Roles in Reporting Back: Challenges and Solutions

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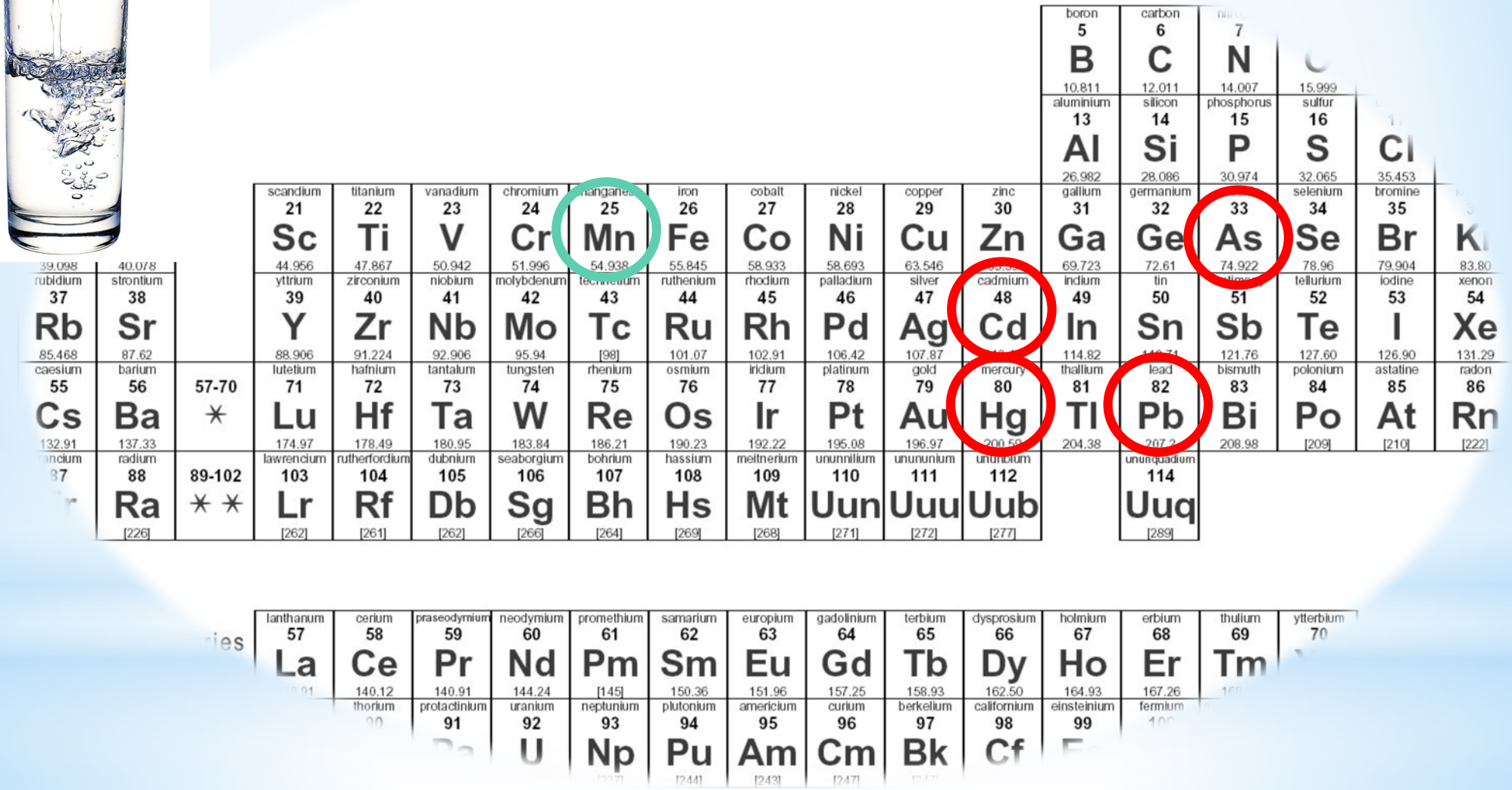
Director, Graduate Studies, CiTEM

Institute for Environmental Health Solutions

The UNC Superfund Research Program

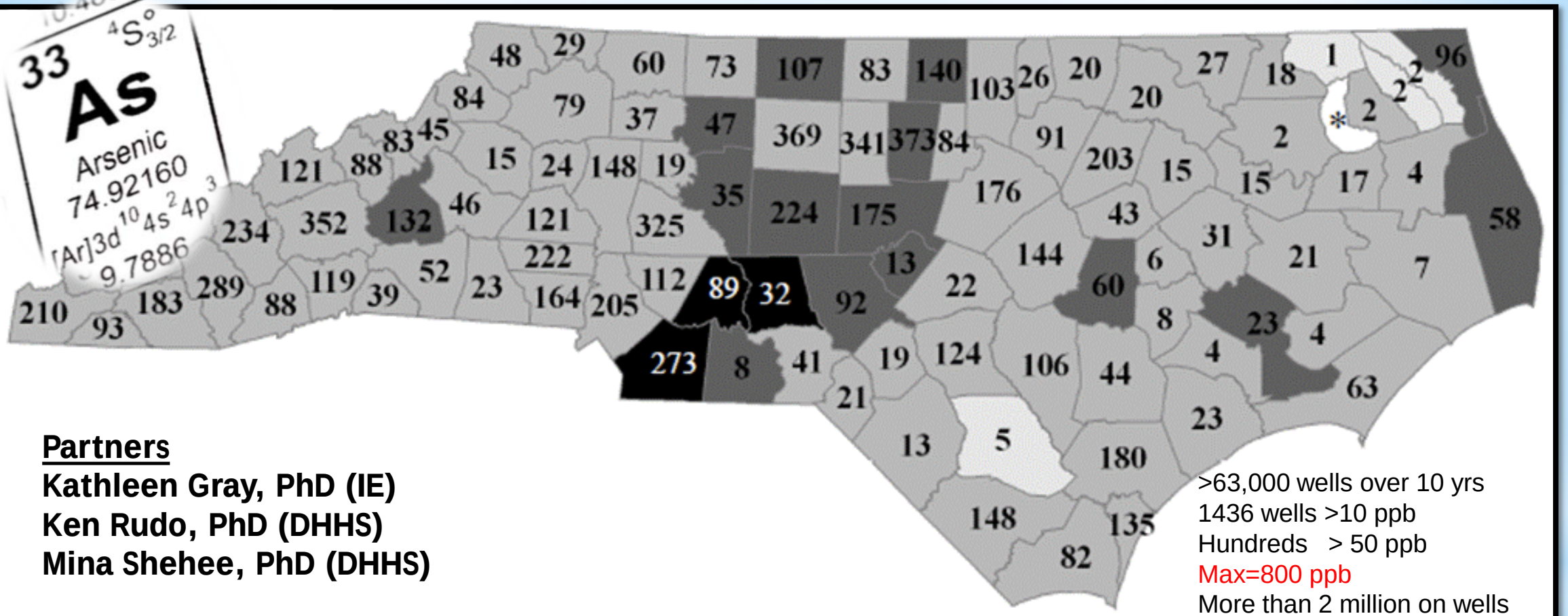
Environmental Epigenetics Laboratory



Toxic metal-serves no purpose in the body

Private wells are unregulated

Are there concerns about toxic metal exposure in North Carolina ?


33
As
Arsenic
74.92160
[Ar]3d10 4s2 4p3
9.7886
48 29 60 73 107 83 140 103 26 20 20 27 18 1 2 2 96
84 79 37 47 369 341 373 84 91 203 15 15 17 4
83 45 15 24 148 19 35 224 175 176 43 58
121 88 132 46 121 325 144 31 21 7
234 352 222 13 22 60 6
289 119 52 23 164 205 112 89 32 92 8 23 4
210 93 183 88 39 273 8 41 19 124 106 44 4 63
21 23
13 5 180
148 135
82
Partners
Kathleen Gray, PhD (IE)
Ken Rudo, PhD (DHHS)
Mina Shehee, PhD (DHHS)
>63,000 wells over 10 yrs
1436 wells >10 ppb
Hundreds > 50 ppb
Max=800 ppb
More than 2 million on wells

UNC Analysis Finds Arsenic, Metals in North Carolina Wells

By Jennifer Suarez | July 11, 2012

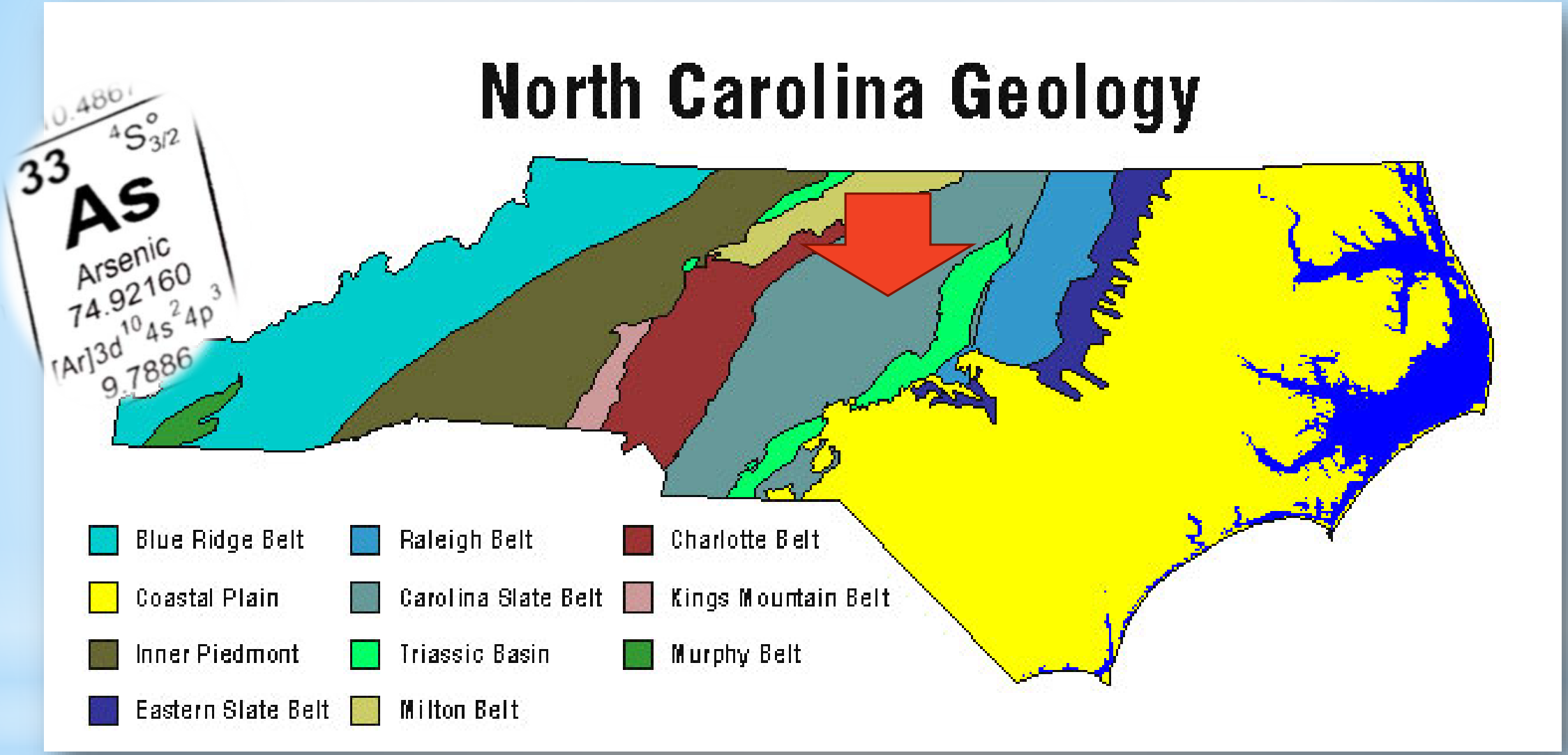
SHARE TWEET EMAIL PRINT MORE

The water may look clear, but in Wake County, it might contain iron, lead, manganese, arsenic or copper.

A statewide analysis of well data for the past several years found various contaminants in private wells, an area some say needs more oversight.

While most water in cities and towns come from closely monitored municipal water systems, residents on well water are in responsible for their own testing. A state law passed in 2008 requires new wells to be tested, but prior to that there were only testing requirements in 15 out of North Carolina's 100 counties. Wells built before 2008 have never required testing, even as they rust and age out.

The study was a joint effort between the University of North Carolina Superfund Research Program and the state Department of Health and Human Services, among others.



Are there other sources of toxic metals?

The Latest News On The Coal Ash Spill in Eden, NC

Officials sample contamintion in the Dan River

SARA WARD / USFWS

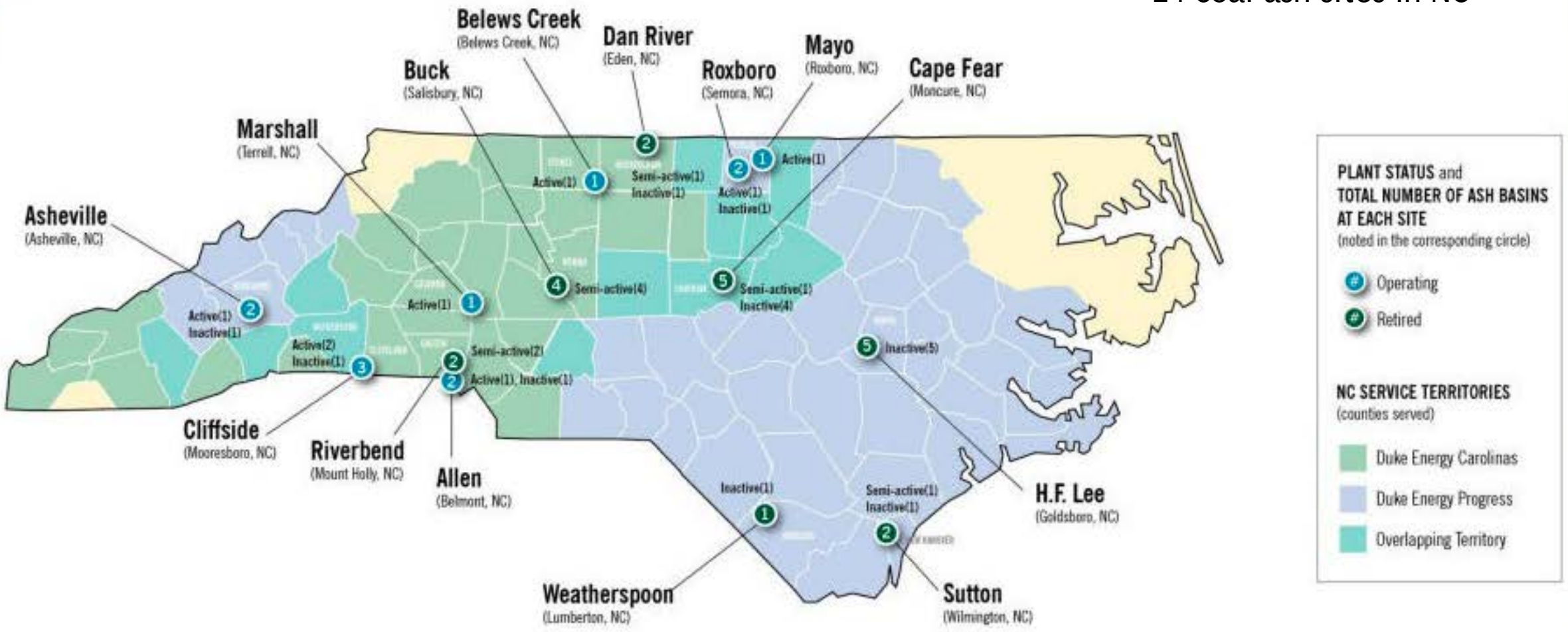
Coal ash is the waste that remains when coal is burned. It is usually collected in a dump, known as a pond. North Carolina has more than 30 such sites in 14 different locations across the state. A pipe running under one of the ponds run by Duke Energy in Eden NC ruptured in February of 2014. The coal ash spilled, largely affecting the Dan River which flows into Virginia. The spill is the third largest of its kind in U.S. history.

Many see potential complications because North Carolina's governor, Pat McCrory, worked for Duke Energy for 28 years.

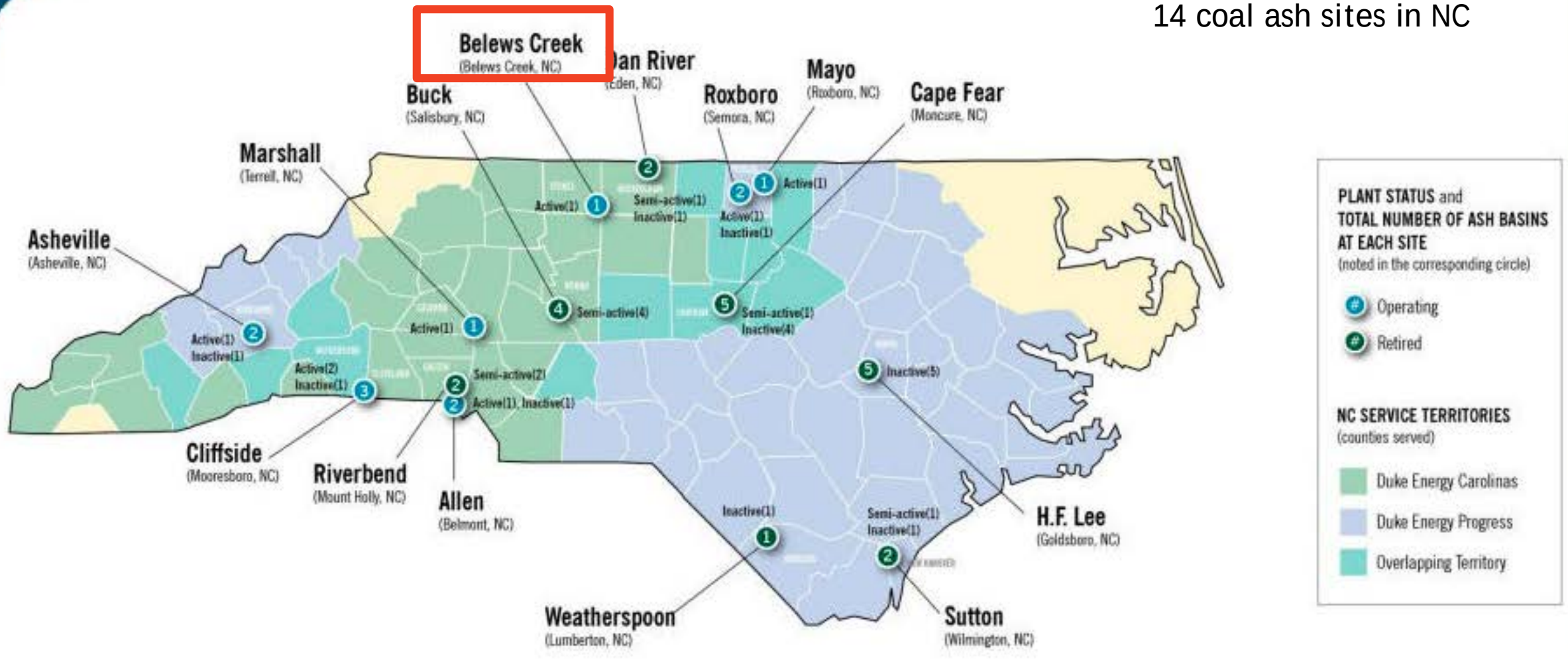
In February 2014, an Eden, North Carolina facility owned by Duke Energy spilled 39,000 tons of coal ash into the Dan River. The company later pled guilty to criminal negligence in their handling of coal ash at Eden and elsewhere and paid substantial fines.

Coal Ash Spill in Town of Eden

14 coal ash sites in NC



14 coal ash sites in NC



Belews Creek Steam Station

2014

GENERAL ASSEMBLY OF NORTH CAROLINA
SESSION 2013

SESSION LAW 2014-122
SENATE BILL 729

AN ACT TO (1) PROHIBIT RECOVERY OF COSTS RELATED TO UNLAWFUL DISCHARGES FROM COAL COMBU
IMPOUNDMENTS; (2) ESTABLISH A MORAT
(3) CREATE THE COAL ASH MANAGEMEN
APPROVE COAL COMBUSTION RESIDU
CLASSIFICATIONS AND CLOSURE PLANS
MAKE RECOMMENDATIONS ON LAWS GOV
COMBUSTION RESIDUALS; (4) REQUIRE
DEPARTMENT OF ENVIRONMENT AND
PERMIT NECESSARY TO CONDUCT ACTIVI
ESTABLISH VARIOUS REPORTING REQU
ASSEMBLY, INCLUDING A QUARTERLY RE
ENVIRONMENT AND NATURAL RESO
ACTIVITIES, PROGRAMS, AND PROGR
OBLIGATIONS UNDER THIS ACT FOR
SURFACE IMPOUNDMENTS; (6) PROHIBIT LO
OF MANAGEMENT OF COAL COMBU
COMBUSTION PRODUCTS; (7) PROHIBIT
EXPANSION OF EXISTING COAL COM
IMPOUNDMENTS EFFECTIVE OCTOBER 1,
OF COAL COMBUSTION RESIDUALS INTO
SURFACE IMPOUNDMENTS AT COAL-FIRE
NO LONGER PRODUCING COAL COMB
OCTOBER 1, 2014; (9) PROHIBIT DISPOS
COMBUSTION RESIDUALS SURFACE IMPOU

Home | Permits & Rules | Outreach & Education | Energy & Climate | Conservation | News | About

Well test information for residents near Duke Energy coal ash impoundments

Web Content Display

Information on well testing for residents near a Duke Energy coal-fired electrical generating facility.

- As part of the groundwater assessment being conducted in accordance with theÂ Coal Ash Management Act of 2014 , the N.C. Department of Environment and Natural Resources (DENR) is requesting that Duke Energy tests all water supply wells within 1,000 feet of each of the utility's 14 coal-fired electrical generating facility boundaries be sampled.
- Information gathered during this investigation will be used to guide the successful closure of the coal ash basins. Well testing costs are paid by Duke Energy.

DWR and Coal Ash Regulation

- Drinking Water Receptor Surveys for Duke Energy Coal Ash Facilities
- Well test information for residents near Duke Energy coal ash impoundments
- Duke Energy NPDES Permits for Facilities with Coal Ash Ponds
- Coal Ash Excavation Plans
- Coal Ash Pond Maps
- Groundwater Assessment Plans for Duke Energy Coal Ash Facilities
- Groundwater Monitoring Data for Duke Energy Coal Ash Facilities

Residents Near Duke Ash Ponds Told To Not Drink Their Water

AV's Intern Team | June 15, 2015 | No Comments

Utility pleads guilty to separate water pollution charges

By Sarah Kellogg

Residents impacted by coal ash join together with concerned citizens to rally outside the annual Duke Energy shareholder's meeting in Charlotte on May 7. Photo courtesy of NC WARN

Jeff Keiser and his wife, Kim, have lived in a small neighborhood in Belmont, N.C., near Duke Energy's G.G. Allen power plant, for 15 years. Although their community is surrounded on three sides by coal ash, the toxic by-product of burning coal, the Keisers have used their tap water just like anyone else. But that changed in late April when they and their neighbors started receiving letters from the state health department advising them not to drink or cook with their water.

"It was pretty frightening for us to hear all of our neighbors getting do not drink letters from the state," recalls Keiser. "We had been drinking the water with no worry at all, now we're scared for our health."

VIEW THIS ISSUE

Related Stories

Blue Ridge Energy's solar policies among the worst in Southeast

Power Play: Countering Electric Utilities' Political Influence

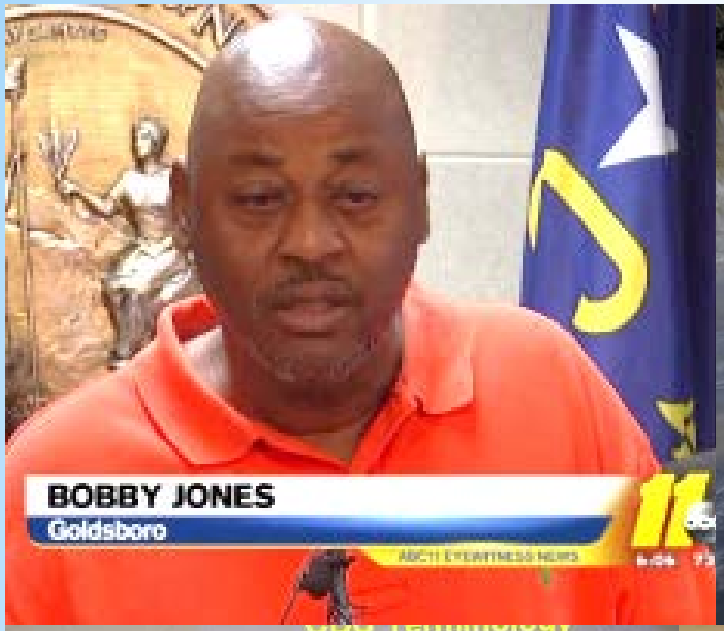
The Problem with Monopoly Utilities

Hurricane Highlights Coal Ash Risks

Hurricane Florence Devastates the Carolinas

Caroline Armijo

Photo source: Appalachian Voices



Engage Communities

Graves

Gray

George

Yelton

Members:

Impacted communities
Riverkeepers
Local government staff
Environmental NGOs
Local and state health agencies

WELL EMPOWERED

A Research Study on Well Water

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Survey → Water Sampling → Metals Analysis → Report Results → Distribute Filters

WELL EMPOWERED

A Research Study on Well Water

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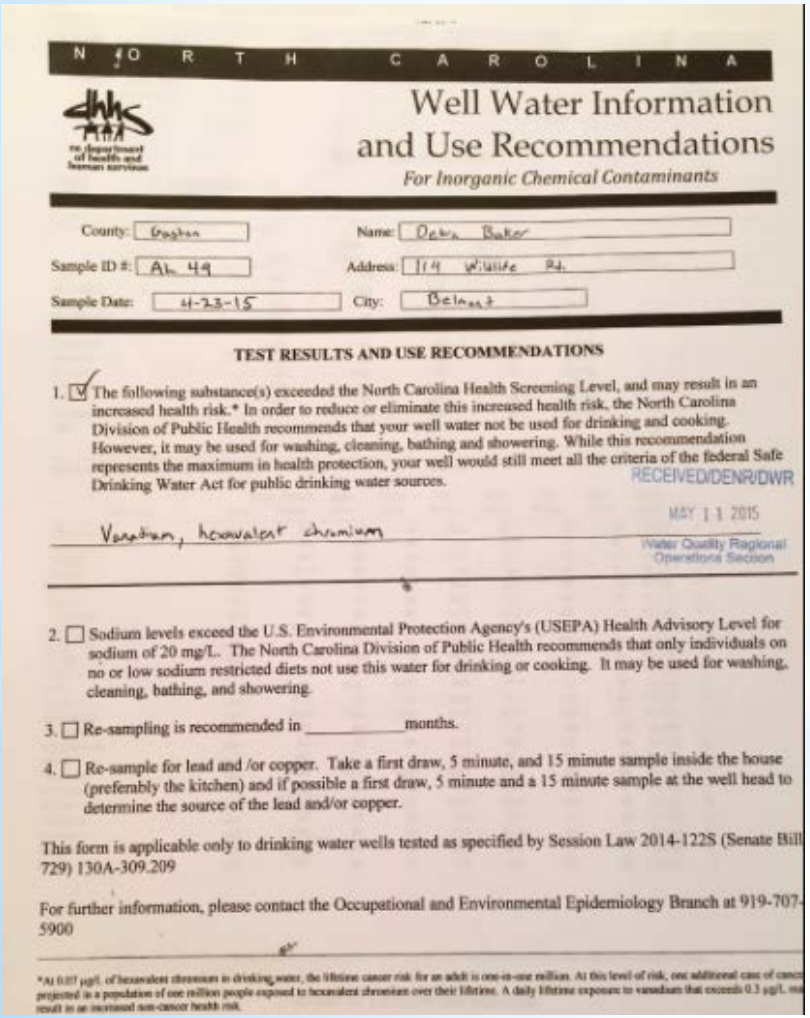
Problem 1. Conveying results in an easy to understand format is tricky!!!



N O R T H C A R O L I N A

Well Water Information and Use Recommendations

For Inorganic Chemical Contaminants

County: Gaston Name: Debra Baker

Sample ID #: AL 49 Address: 114 Wildlife Rd.

Sample Date: 4-23-15 City: Belmont

TEST RESULTS AND USE RECOMMENDATIONS

1. ☑ The following substance(s) exceeded the North Carolina Health Screening Level, and may result in an increased health risk.* In order to reduce or eliminate this increased health risk, the North Carolina Division of Public Health recommends that your well water not be used for drinking and cooking. However, it may be used for washing, cleaning, bathing and showering. While this recommendation represents the maximum in health protection, your well would still meet all the criteria of the federal Safe Drinking Water Act for public drinking water sources.

RECEIVED/DENR/DWR MAY 11 2015 Water Quality Regional Operations Section

Vanadium, hexavalent chromium

2. ☐ Sodium levels exceed the U.S. Environmental Protection Agency's (USEPA) Health Advisory Level for sodium of 20 mg/L. The North Carolina Division of Public Health recommends that only individuals on no or low sodium restricted diets not use this water for drinking or cooking. It may be used for washing, cleaning, bathing, and showering.

3. ☐ Re-sampling is recommended in _____ months.

4. ☐ Re-sample for lead and /or copper. Take a first draw, 5 minute, and 15 minute sample inside the house (preferably the kitchen) and if possible a first draw, 5 minute and a 15 minute sample at the well head to determine the source of the lead and/or copper.

This form is applicable only to drinking water wells tested as specified by Session Law 2014-122S (Senate Bill 729) 130A-309.209

For further information, please contact the Occupational and Environmental Epidemiology Branch at 919-707-5900

*At 0.07 µg/L of hexavalent chromium in drinking water, the lifetime cancer risk for an adult is one-in-one million. At this level of risk, one additional case of cancer projected in a population of one million people exposed to hexavalent chromium over their lifetime. A daily lifetime exposure to vanadium that exceeds 0.3 µg/L may result in an increased non-cancer health risk.

Letters and tables are often confusing!

Arsenic Community Summary

(39 samples) Range: 0.01—25.51 ppb

Sarah Yelton

Easy to read graphics are key

Problem 2. There are many different types of standards!

- EPA Maximum Contaminant Level
- NC DEQ NCAC 02L Groundwater Quality Standard
- NC DEQ NCAC 02L Groundwater Quality Standard Interim Maximum Allowable Concentration (IMAC)

Spending time on what these mean during report back sessions is essential!

15A NCAC 02L .0202 GROUNDWATER QUALITY STANDARDS

(a) The groundwater quality standards for the protection of the groundwaters of the state are those specified in this Rule. They are the maximum allowable concentrations resulting from any discharge of contaminants to the land or waters of the state, which may be tolerated without creating a threat to human health or which would otherwise render the groundwater unsuitable for its intended best usage.

(b) The groundwater quality standards for contaminants specified in Paragraphs (h) and (i) of this Rule are as listed, except that:

(1) Where the standard for a substance is less than the practical quantitation limit, the detection of that substance at or above the practical quantitation limit constitutes a violation of the standard.

(2) Where two or more substances exist in combination, the Director shall consider the effects of chemical interactions as determined by the Division of Public Health and may establish maximum concentrations at values less than those established in accordance with Paragraphs (c), (h), or (i) of this Rule. In the absence of information to the contrary, in accordance with Paragraph (d) of this Rule, the carcinogenic risks associated with carcinogens present shall be considered additive and the toxic effects associated with non-carcinogens present shall also be considered additive.

(3) Where naturally occurring substances exceed the established standard, the standard shall be the naturally occurring concentration as determined by the Director.

(4) Where the groundwater standard for a substance is greater than the Maximum Contaminant Level (MCL), the Director shall apply the MCL as the groundwater standard at any private drinking water well or public water system well that may be impacted.

(c) Except for tracers used in concentrations which have been determined by the Division of Public Health to be protective of human health, and the use of which has been permitted by the Division, substances which are not naturally occurring and for which no standard is specified shall not be permitted in concentrations at or above the practical quantitation limit in Class GA or Class GSA groundwaters. Any person may petition the Director to establish an interim maximum allowable concentration for a substance for which a standard has not been established under this Rule. The petitioner shall submit relevant toxicological and epidemiological data, study results, and calculations necessary to establish a standard in accordance with Paragraph (d) of this Rule. Within three months after the establishment of an interim maximum allowable concentration for a substance by the Director, the Director shall initiate action to consider adoption of a standard for that substance.

(d) Except as provided in Paragraph (f) of this Rule, groundwater quality standards for substances in Class GA and Class GSA groundwaters are established as the least of:

(1) Systemic threshold concentration calculated as follows: [Reference Dose (mg/kg/day) x 70 kg (adult body weight) x Relative Source Contribution (.10 for inorganics; .20 for organics)] / [2 liters/day (avg. water consumption)];

(2) Concentration which corresponds to an incremental lifetime cancer risk of 1x10-6;

(3) Taste threshold limit value;

(4) Odor threshold limit value;

(5) Maximum contaminant level; or

(6) National secondary drinking water standard.

(e) The following references, in order of preference, shall be used in establishing concentrations of substances which correspond to levels described in Paragraph (d) of this Rule.

(1) Integrated Risk Information System (U.S. EPA).

(2) Health Advisories (U.S. EPA Office of Drinking Water).

(3) Other health risk assessment data published by the U.S. EPA.

(4) Other relevant, published health risk assessment data, and scientifically valid peer-reviewed published toxicological data.

(f) The Commission may establish groundwater standards less stringent than existing maximum contaminant levels or national secondary drinking water standards if it finds, after public notice and opportunity for hearing, that:

(1) more recent data published in the EPA health references listed in Paragraph (e) of this Rule results in a standard which is protective of public health, taste threshold, or odor threshold;

(2) the standard will not endanger the public health and safety, including health and environmental

Spending time on the differences in these levels during report back sessions is essential!

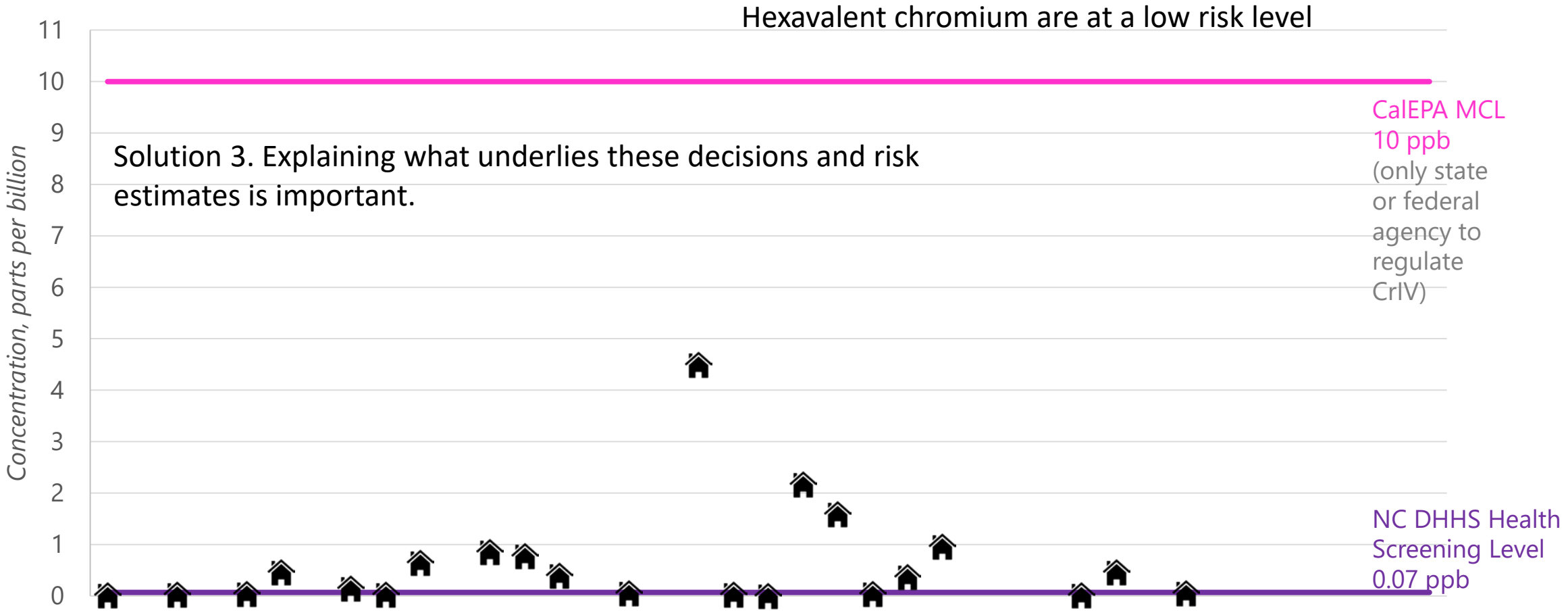
Problem 3. Some standards are not the same across the country!

Contaminant	US	NC
Arsenic	10 ppb	10 ppb
Cadmium	5 ppb	5 ppb
Chromium	100 ppb	0.07 ppb *
Lead	15 ppb	15 ppb
Mercury	2 ppb	2 ppb
Selenium	50 ppb	50 ppb
Vanadium	-	0.3 ppb

*NC has a groundwater quality standard of 10 ug/L that is protective for Chromium 6. The DHHS has developed a health screening level for Chromium VI, using a method consistent with 15A NCAC 02L (Groundwater Rules) at 0.07 ug/L, based on its independent review of current literature corresponding to a one in a million lifetime cancer risk level.

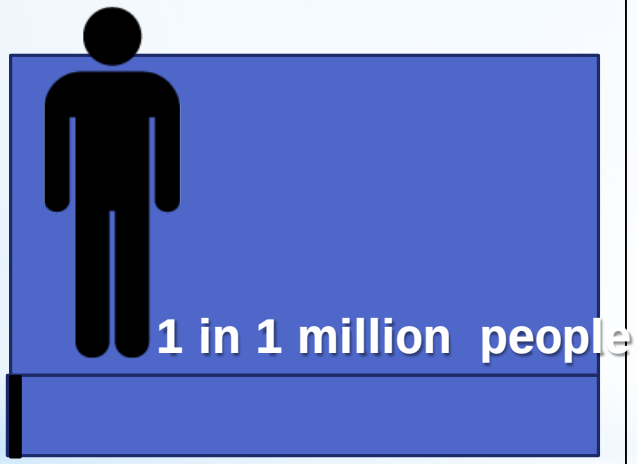
Hexavalent Chromium Community Summary

(33 samples) Range: below detection—4.50 ppb



USEPA Guidance on Risk Levels

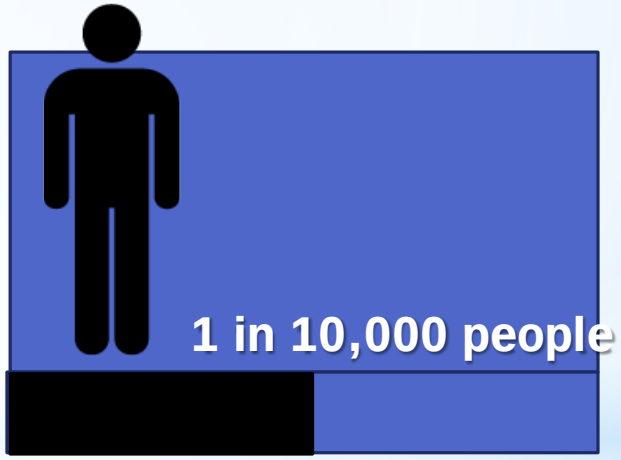
*The level of excess cancer risk that is of concern is a matter of personal, community, and regulatory judgment.



USEPA generally considers excess cancer risks that are **below 1 chance in 1,000,000 to be <u>so small as to be negligible</u>**.

Excess cancer risks between **1 in 1,000,000 and 1 in 10,000** are generally considered to be acceptable.

Sometimes USEPA determines that risks less than **1 chance in 10,000** are not sufficiently protective and require remediation.



USEPA generally considers excess cancer risks that are **above 1 chance in 10,000 to be <u>sufficiently large that remediation is desirable</u>.**

Arsenic Community Summary

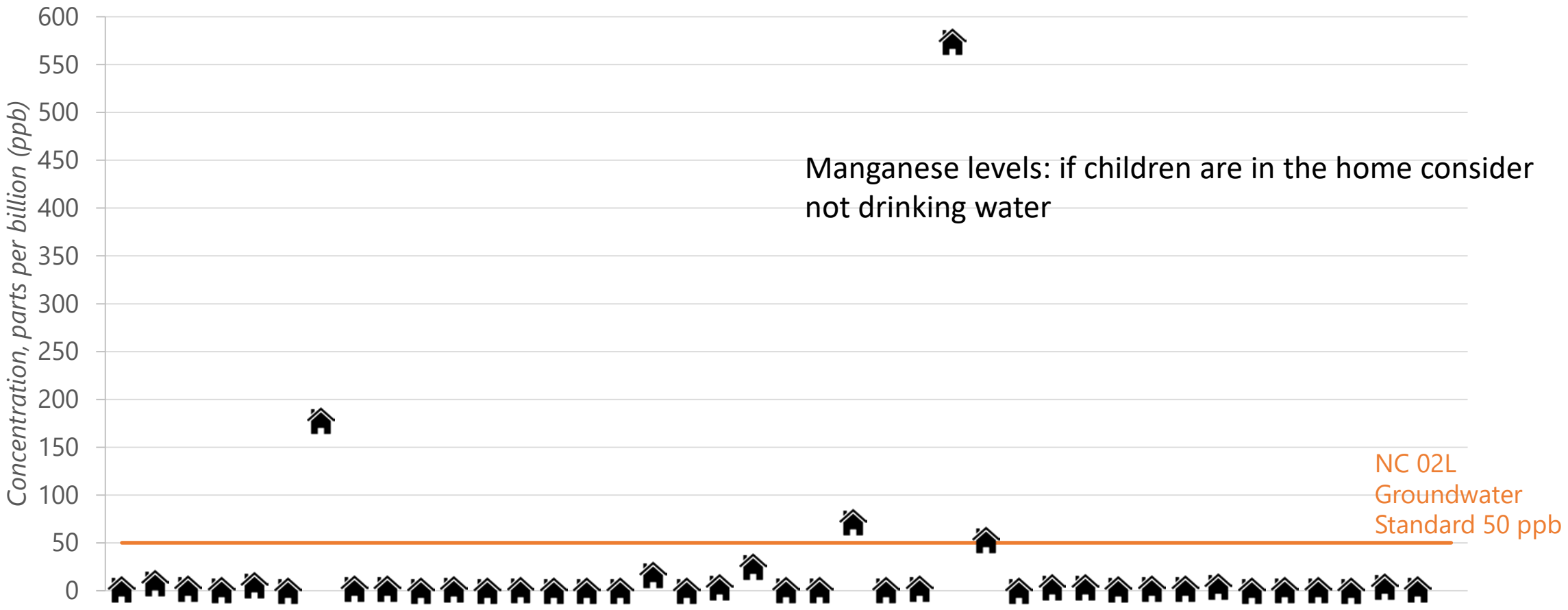
(39 samples) Range: 0.01—25.51 ppb

Lead Community Summary

(39 samples) Range: 0.004—24.80 ppb

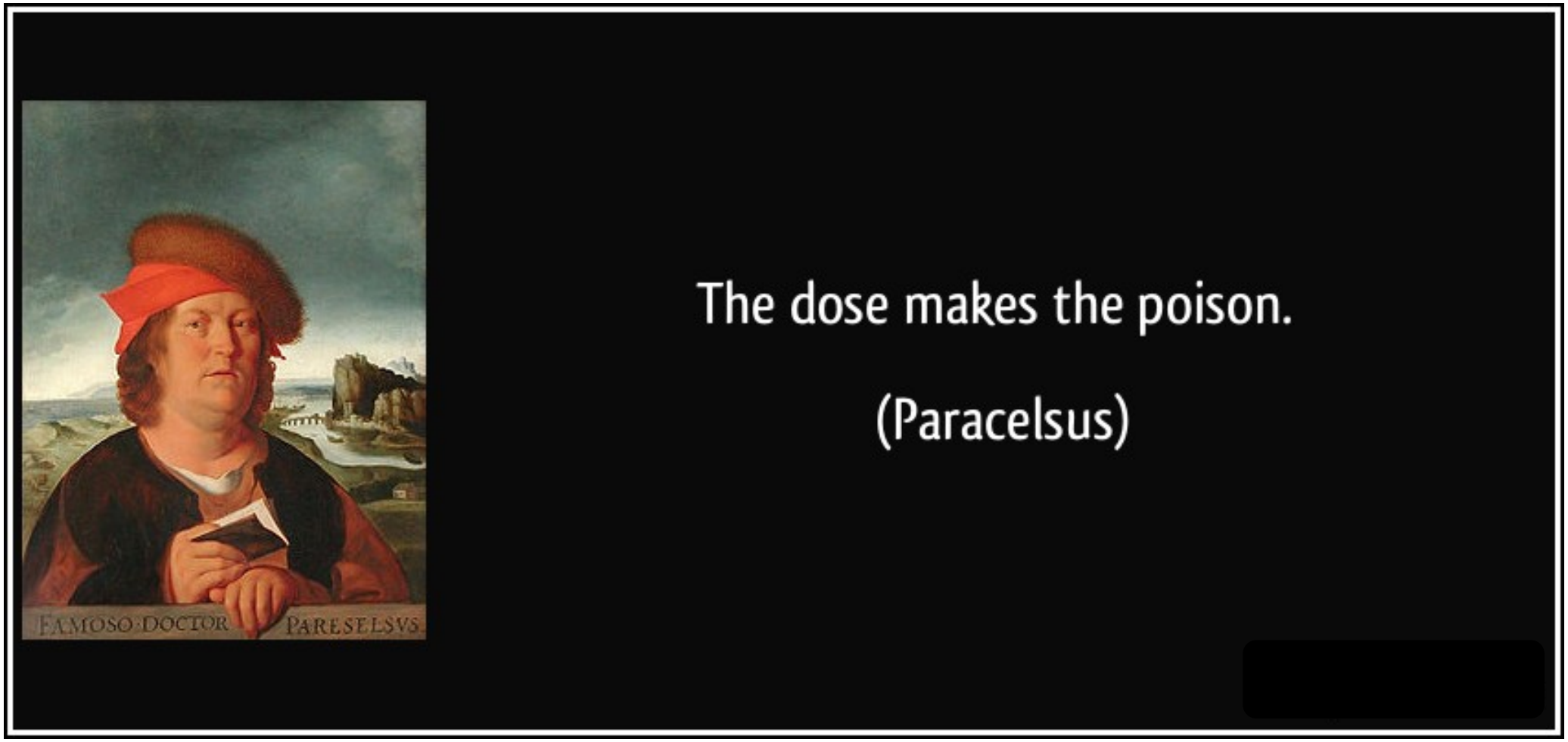
Manganese Community Summary

(39 samples) Range: 0.02—574.27 ppb



Problem 4. Some key toxicological principals are key to understanding results!

Anti-oxidant
Metabolism
Bone development



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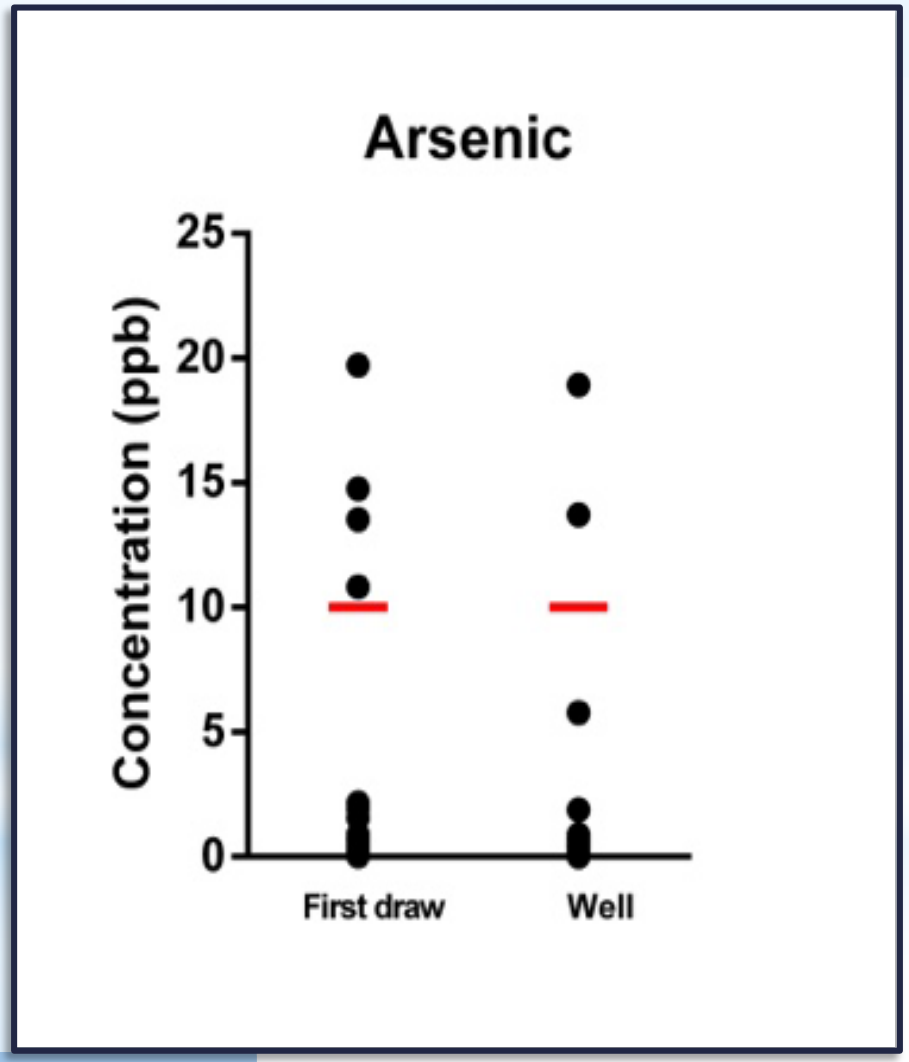
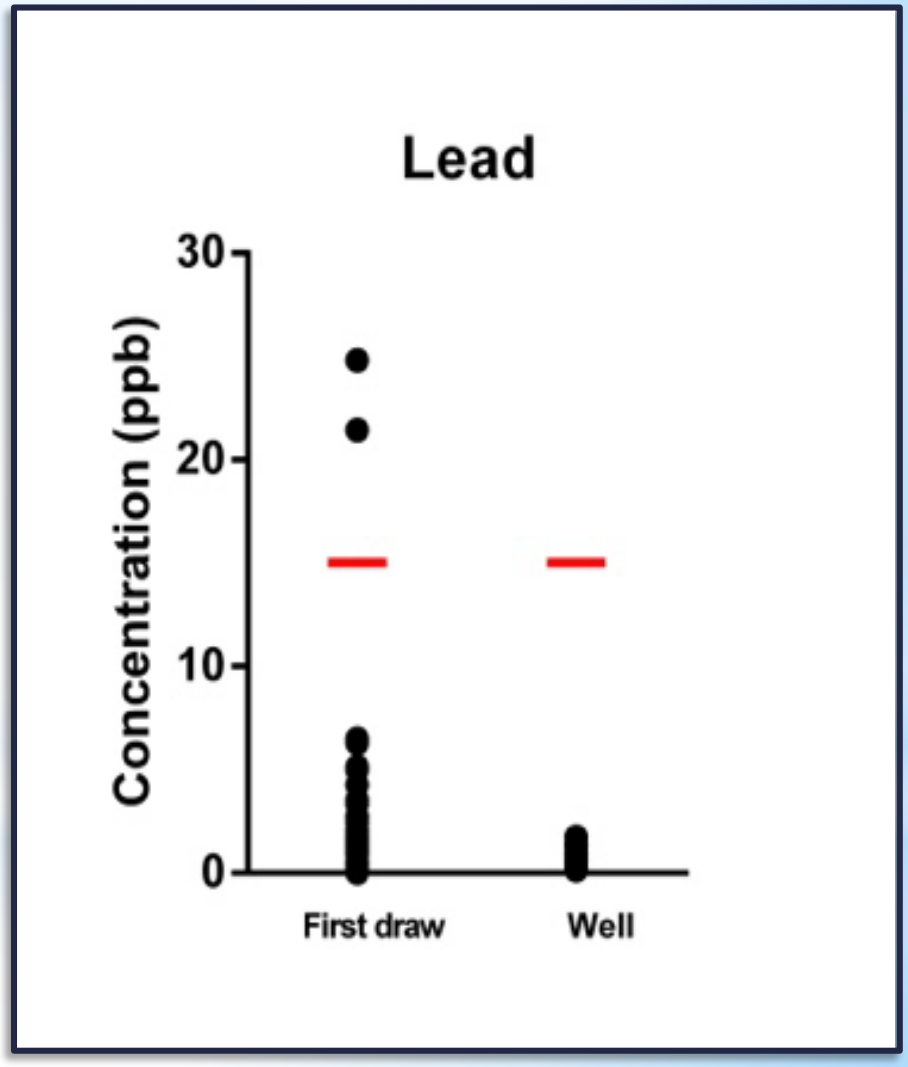
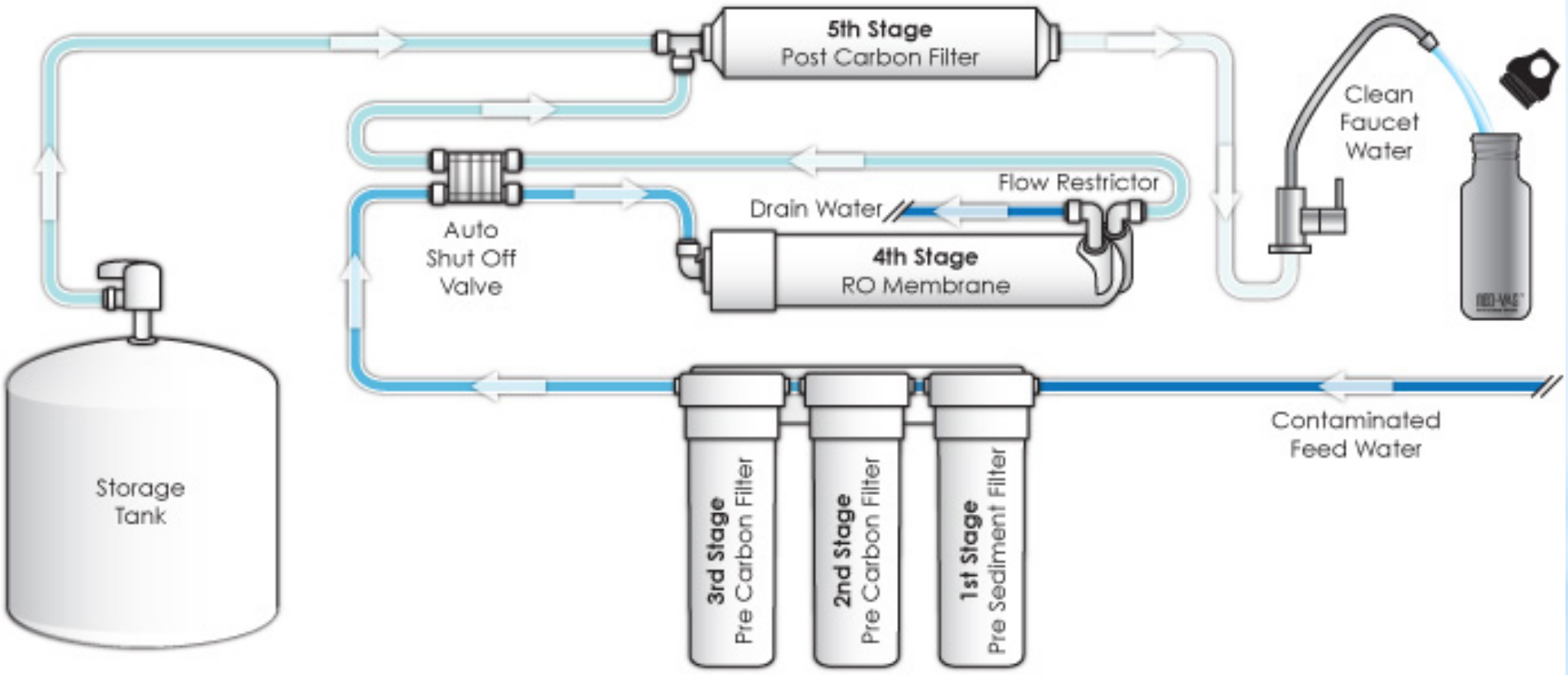

Arsenic
Concentration (ppb)
25
20
15
10
5
0
First draw
Well


Lead
Concentration (ppb)
30
20
10
0
First draw
Well

Problem 4. Identifying solutions can be difficult and often expensive! $$$$$



Contents lists available at ScienceDirect

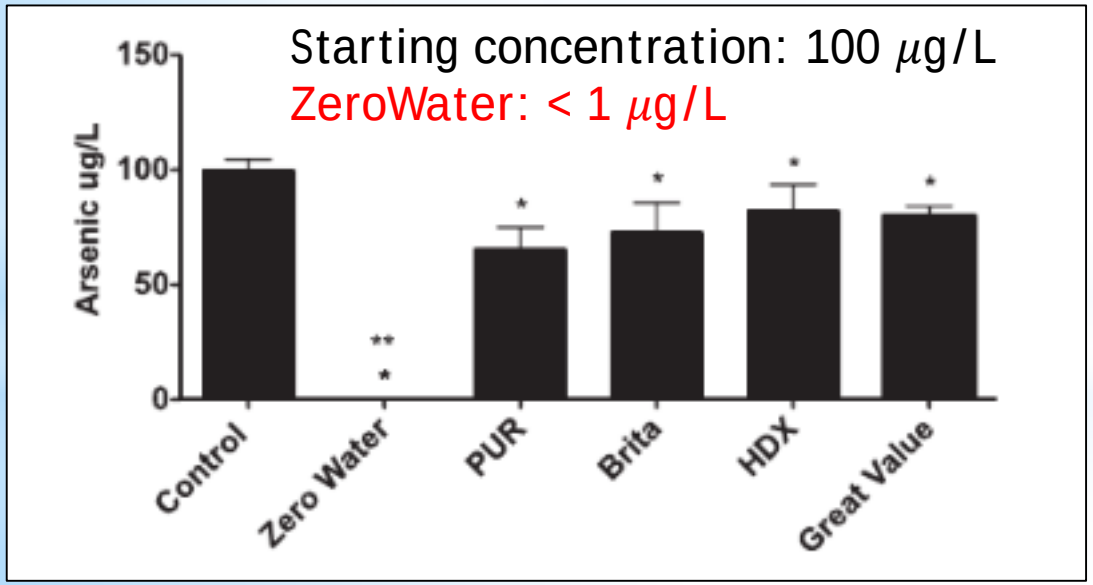
Environmental Research

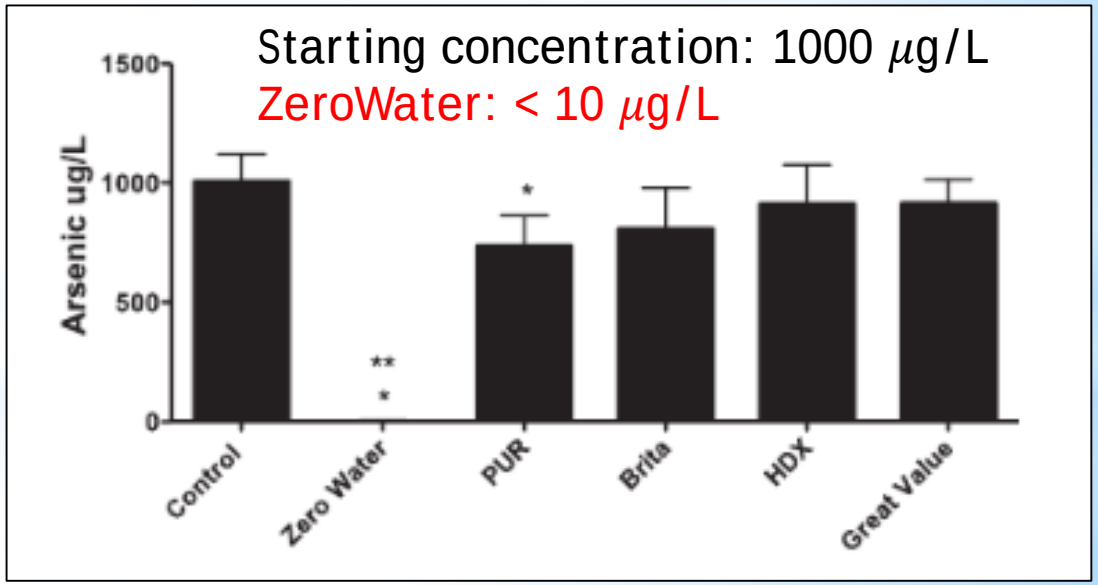
journal homepage: www.elsevier.com/locate/envres

Effectiveness of table top water pitcher filters to remove arsenic from drinking water

Roxanna Barnaby[a], Amanda Liefeld[a], Brian P. Jackson[b], Thomas H. Hampton[a], Bruce A. Stanton[a,*]

[a] Department of Microbiology and Immunology, The Geisel School of Medicine at Dartmouth, Hanover, NH 03755, United States
[b] Department of Earth Sciences, Dartmouth College, Hanover, NH 03755, United States

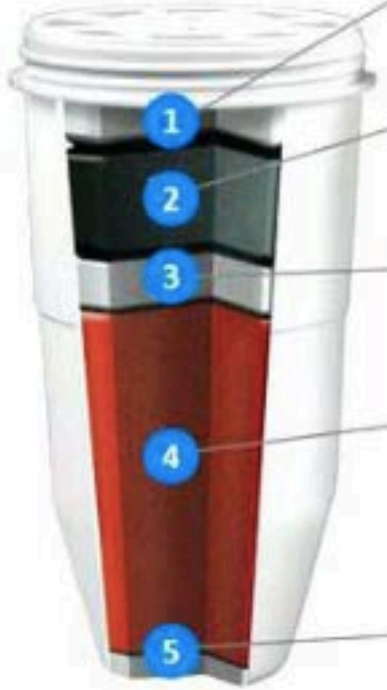




ZeroWater filter: 5 stage removal

2 stages vs. 5 stages

✓	Coarse Filter to remove fine particles	✓
✓	Distributor to maximize contact time	✓
	Multi-layered activated carbon and oxidation reduction alloy	✓
	Dual Ion Exchange Array	✓
	Non-Woven Micron	✓



Stage 1 - Removes suspended solids such as dust and rust that make your water appear cloudy

Stage 2 - Removes organic contaminants; pesticides, herbicides, etc.

Stage 3 - Removes additional suspended solids

Stage 4 - Removes inorganic compounds, such as metals and nonmetals, as well as radiological contaminants

Stage 5 - Removes remaining suspended solids

MORE content filtered from water

Distribute Filters

* Homes that exceeded for arsenic or lead were provided with Zerowater filters.

* Sampled water pre-filtration and post-filtration

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A Research Study on Well Water

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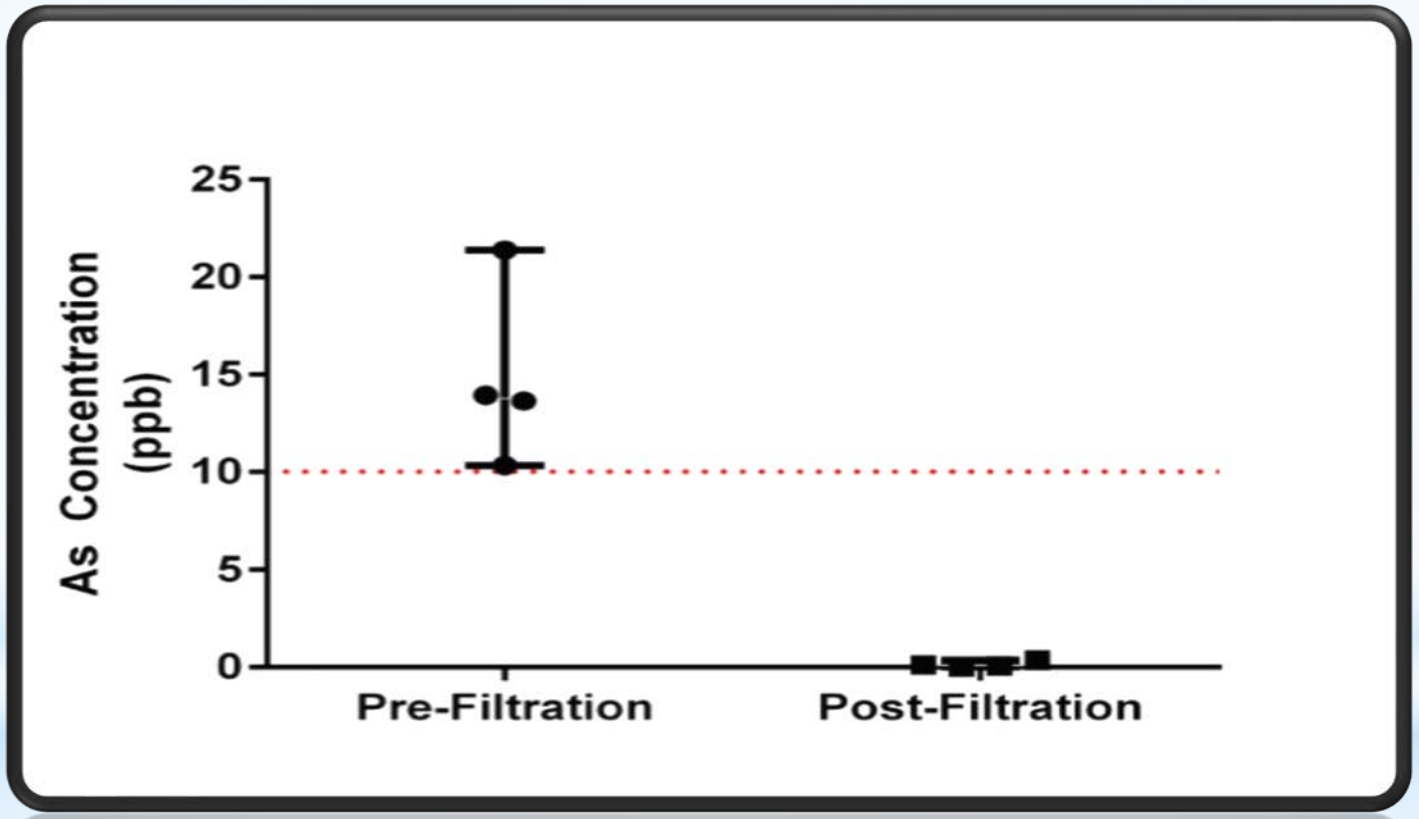
Arsenic Filters Summary

The good news-we can make a change
We can remove toxicants from drinking water
We can improve public health



WELL EMPOWERED
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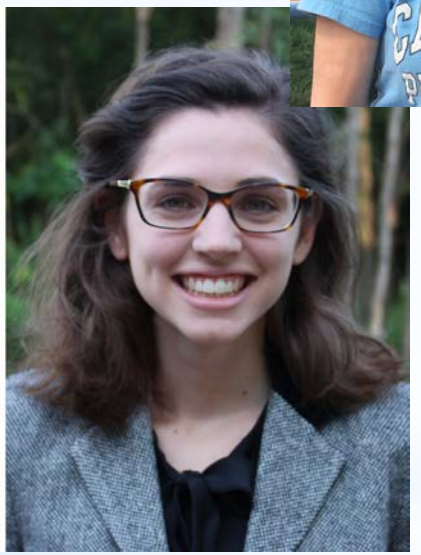
Thank you!

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Ask me about my work!
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PUBLIC HEALT
CEHS