

Podcast Transcript: Arsenic in Drinking Water

[Theme music]

Ashley Ahearn (AA): You're listening to Environmental Health Chat – a show from the National Institute of Environmental Health Sciences that explores the connections between our health and our world.

I'm Ashley Ahearn.

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More than 200 million people are thought to be exposed to naturally occurring arsenic in drinking water around the world at levels above the guideline values established by the World Health Organization.

Inorganic arsenic occurs in rock formations and soil and can get into water supplies and crops. It can also turn up in the drinking water near hazardous waste sites and industrial facilities, like steel mills. And if you're exposed to it long term, it can adversely affect your health.

Annie Nigra (AN): It impacts almost every major organ system that we look at. So it's an established human carcinogen. It's one of the most potent carcinogens that we know of for humans. It's associated with cardiovascular disease, it's associated with diabetes and metabolic dysfunction, it's associated with adverse birth outcomes, like low birth weight and preterm birth, lung disease, immunological effects, I mean, every major organ system that we look at, we see some effect of inorganic arsenic. So, it is a really nasty contaminant. And a really nasty metal, a metalloid.

AA: Dr. Annie Nigra is an assistant professor of environmental health sciences at Columbia University's Mailman School of Public Health in New York. She's been studying arsenic for most of her academic career.

AN: The arsenic world, it really pulls you in. It's really interesting. It's complicated. It's fascinating. Just when we think we have an answer, we realize we don't have the full picture and there's more work to be done.

AA: Dr. Nigra is especially drawn to advancing our understanding of the social and environmental justice elements of arsenic exposure – basically asking why and how certain groups are more likely to be exposed to elevated levels of arsenic in their drinking water than others.

The U.S. Environmental Protection Agency is responsible for setting standards for arsenic and other contaminants in drinking water at the federal level. Their acceptable level for arsenic is 10 micrograms per liter, or 10 parts per billion. That aligns with the guidance from the World Health Organization on arsenic, but there are many experts who say that number is far too high.

AN: So, EPA says there's no safe level of exposure to arsenic in drinking water. And ideally, we would have no arsenic in our water. But because we have to account for the cost and the technical feasibility, we set a standard at 10 micrograms per liter, or 10 parts per billion.

AA: It is possible to filter out arsenic from drinking water, either by installing filtration systems in individual homes, or by upgrading the filtration system at the public water treatment facility.

Dr. Nigra says that cost should not fall directly on individual citizens but should be carried out at the municipal level.

AN: In public health, right, I'm a public health scientist, I'm really interested in protecting entire populations and in thinking about solutions that do not require individual people or households to spend a lot of time, money, energy, and resources to prevent exposures themselves. I really feel that we should be doing that at the community level, at the state level, at the federal level.

AA: Dr. Nigra and her colleagues have done some eye-opening research on arsenic levels in public water supplies across the country. They analyzed water samples from more than 40,000 public utilities and lined that up with the racial demographics of the communities they served.

Of the utilities they sampled, they found that those serving communities with higher proportions of Latino, Hispanic, or American Indian residents had higher levels of arsenic in the regulated public drinking water.

AN: We've analyzed and crunched the data a number of different ways. And the story is really consistent. For every 10% increase in the proportion of residents who are Hispanic or Latino, water arsenic increases by 6%. And for every 10% increase in the proportion of residents who are American Indian, water arsenic also increases by 6%. And that's really concerning, for obvious reasons and really unacceptable, right, especially from a public health equity and environmental justice perspective.

AA: Dr. Nigra says there could be several different explanations for this inequity. It could partly be due to language barriers – if non-English speaking residents receive materials from their public water utility in English, they may not be able to understand their risks. Water quality standards may not be enforced as diligently in some communities as in others. Or there could be socioeconomic barriers. If residents can't afford to install water filtration systems in their own homes, or take the time needed to advocate for themselves with their public water utility, they may not be able to push for safer drinking water.

AN: And then in some communities, this is really an issue of economies of scale. You have very small water systems that operate on tight margins that serve more rural communities, and they're not able to invest in expensive treatment technologies or invest in source water switching in order to reduce contaminant concentrations. So, the story is complicated. The pattern is consistent across the U.S., but the specific mechanism is different for each community.

AA: The vast majority of Americans get their drinking water from public water systems, so Dr. Nigra says federal and state funding, as well as better regulatory enforcement, are critical to reducing exposures to arsenic in public drinking water supplies.

However, not everyone gets their water from public utilities. Roughly 43 million people in the U.S. get their water from private wells. And according to the U.S. Geological Survey about 2.1 million people in the U.S. may be drinking well water with high concentrations of arsenic.

AN: And this is one of the major environmental injustice issues related to drinking water that we still have in the U.S. Private well users are kind of hung out to dry and they're totally on their own to evaluate their drinking water, get it tested for any number of contaminants that might be relevant for them, install those expensive treatment systems, and maintain those expensive treatment systems over time. And there is evidence in the literature that shows that households with private

wells, households with lower incomes or lower educational attainment, are less likely to test their wells for arsenic, they're less likely to install appropriate treatment systems, and they're less likely to maintain those systems over time. So, the inequities just kind of build, right? If you're on a private well, especially.

AA: Dr. Nigra and her colleagues have also studied arsenic levels in the drinking water of correctional facilities in the Southwest, where naturally occurring arsenic levels can be high.

They found that arsenic concentrations in the prisons were indeed twice as high as they were in the water being distributed to other non-incarcerated citizens in the area. The correctional facility water systems they tested were also twice as likely to exceed the federal regulatory standard for arsenic.

AN: And, you know, we learned that there were a number of ongoing lawsuits that had been brought by incarcerated people, or formerly incarcerated people, where they were claiming that their drinking water had made them acutely ill or had contributed to some of their chronic health conditions, including things like diabetes and kidney disease, which are both associated with arsenic exposure. And so, what I learned from that, you know, was that this research is really relevant to people's lives and that we need to keep pushing, and we need to keep going.

AA: From the very beginning of her career, Dr. Nigra has been drawn to working with Native American communities in the Northern Plains, and she says those experiences have shaped the direction of her research.

AN: And the feedback that we've gotten from the community has consistently been, you know, 'we're so happy to partner with you, we think this research is really important, and what are you doing to engage our youth?'

AA: It was actually in partnership with a woman from the Cheyenne River Sioux Tribe in South Dakota that the EARTH program was first created. EARTH stands for Environmental Health Science Research for Teachers and Highschool Students.

AN: And so the EARTH program came out of a conversation that I had with a community collaborator, maybe 6 to 8 years ago, where we sat down at her kitchen table – her name is Marcia – and we discussed what would a program look like where we could engage local students, high school students, in environmental health research related to arsenic or uranium or other environmental hazards. Important research that was community driven, that was relevant to the communities, that responded to the priorities of the students and their communities. What would such a program look like?

AA: Dr. Nigra's brainstorming buddy, Marcia O'Leary, is with the Missouri Breaks Industries Research Incorporated, a tribally owned research institution that works on several reservations in the Northern Plains.

The idea that was born at Marcia's kitchen table ended up receiving funding from the NIEHS. Now Dr. Nigra and her colleagues are working with nine students in three different high schools on reservations in South Dakota to do research projects related to environmental health in their communities.

AN: And one of our teams is working on evaluating metals in traditional plants and medicines. And one of our teachers is an instructor of Lakota studies. And she is, through the EARTH program, is teaching all of us who are engaged with the program, about Lakota principles and ecological preservation and relatedness and plant relatives and proper protocols for sampling plant relatives, and giving thanks to Mother Earth, and just many really critical, important pieces of the research process that I just had no idea about before learning from this one community member. So, I am really thankful myself, and just really aware of the limits of my own knowledge and my own training, and that this type of work just cannot be done without being led by, really led by, these indigenous scientists.

AA: This research has always been personal for Dr. Nigra. She grew up in a working-class steel mill town outside of Pittsburgh, Pennsylvania, where the air had some of the highest levels of chromium, manganese, and lead in the country.

Arsenic exposure is a solvable problem, she says. We can fix this, as a society, if we put our minds to it. That's what keeps Dr. Nigra going, that optimism – molded and shaped by all the groups she's been privileged to work with throughout her career – from rural folks to urban, Native American to Hispanic and Latino, to the incarcerated...

AN: I just still remain really grounded in the idea that the income of your community, the racial, ethnic composition of your community, how rural your community is, you know, whether you're from a steel mill community or a rural area, or like a dense urban area, that shouldn't impact your environmental exposures. And that I think, is at the end of the day, what drives my research agenda is the idea that we shouldn't have inequities in exposures.

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AA: I'm Ashley Ahearn. Thanks for listening to Environmental Health Chat.