic levels. Home #2 used a point-of-entry reverse osmosis (RO) system that was found to be malfunctioning at the time of this investigation. Urine arsenic levels for three members of this home were up to 18 times higher than the reference level.⁴ One participant (Resident D), who was advised to stop well water consumption, had a >50% decrease (138 ppb) in urine arsenic on follow-up testing two weeks later. In Home #3, consumption of arsenic-contaminated water resulted in an elevated urine arsenic level in one resident; another resident who had not consumed an appreciable amount of tap water in recent days had a normal level. Home #4 had a point-of-use RO system that reduced the well water's arsenic concentration from 735 ppb to a non-detectable level. All four household members in Home #4 had normal urine arsenic levels; none of them drank the water.

Most residents used water softeners or carbon filters (which are ineffective at removing arsenic) to resolve color, hardness, odor, or taste concerns. SOE advised residents to consider alternative water sources or RO filtration, where appropriate.

Table. Water and Urine Arsenic Levels in Homes with a Well Water Arsenic Concentration >10 ppb

Home #	Resident	Well Water [†]		Drank Tap Water	Total Urine Arsenic [‡]
		Pre-RO	Post-RO		
1	A	191	NF	No	ND
	B				13
2	C	NA	1140	Yes	463
	D				324
	E				613
3	F	219	NF	Yes	124
	G				25
4	H	735	ND	No	13
	I				ND
	J				7
	K				23

[†]Concentrations in ppb (reference level 35 ppb); RO=reverse osmosis; NA=no sample available; NF=no reverse osmosis filtration system used; ND=arsenic not detected

Discussion

Although this investigation involved a convenience sample of a small number of homes, several wells with high arsenic concentrations were identified, including some where residents were drinking the well water and found to have elevated urine arsenic levels. This finding underscores the fact that other people throughout FNSB and elsewhere in Alaska are also at risk for having unsafe levels of arsenic exposure from consuming contaminated well water. Moreover, three people living in a home with a reverse osmosis filter in place were found to have concerning urine arsenic levels because their filtration system was malfunctioning (Home #2; Table).

Lastly, many residents in the investigation area relied on hauled water instead of private wells. While the Fox Watering Point spring in FNSB is monitored by DEC, no other natural springs in Alaska are routinely tested by DEC for arsenic.

Recommendations

1. Homeowners should test their private wells annually for arsenic and other contaminants, and be aware that arsenic levels in groundwater and well water can vary seasonally or following geologic events such as earthquakes.⁵
2. Residents that treat their water to remove arsenic should maintain their treatment systems regularly and test the treated water to ensure proper system functionality.
3. Health care providers should familiarize themselves with the signs and symptoms of arsenic toxicity and encourage patients who drink well water to test the water regularly.¹
4. Health care providers should advise patients to not eat seafood for ≥48 hours before getting a urine arsenic test.
5. Laboratories must report all clinical heavy metal test results (including arsenic) to SOE (7AAC27.018).

References

1. ATSDR. Public Health Statement for Arsenic. Available at: <http://www.atsdr.cdc.gov/phs/phs.asp?id=18&tid=3>
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4. ACGIH. Threshold limit values and biological exposure indices. Cincinnati: ACGIH Signature Publications; 2015.
5. ADEC. Division of Environmental Health. Drinking Water Program. Available at: http://dec.alaska.gov/eh/dw/DWP/DWP_PrivateWells.html