

# Private Well Testing Results in Union County, NC May 24, 2023



## Agenda

**Welcome:** Traci Colley, *Union County Environmental Health*

**Overview of UNC research:** Kathleen Gray & Rebecca Fry, *UNC SRP*

**Community-wide results of well testing:** Andrew George, *UNC SRP*

**Treatment solutions:** David Finley, *Union County Environmental Health*

**Questions**



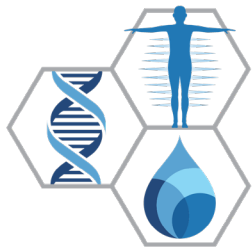
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## Our Mission

**Develop new solutions for arsenic reduction and disease prevention through mechanistic and translational research**





Biomedical researchers study how arsenic exposure affects the body and influences risk of diabetes

### Liver

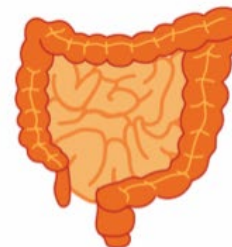
- **Arsenic** inhibits insulin signaling
  - **Arsenic** (+3 oxidation state) methyltransferase (*As3mt*) influences iAs metabolism
- » Examine the role of miRNAs as drivers of arsenic-induced diabetes (Project 1)
- » Examine the impact of *As3mt* polymorphisms (Project 2)



Glucose

### Intestine

- **Arsenic** modifies the gut microbiome, and the gut microbiome modifies arsenic metabolism
- » Examine the impact of microbiome modulation on arsenic-induced diabetes (Project 3)

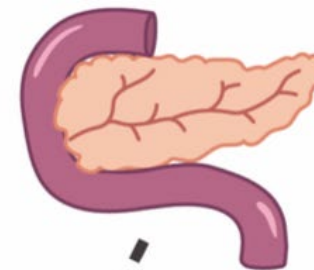


Bile Acids  
Bacterial Metabolites

**Metabolic Dysfunction**

### Pancreas

- **Arsenic** modifies insulin secretion
- » Examine the role of miRNAs as drivers of arsenic-induced diabetes (Project 1)



Insulin



Environmental science researchers explore how to **predict arsenic contamination** when **siting wells** and **test effectiveness of new filters**

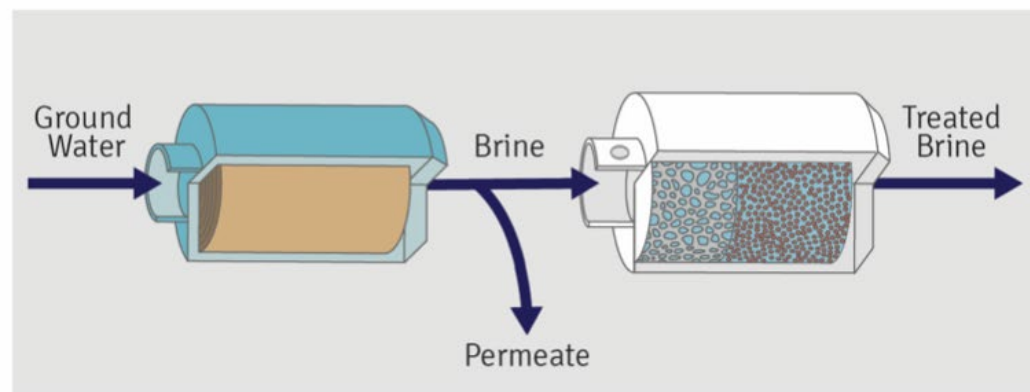
### Prediction

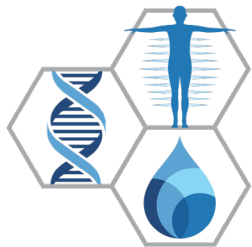
- iAs contamination in wells is linked to the presence of chemical oxidants
- » Identify geochemical methods to predict high levels of iAs contamination using (Project 4)



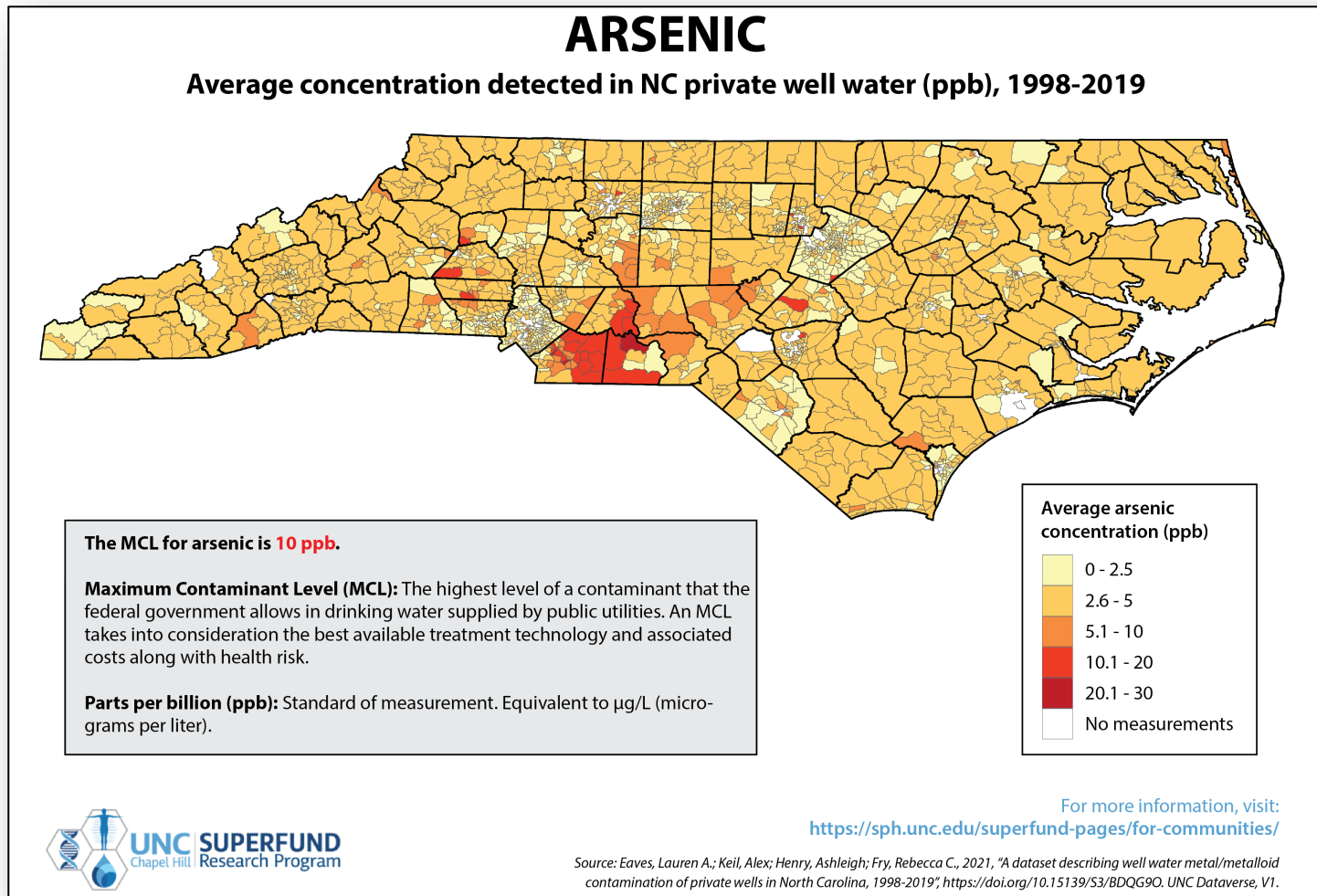
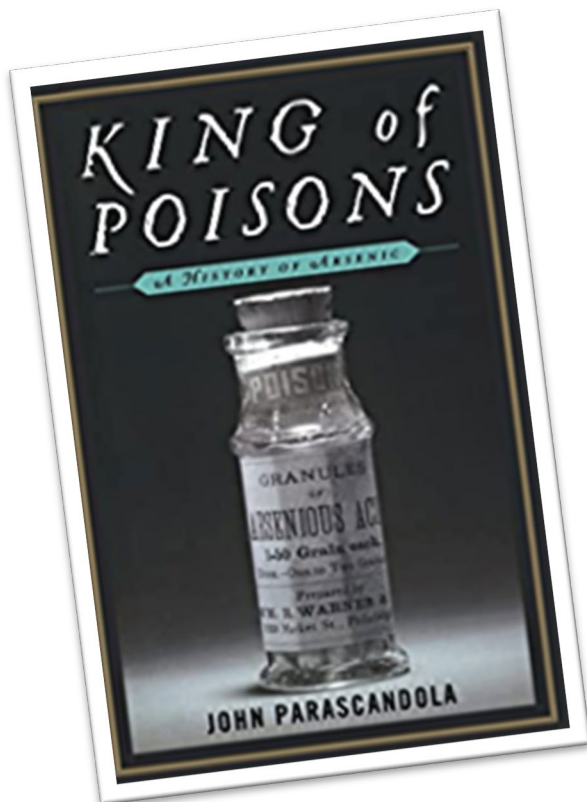
### Removal

- iAs and other contaminants co-occur in drinking water from private wells
- » Test effectiveness of an integrated membrane-sorbent system to remove iAs and co-occurring contaminants (Project 5)





# Why are we studying arsenic?





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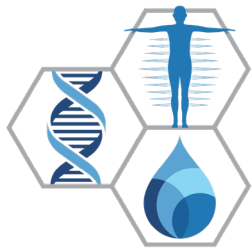
# How can arsenic harm health?

Arsenic exposure is linked to many health problems including:

- Skin lesions
- Bladder, lung and skin cancer
- Heart and lung disease
- Diabetes
- Lower immune function
- Poor brain function in children



**Arsenic** is a greater concern  
for **children** since they eat about  
**3x more** food  
per pound of body weight than adults.



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Testing wells



Informing residents



Deploying filters

***Well Empowered:*** preventing and reducing exposure to contaminated well water in NC communities





# Why are we testing wells?

- Private well water is not regulated by the Safe Drinking Water Act
- Recommended well water testing schedule
  - **Every year** for **total and fecal coliform bacteria**
  - **Every 2 years** for **inorganic metals**, (such as **lead** and **arsenic**), **nitrates**, and **nitrites**
  - **Every 5 years** for **pesticides** and **volatile organic compounds (VOCs)**, *which are industrial chemicals used in manufacturing*
- <https://sph.unc.edu/superfund-pages/well-testing/>

**Many harmful contaminants cannot be seen, smelled or tasted.**





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Chapel Hill Research Program



**Well Empowered**

THE UNIVERSITY  
of NORTH CAROLINA  
at CHAPEL HILL

Recruitment in Union Co.



200 bottles  
mailed to  
Union County



# Sampling: Step 1

6+ hours of no water use  
Completed questionnaire



**Sample Number** (See sticker on your water bottle):

**Name:**

**Address:**

**Phone number:**

**Email:**

**Date water collected** (month/day/year):

**Time water collected:** \_\_\_\_\_ AM / PM

**Water remained stagnant for at least 6 hours** (circle one):

**Water was collected after filter** (circle one): Yes / No

**Water collection location** (circle one): Yes / No

**Well type** (circle one): drilled / dug / don't know

**Date of last well test** (year): \_\_\_\_\_ / don't know / never tested

**Well depth:** \_\_\_\_\_ feet / don't know

**How did you hear about this study?** (Check one)

- Post card in mail
- Health Dept. Communications
- Cooperative Extension Communications
- Friend or family
- Other: \_\_\_\_\_

**Why did you decide to participate in this study?**

## Sampling: Step 2

Samples mailed to UNC or  
dropped off locally

**224**  
**wells**  
**sampled**



# What information did participants receive?



THE UNIVERSITY  
of NORTH CAROLINA  
at CHAPEL HILL

## YOUR WELL RESULTS – METALS AND YOUR HEALTH



SAMPLE #98

METAL	HEALTH STANDARD <sup>1</sup>	YOUR WELL <sup>1</sup>	POTENTIAL HEALTH EFFECTS
<b>US EPA MAXIMUM CONTAMINANT AND ACTION LEVELS<sup>2</sup></b>			
Arsenic	10	97	Arsenic may cause he
Lead	15	0.7	Lead may cause health Adults: Kidney problem
Uranium	30	2.7	
<b>US EPA HEALTH ADVISORY LEVEL<sup>3</sup></b>			
Sodium	20,000	18,943	
<b>NC DEQ GROUNDWATER STANDARDS<sup>4</sup></b>			
Aluminum	3,500	<1	
Barium	700	32	
Cadmium	2	<0.1	
Chromium	10	<1	
Cobalt	1	0.3	
Copper	1,000	71	
Iron	2,500	18	
Manganese	300	48	
Nickel	100	0.8	
Selenium	20	2.1	
Strontium	2,000	407	
Vanadium	7	<1	
Zinc	1,000	830	



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GLOBAL PUBLIC HEALTH

THE UNIVERSITY OF NORTH CAROLINA AT CHAPEL HILL  
GILLINGS SCHOOL OF GLOBAL PUBLIC HEALTH

919-966-3215 | F 919-966-7678

Rosenau Hall | Suite 170 | Campus Box 7400  
135 Dauer Drive | Chapel Hill, NC 27599-7400  
gph.unc.edu

April 28, 2023

Dear Well Empowered participant:

Thank you for volunteering to participate in the Well Empowered research study. The purpose of this study is to prevent and reduce harmful exposure to contaminated well water.

Your well water tested above the federal or state standards for one or more metals, as follows:

Metals in your water	Recommendations
Arsenic	Do Not Drink Until Your Water Has Been Treated
Lead	Consider Treating Your Water

*Samples were analyzed in the Department of Civil and Environmental Engineering at Virginia Tech.*

We expect that you will have questions about these results and potential treatment options, and the following people are available as resources:

- To discuss your individual well results, contact Andrew George, PhD, UNC Superfund Research Program (SRP) Community Engagement Coordinator, at 919-966-7839 or [andrewg@unc.edu](mailto:andrewg@unc.edu).
- For follow-up testing and further investigation, contact the Union County Environmental Health Division at 704-283-3553 or [unioncountveh@unioncountync.gov](mailto:unioncountveh@unioncountync.gov). To request follow-up testing by the Union County Environmental Health Division, please submit a [well water sample request form](#).

The following information is included in this packet:

# Recommendations



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☎ 919-966-3215 | ☎ 919-966-7678

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The following information is included in this packet:

1. Your complete drinking water quality results.
2. Information about potential health effects for metals that exceeded standards in your water.
  - [Arsenic](#) (PDF)
  - [Lead](#) (PDF)
3. Information about treatment systems that can remove/reduce these contaminants.
  - [How to select a well water treatment system for your home](#) (PDF)

**ORANGE = DO NOT DRINK UNTIL YOU  
HAVE TREATED YOUR WATER**

**YELLOW = CONSIDER TREATMENT**



Pitcher filters provided to residents with arsenic and lead levels above standards

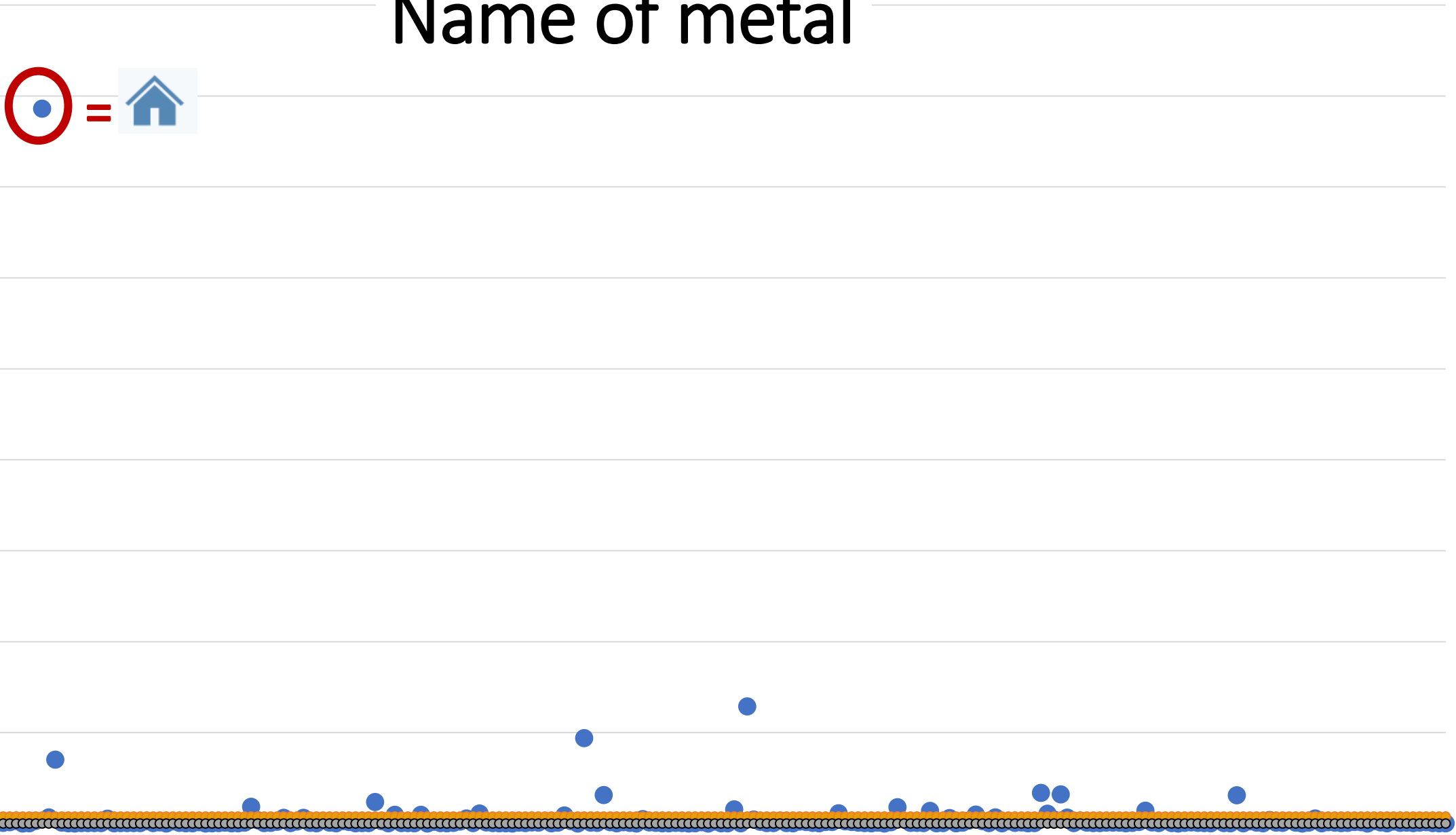
Before we review study results, let's talk about what you'll see on the following slides.



# Name of metal

Concentration (ppb)

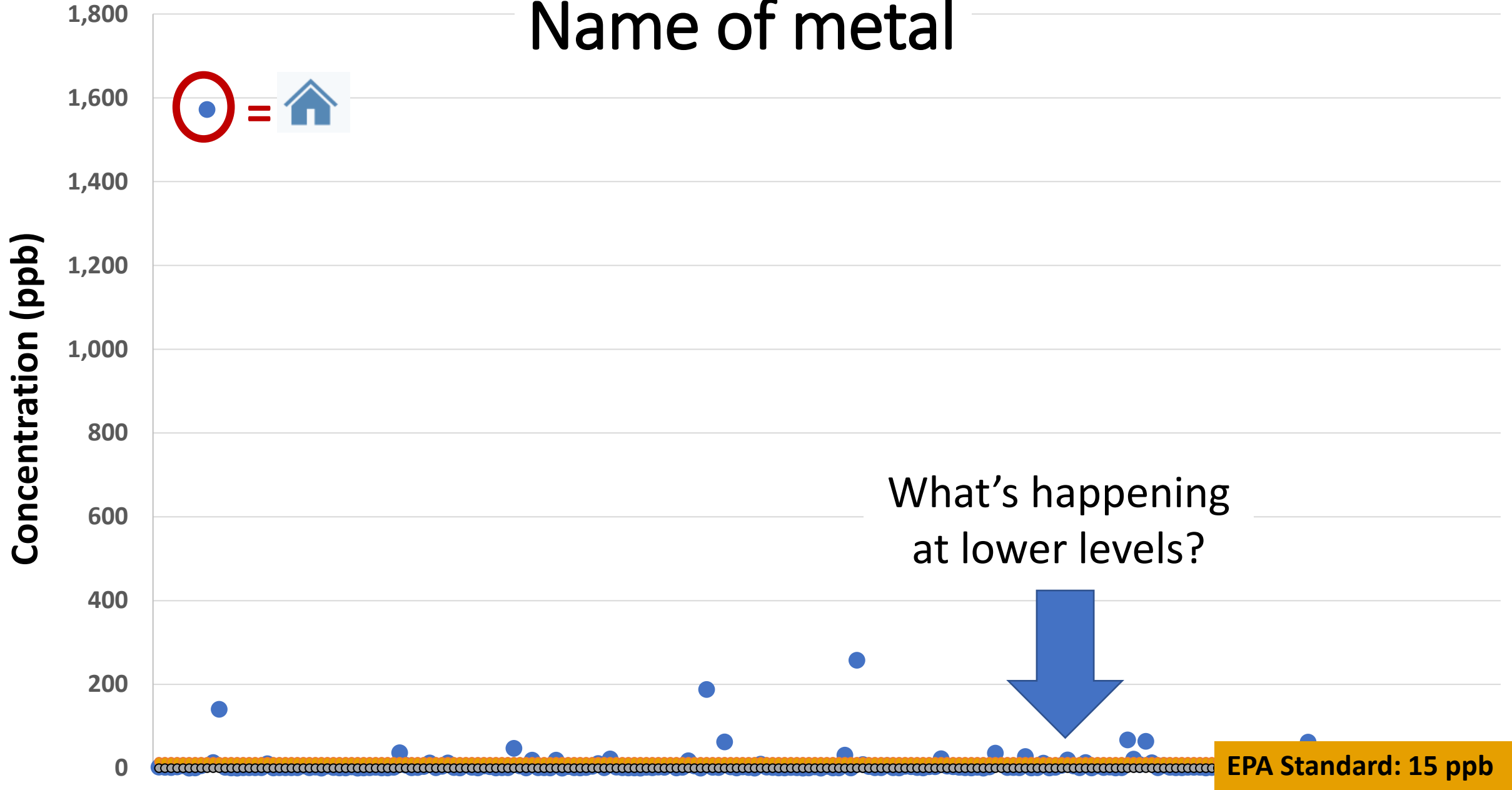
1,800  
1,600  
1,400  
1,200  
1,000  
800  
600  
400  
200  
0



1 ppb is one drop of water in a swimming pool



# Name of metal



# Name of metal

## wells above  
70 ppb  
70



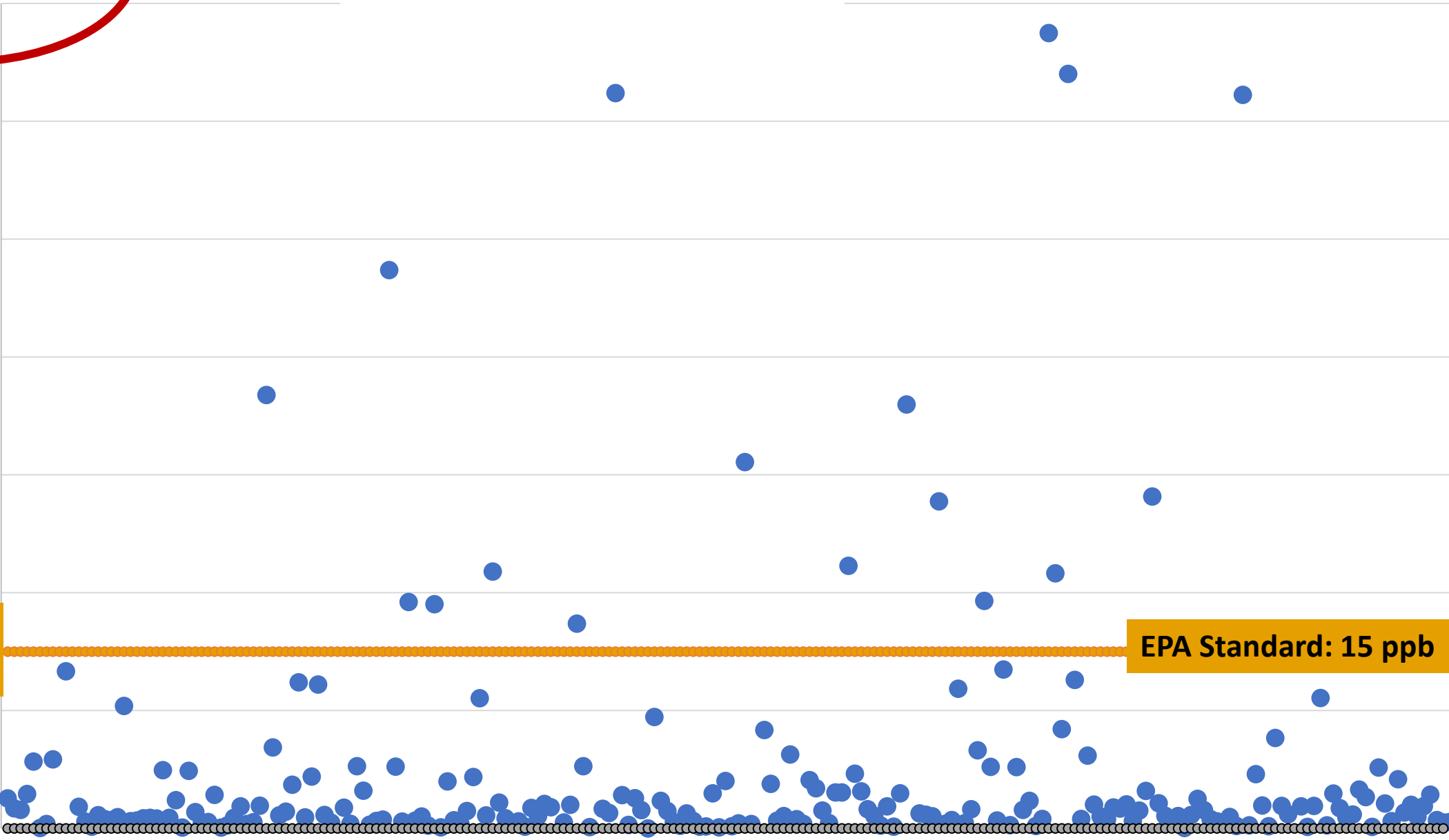
Concentration (ppb)

70  
60  
50  
40  
30  
20  
10  
0

Recommendation:  
DO NOT DRINK

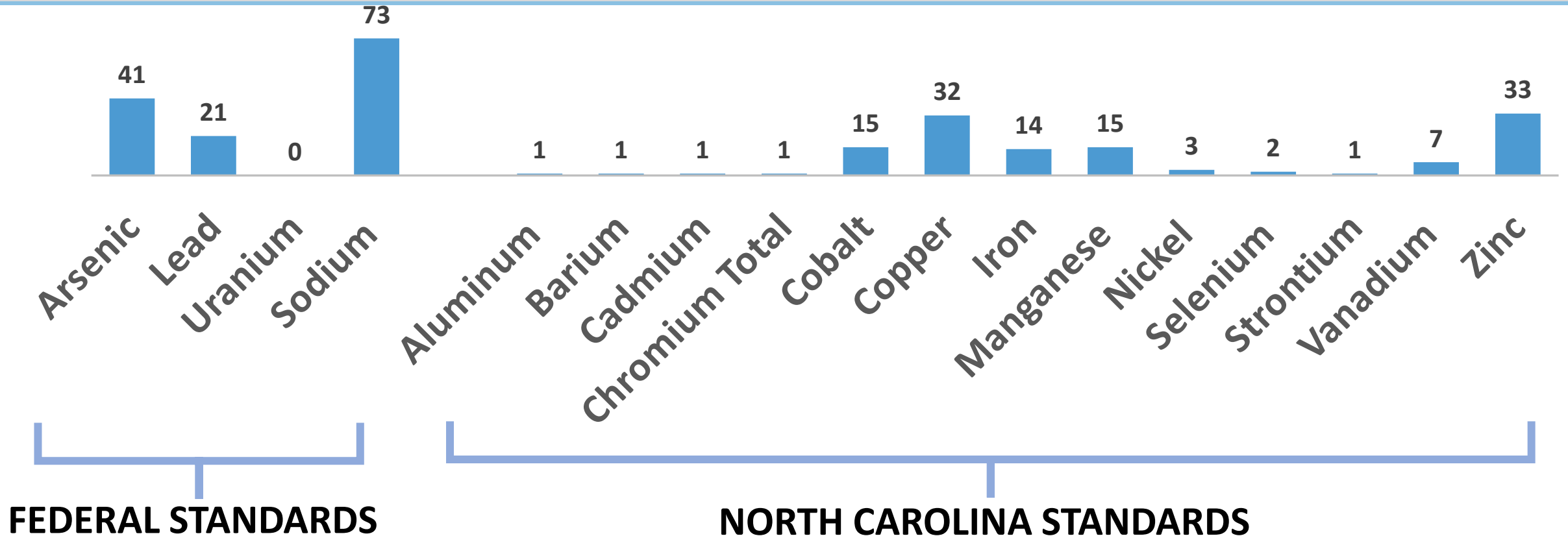
Recommendation:  
CONSIDER TREATMENT

EPA Standard: 15 ppb



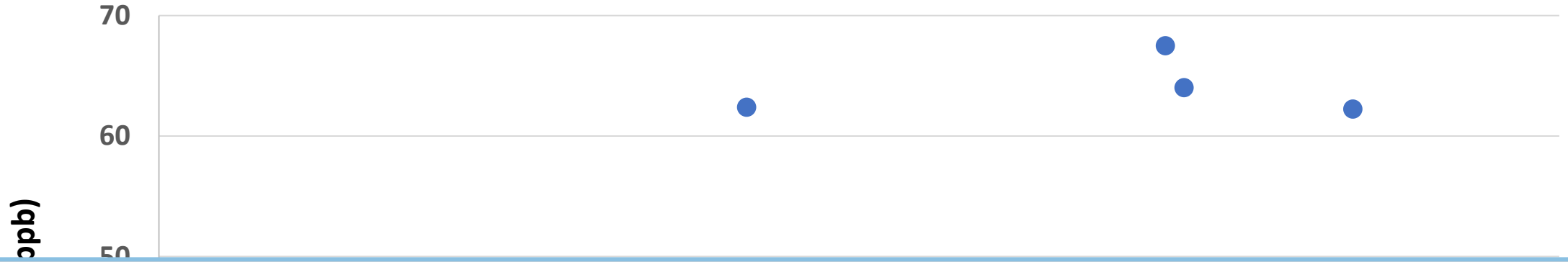
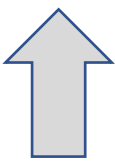
# Metal contamination in Union County private wells

62% of well samples exceeded at least one federal or state standard  
38% of wells did not exceed standards  
98% of participants were advised to consider treatment

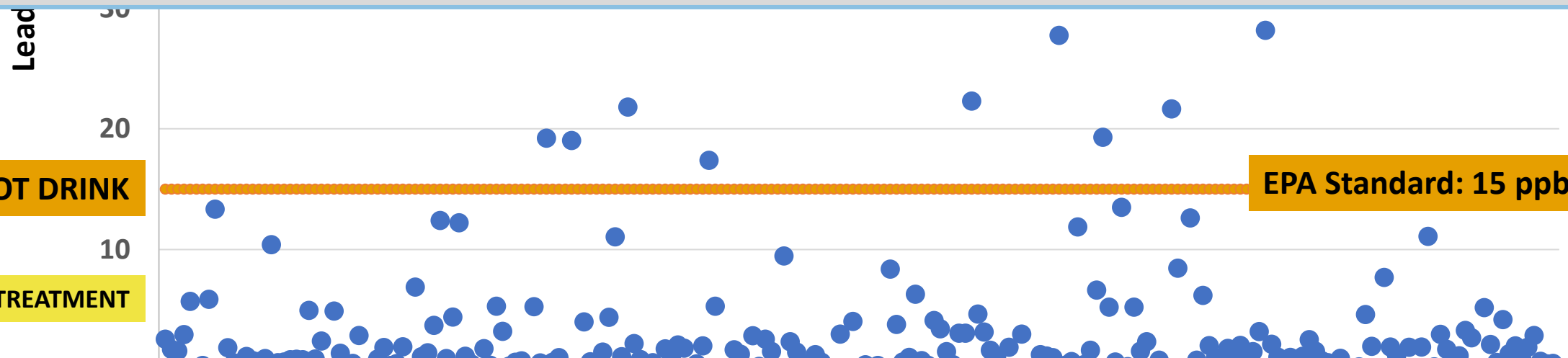


# Lead

4 wells above  
70 ppb



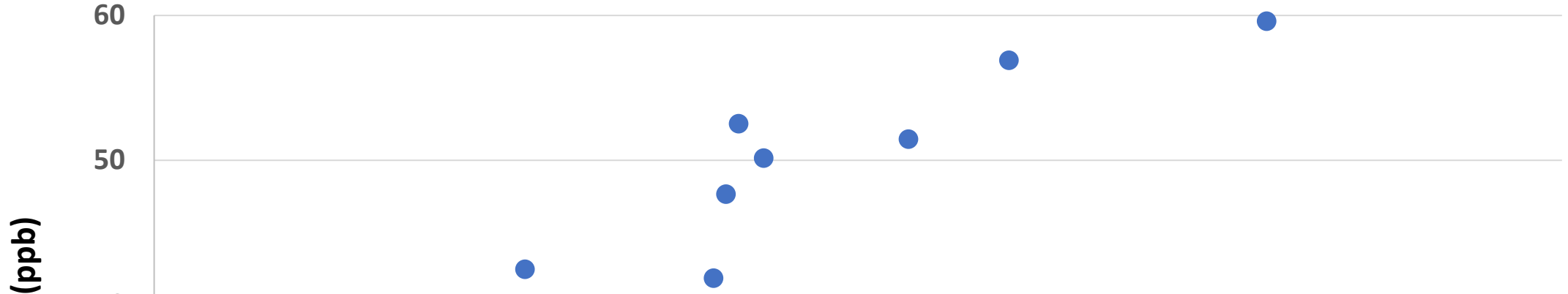
**9%** of well samples above federal standard  
**85%** of participants advised to consider treatment  
**Max result: 1,572 ppb**



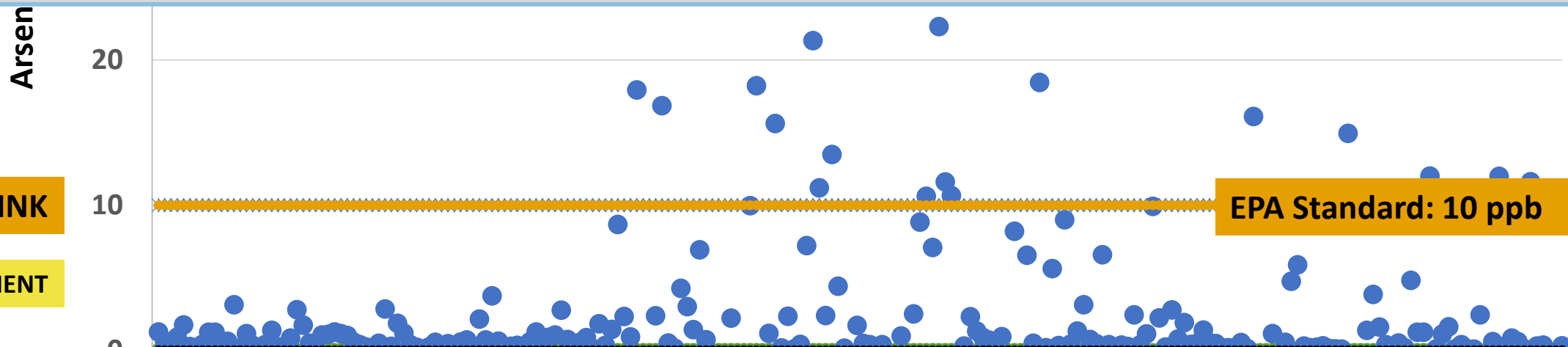
EPA has set the maximum contaminant level *goal* for **lead** in drinking water at **zero** because **lead can be harmful to human health even at low exposure levels.**

# Arsenic

6 wells above  
60 ppb



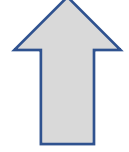
**18%** of well samples above federal standard  
**46%** of participants advised to consider treatment  
**Max result: 161 ppb**



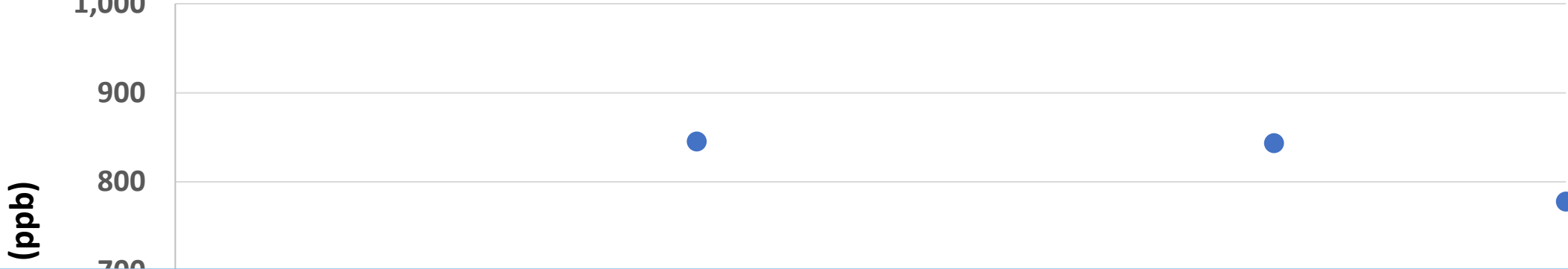
EPA has set the maximum contaminant level *goal* for **lead** in drinking water at **zero** because **lead can be harmful to human health even at low exposure levels.**

# Manganese

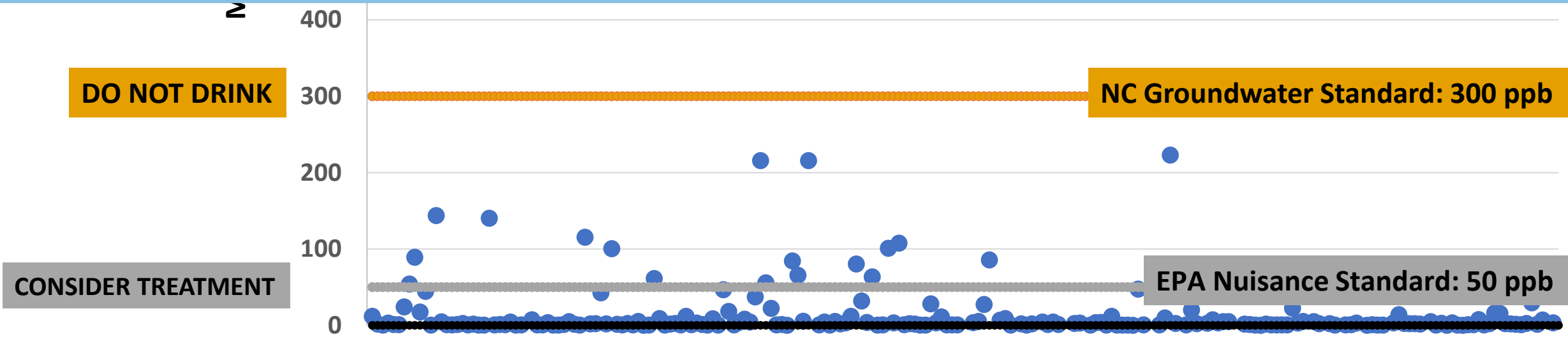
6 wells above  
1000 ppb



1,000



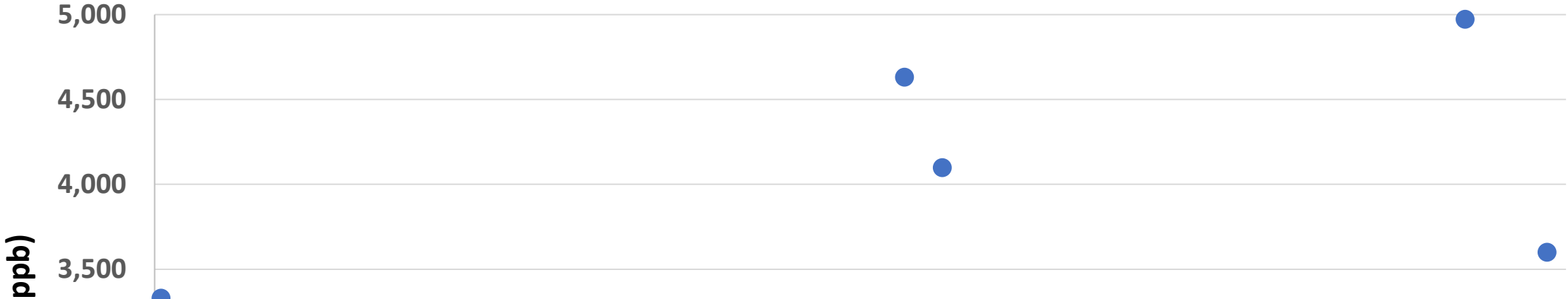
**7%** of well samples above state standard  
**9%** of participants advised to consider treatment  
**Max result: 4,802 ppb**



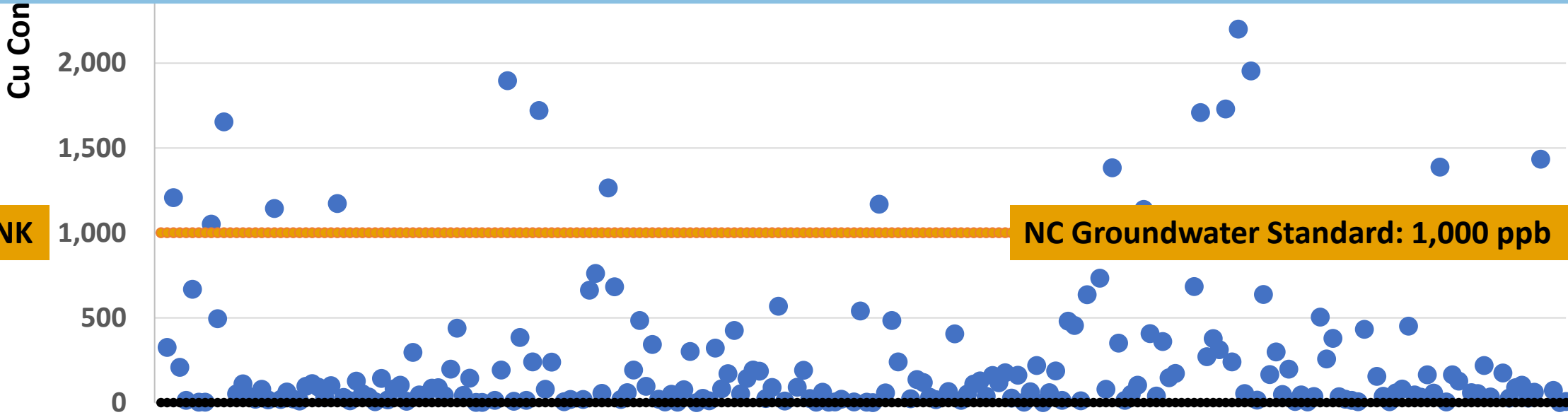


# Copper

4 wells above  
5,000 ppb



**14%** of well samples above state standard  
**Max result: 8,683 ppb**

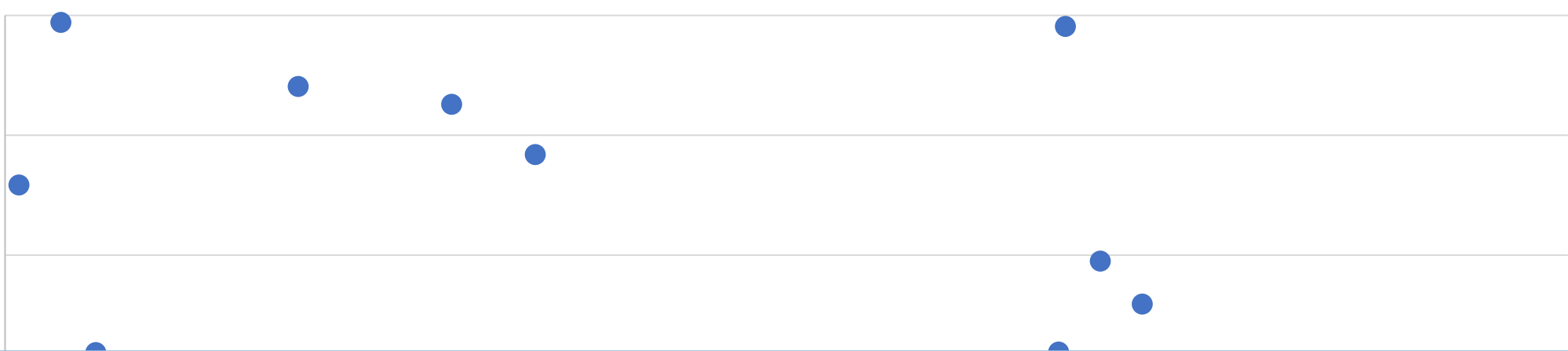


# Zinc

2 wells above  
4000 ppb



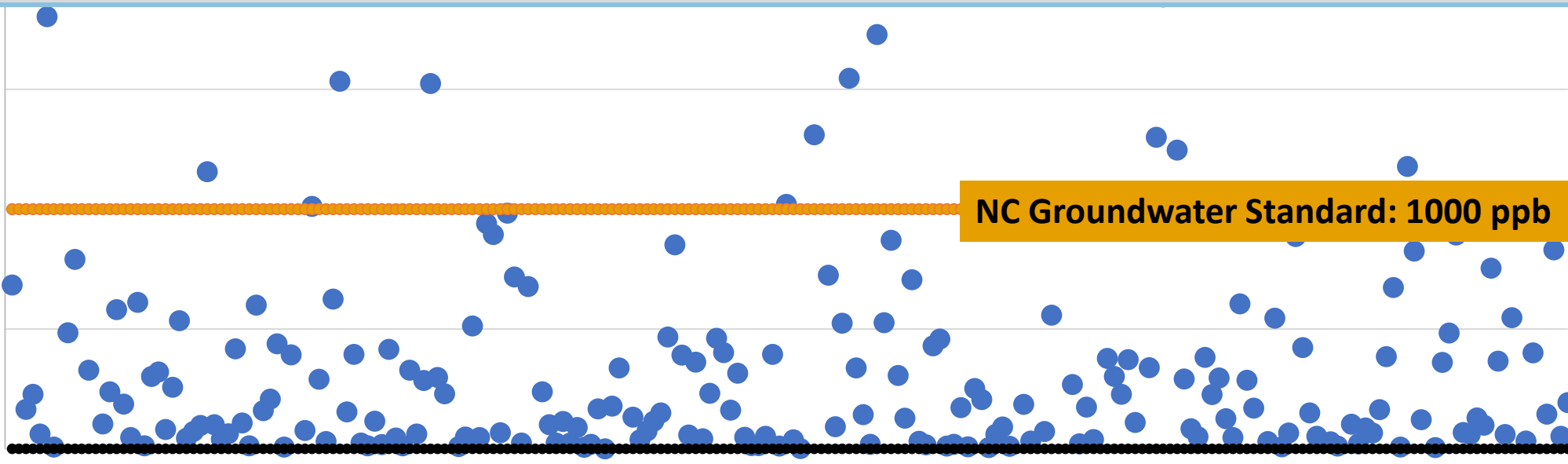
Zinc Concentration (ppb)



**15% of well samples above state standard**  
**Max result: 6,957 ppb**

Zinc Concentration (ppb)

**DO NOT DRINK**



**NC Groundwater Standard: 1000 ppb**

# Sodium

13 wells above  
100,000 ppb



100,000

90,000

80,000

70,000

Sodium Concentration (ppb)

**33%** of well samples above federal standard  
**Max result: 269,856 ppb**

Sodium Concentration (ppb)

40,000

30,000

20,000

10,000

0

CONSIDER TREATMENT

EPA Health Advisory Level: 20,000 ppb





**UNIONCOUNTY**

north carolina

# Common Contaminants Observed In Union County Well Water




- Arsenic
- Iron
- Manganese
- Coliform Bacteria
- E. Coli
- Lead\*

\* In Union County, lead is not typically found in groundwater; it is associated with leaching from plumbing fixtures.




**UNIONCOUNTY**  
north carolina

# Treatment Options

-  Arsenic: As III/As V
  - Special Iron Oxide Adsorptive Media (pre-oxidation **not** required)
  - Other Adsorptive Media/Activated Alumina (pre-oxidation required)
  - Anion Exchange (pre-oxidation required)
  - Reverse Osmosis (pre-oxidation required)
-  Iron & Manganese
  - Oxidizing Filtration
  - Cation Exchange (Water Softeners / Recommended for low levels)
-  Lead
  - Activated Carbon Filtration
  - Reverse Osmosis
  - Run water 30 seconds -2 minutes to flush the plumbing

# Treatment Options cont.

-  Coliform Bacteria & E. Coli
  - Chlorinator (**Not just chlorinating the well**)
  - Ozone
  - Ultra-Violet Light (UV)

# Union County Environmental Health

[unioncountyeh@unioncountync.gov](mailto:unioncountyeh@unioncountync.gov)

704-283-3553



# Questions from study participants



If my water contains **arsenic** and/or **lead**...

Should I use it for **cooking**?

Should I use it for **bathing** or **showering**?

Should I give it to my **animals**?

Should I use it for **watering my garden**?

Is **arsenic** in our bodies measured through a **blood test** like with lead?

What **maintenance** is needed for my water **filter** or **treatment system**?

# Thanks to study participants & partners!

## **Clean Water for North Carolina:**

Christine Diaz, Veronica Oakler, Rachel Velez

## **NC DHHS:**

Kennedy Holt (Occupational and Environmental Epidemiology Branch),  
Wilson Mize (Onsite Water Protection Branch)

## **Union County Cooperative Extension:**

Debbie Dillion

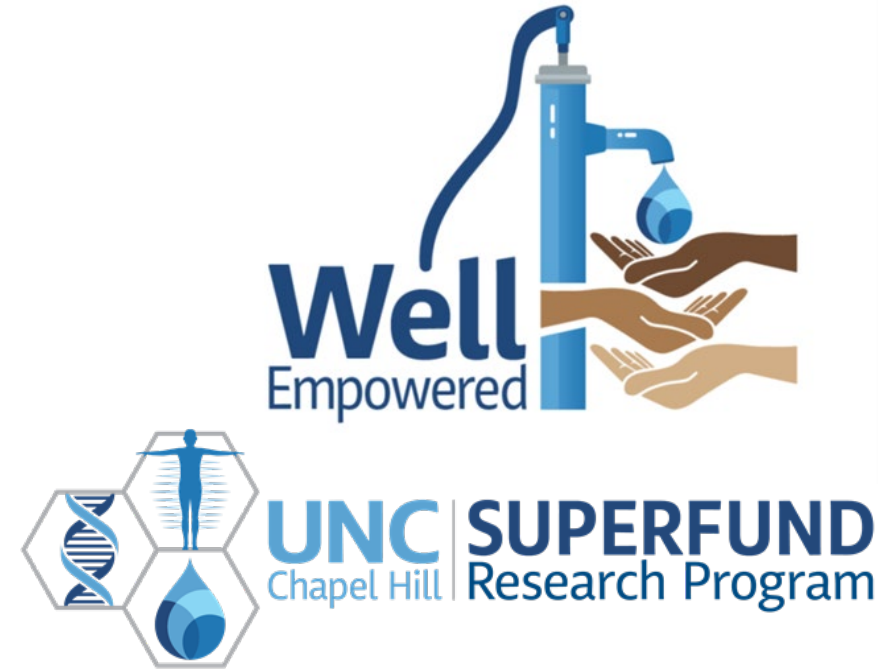
## **Union County Health Dept:**

Traci Colley, Nicole Hricik

## **UNC Chapel Hill Superfund Research Program:**

Megan Lane & Sarah Yelton (UNC-Chapel Hill)  
Rob Austin & Owen Duckworth (NCSU)  
David Vinson (UNC-Charlotte)

**Funder:** National Institute of Environmental Health Sciences  
(Grant #P42 ES031007)



<http://go.unc.edu/welltesting>

# Questions? Ask the experts in the room.



**Rebecca Fry**

Director  
UNC SRP



**Traci Colley**

Environmental Health Director  
Union Co. Environmental Health



**David Finley**

Onsite Water Protection Program  
Union Co. Environmental Health



**Kennedy Holt**

Occupational & Env. Epidemiology Branch  
NC DHHS



**NCDHHS**

**John Brooks**

Onsite Water Protection Branch  
NC DHHS