THANK YOU!

Public Health
Prevent. Promote. Protect.
Iredell County Health Department

FIRE SERVICES
IREDELL COUNTY
EM
EMERGENCY MANAGEMENT

SHERIFF
IREDELL COUNTY

UNC
INSTITUTE FOR
THE ENVIRONMENT

Rocky Mount

VIRGINIA
TECH™

This research was supported by the US Environmental Protection Agency and the National Science Foundation

If you have questions during this meeting, you can text or email us

Website: pollEV.com/iredell
Text: IREDELL to 22333

Agenda

Welcome: Brady Freeman, Iredell Health and Senator Sawyer

Overview of team: Marc Edwards, Virginia Tech

Overview of sampling: Kelsey Pieper, Virginia Tech

Water results: Rebecca Kriss and Kory Wait, Virginia Tech

Treatment solutions: Wilson Mize, DHHS

Questions

Our research goals

1. Measure lead in drinking water from private wells
2. Examine well water quality and recovery behaviors after Hurricanes Florence and Michael.

Funded by the US Environmental Protection Agency and the National Science Foundation.

Sample collection

6+ hours no water use

First draw sample

Sample collection

6+ hours no water use

First draw sample

Flushed for 5 minutes

Flushed sample

Sample collection

6+ hours no water use

Flushed for 5 minutes

WATER SOURCE:

1. What household water supply source was drawn for sample? Check one:
   ❑ well ❑ spring ❑ cistern ❑ other → specify: _____
   If well is checked above: (a) is it a: ❑ dug or bored well ❑ drilled well ❑ don't know;
   (b) what is the well's depth, if known? _____ ft ❑ don't know
   (c) what year was well constructed, if known? _____ ❑ don't know

2. What water treatment devices are currently installed? Check all that apply:
   ❑ none
   ❑ ultraviolet (UV) light
   ❑ acid neutralizer
   ❑ water softener (conditioner)

Kory Wait, Rebecca Kriss, and Griffin Savedge

2,358 water samples were collected from **786** residents

Kory Wait, Rebecca Kriss,
and Griffin Savedge

2,358 water samples were collected from **786** residents

Over $350,000 in well water testing

VirginiaTech

Department of Civil and Environmental Engineering
418 Durham Hall, 1145 Perry Street, Blacksburg, VA 24061

To: Name
Address
Address

Sample ID: I-#
Date: 2/28/2019

Sampling location: Address

Health-based water quality parameters

Parameter	Your Result	Units	US EPA standard[1]	NC groundwater standard[2]	NC IMAC[3] and health screening level[4]
Antimony	<0.1	µg/L	6	-	1
Arsenic	<0.1	µg/L	10	10	-
Barium	9.1	µg/L	2,000	700	-
Boron	8.5	µg/L	-	700	-
[5]Chromium (Total)	0.40	µg/L	100	10	-
[5]Hexavalent Chromium (Cr6)	0.10	µg/L	-	-	0.07
Cobalt	0.2	µg/L	-	-	1
Fluoride	0.1	mg/L	4	2	-
Selenium	1.9	µg/L	50	20	-
Thallium	<0.1	µg/L	2	-	0.2
Uranium	19.9	µg/L	30	-	-
Vanadium	1.1	µg/L	-	0.3	0.3
First draw sample					
Cadmium	<0.1	µg/L	5	2	-
Copper	435.0	µg/L	1,300	1,000	-
Lead	1.4	µg/L	15	15	-
Nickel	23.0	µg/L	-	100	-
5-minute flush sample					
Cadmium	0.1	µg/L	1,300	1,000	-
Copper	<1.0	µg/L	1,300	1,000	-
Lead	<0.1	µg/L	15	15	-
Nickel	<0.1	µg/L	-	100	-

[1]The US EPA has set legally enforceable health-based Maximum Contaminant Levels and Action Levels for regulated municipal systems. These standards are used as a guide for private wells.

[2]The NC DEQ has set the 15A NCAC 02L.0202 Groundwater Quality Standards These are the maximum allowable concentrations of contaminants in groundwater which may be tolerated without creating a threat to human health or which would otherwise render the groundwater unsuitable for use as a drinking water source.

[3]The NC DEQ sets interim maximum allow concentrations (IMAC) for substances when a standard has not been established. These are developed based on toxicological and epidemiological data, study results, and calculations.

[4]The NC DHHS set a health screening level for hexavalent chromium at a concentration to be protective of people ingesting the water over a lifetime. An exceedance does not mean that negative health effects would be expected for persons ingesting the water, but it indicates a need to take a closer look.

VirginiaTech

Department of Civil and Environmental Engineering
418 Durham Hall, 1145 Perry Street, Blacksburg, VA 24061

To: Name
Address
Address

Sample ID: I-#
Date: 2/28/2019

Sampling location: Address

Nuisance-based water quality standards[†]

Parameter	Your Result	Units	Nuisance-based standard[†]
Aluminum	<10.0	µg/L	200
Chloride	5.7	mg/L	250
Iron	2,566.7	µg/L	300
Manganese	21.7	µg/L	50
Sulfate	4	mg/L	250
Total dissolved solids	106.9	mg/L	500
First draw sample			
Zinc	3242.0	µg/L	5,000
5-minute flush sample			
Zinc	29.3	µg/L	5,000

[†]The Environmental Protection Agency has set these voluntary Secondary Maximum Contaminant Level (SMCL) nuisance-based standards for regulated municipal systems. These standards are used as a guide for private wells.

Unregulated water quality parameters

Parameter	Your Result	Units	Recommended Limits
Calcium	1	mg/L	-
Hardness	6.6	mg/L	-
Magnesium	1.0	mg/L	-
Molybdenum	22.4	µg/L	-
Potassium	3567.82	µg/L	-
Sodium	8.5	mg/L	20
Strontium	172.9	µg/L	-

For more information, contact Kelsey Pieper at Virginia Tech or Andrew George at UNC:

Kelsey Pieper
Virginia Tech
kpieper@vt.edu
(518) 928-0177

Andrew George
UNC Institute for the Environment
andrewg@email.edu
(919) 966-7839

Health-based water quality parameters

Parameter	Your Result	Units	US EPA standard[1]	NC groundwater standard[2]	NC IMAC[3] and health screening level[4]
Antimony	<0.1	µg/L	6	-	1
Arsenic	<0.1	µg/L	10	10	-
Barium	9.1	µg/L	2,000	700	-
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Cobalt	0.2	µg/L	-	-	1
Fluoride	0.1	mg/L	4	2	-
Selenium	1.9	µg/L	50	20	-
Thallium	<0.1	µg/L	2	-	0.2

Health-based water quality parameters

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Thallium	<0.1	µg/l	2	-	0.2

Enforceable standards for **regulated municipal systems**.

Health-based water quality parameters

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Arsenic	<0.1	µg/L	1	10	-
Barium	9.1	µg/L	2,00	700	-
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Fluoride	0.1	mg/L		2	-
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Thallium	<0.1	µg/L		-	0.2

Health-based groundwater standards

Health-based water quality parameters

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Interim standards and goals that have not been fully adopted

Water Testing Results

Rebecca Kriss and Kory Wait

Virginia Tech

Sources of Potential Contaminants

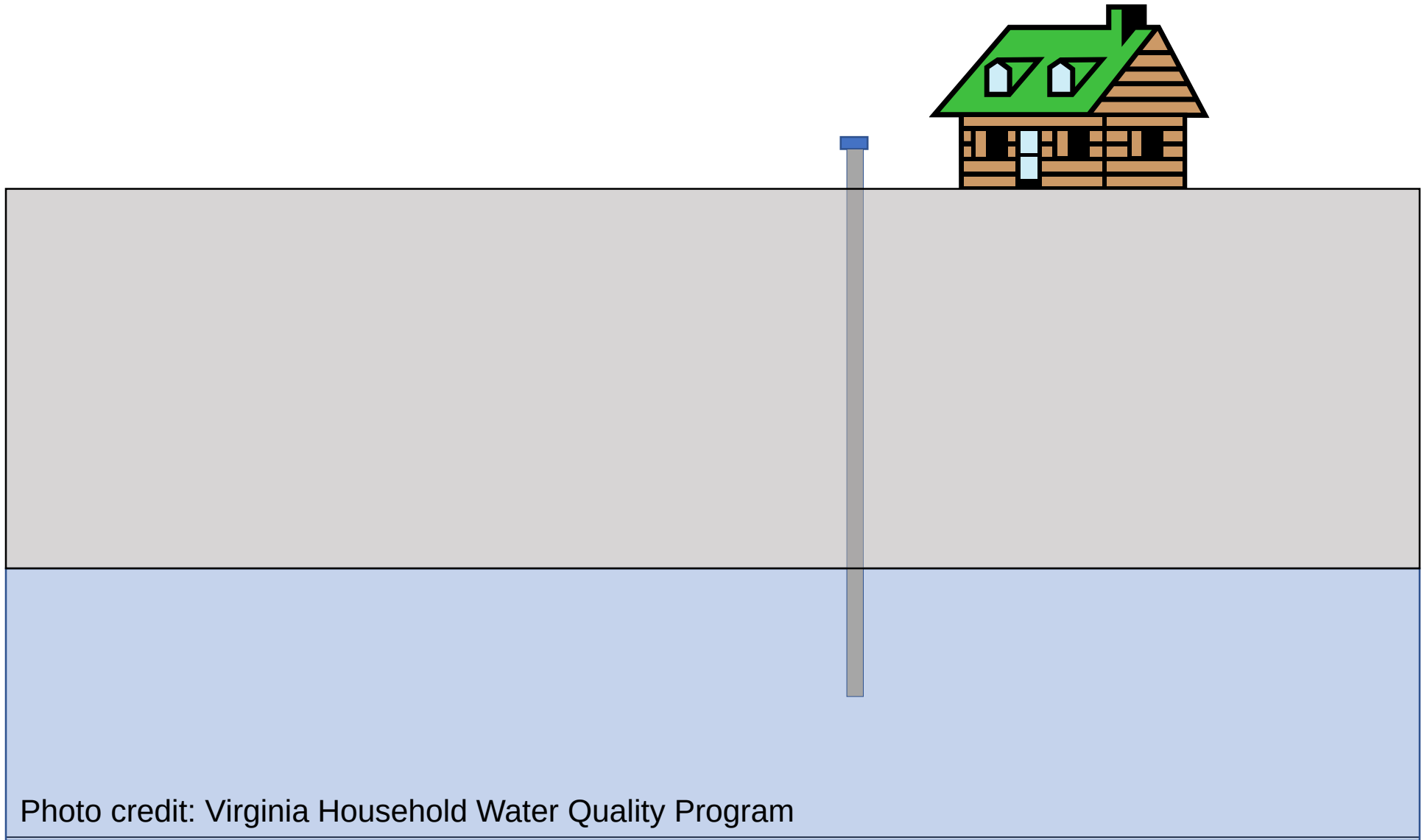
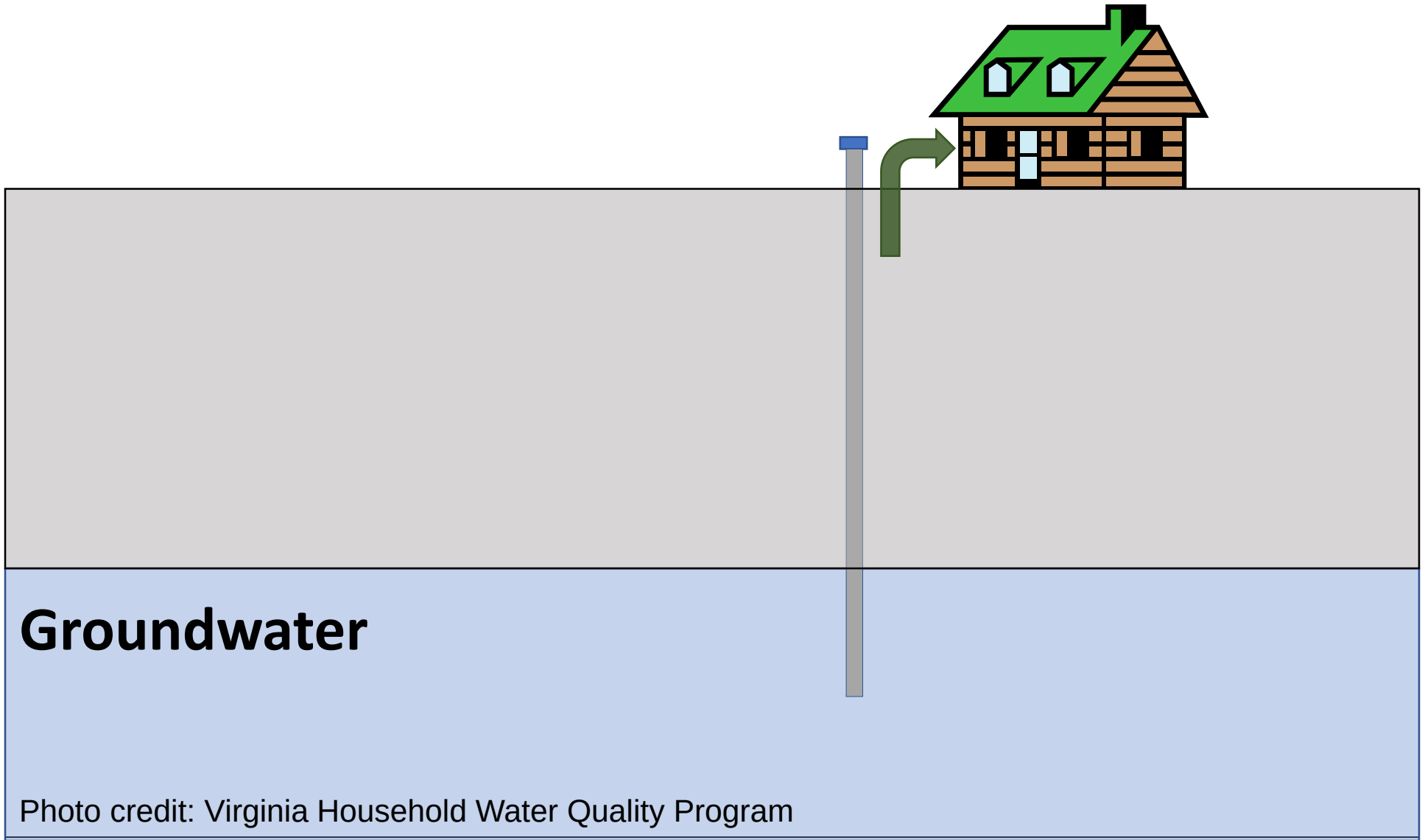


Photo credit: Virginia Household Water Quality Program

Sources of Potential Contaminants



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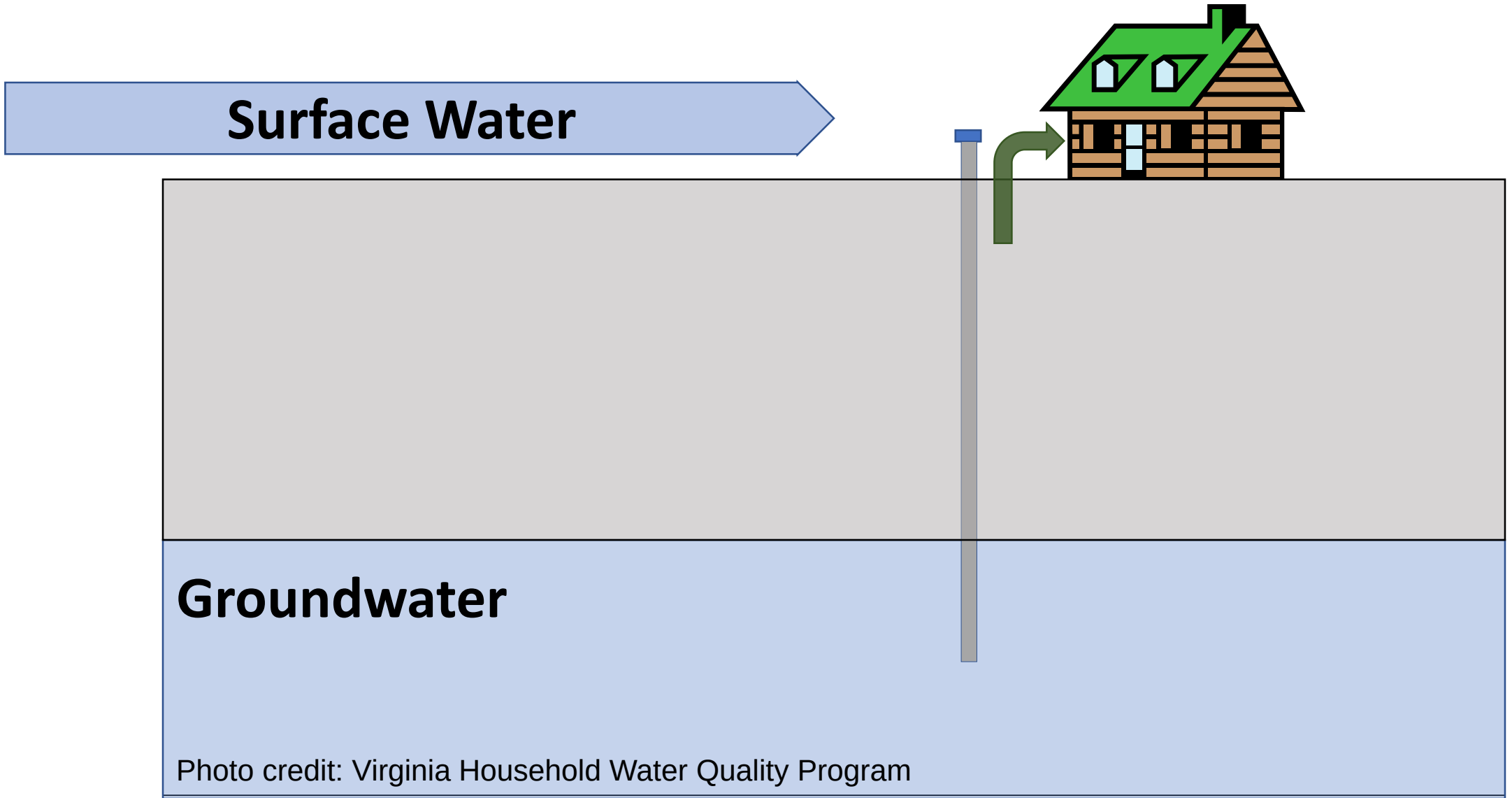

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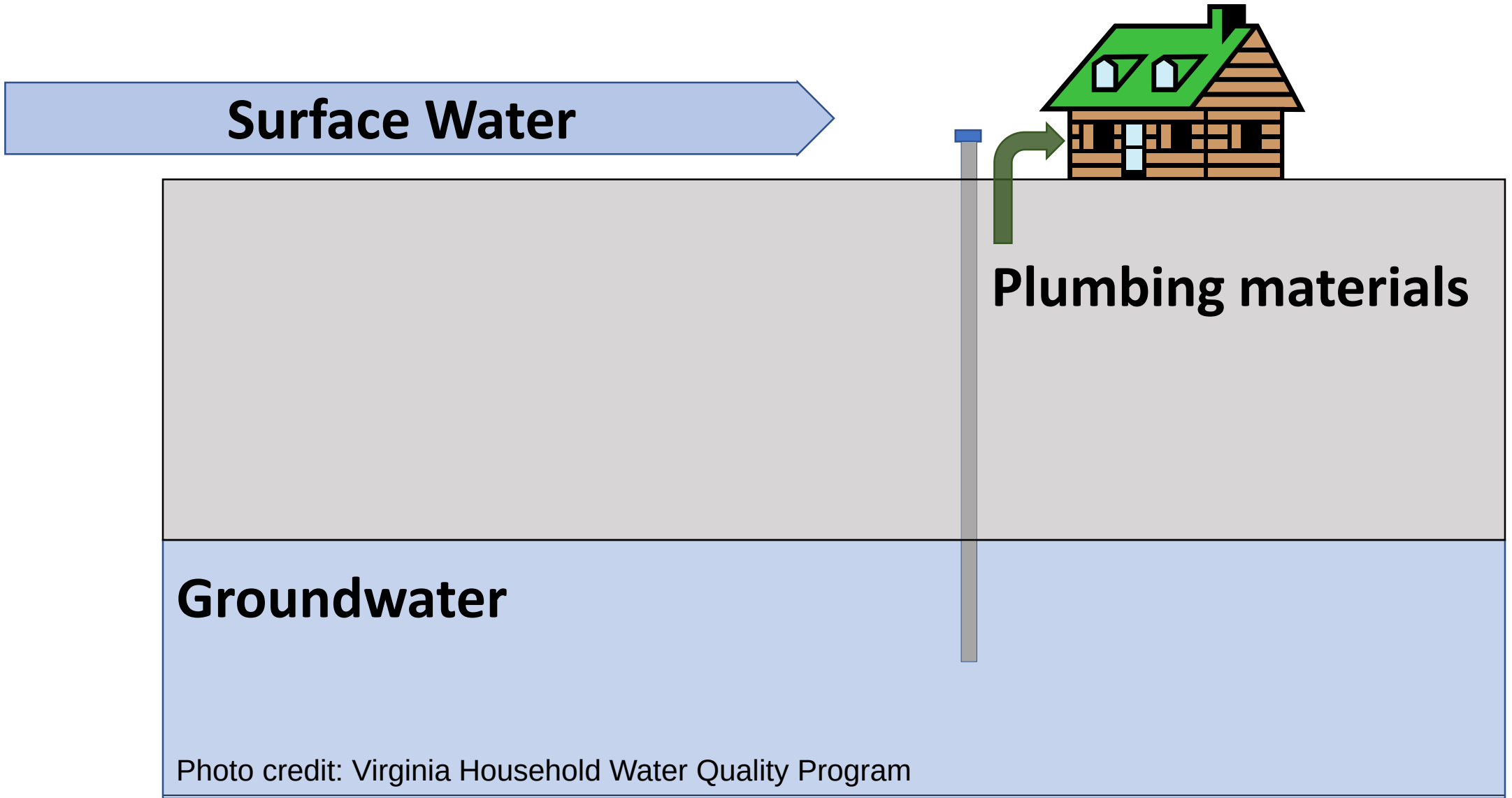

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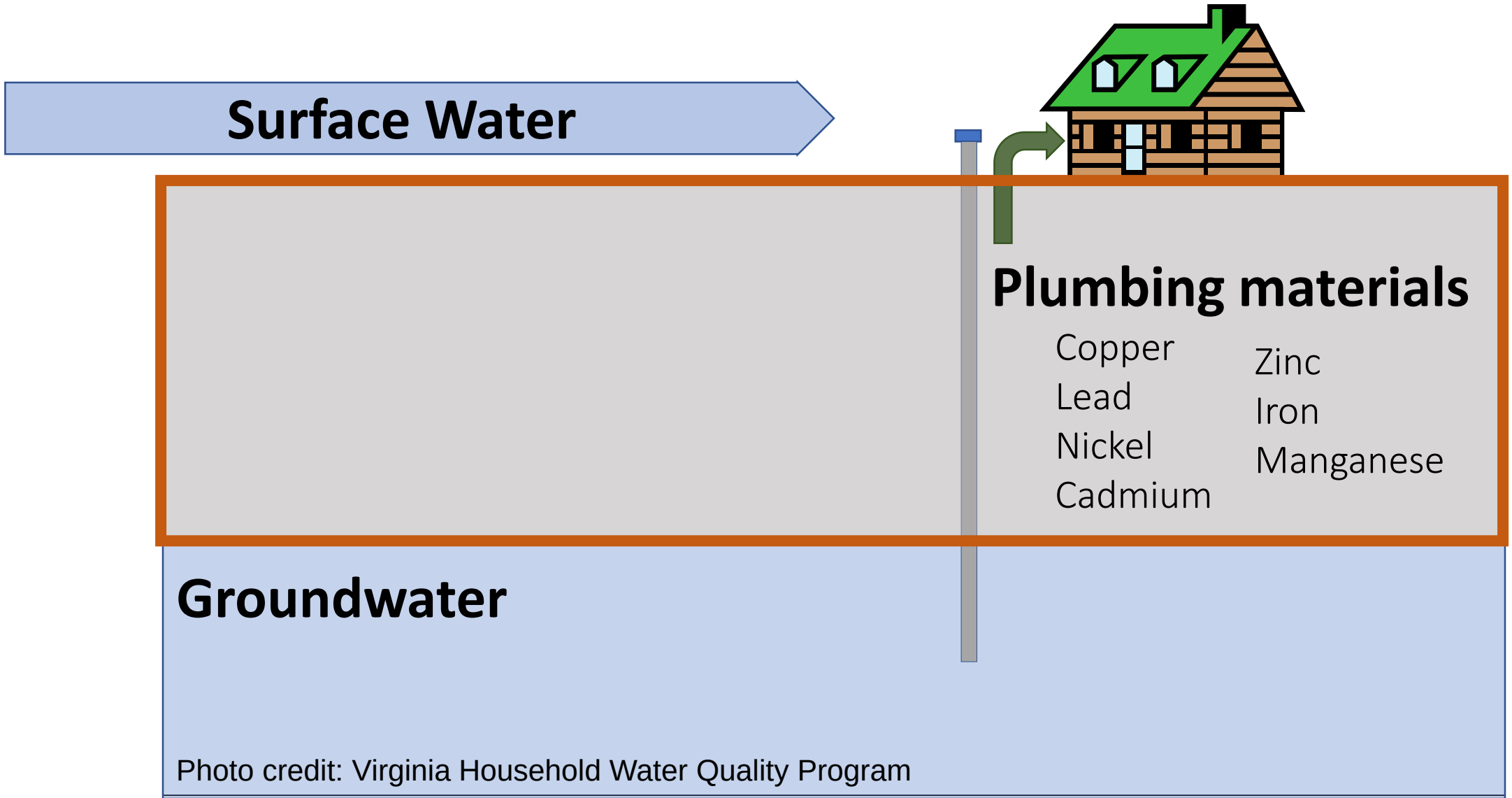

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Sources of Potential Contaminants

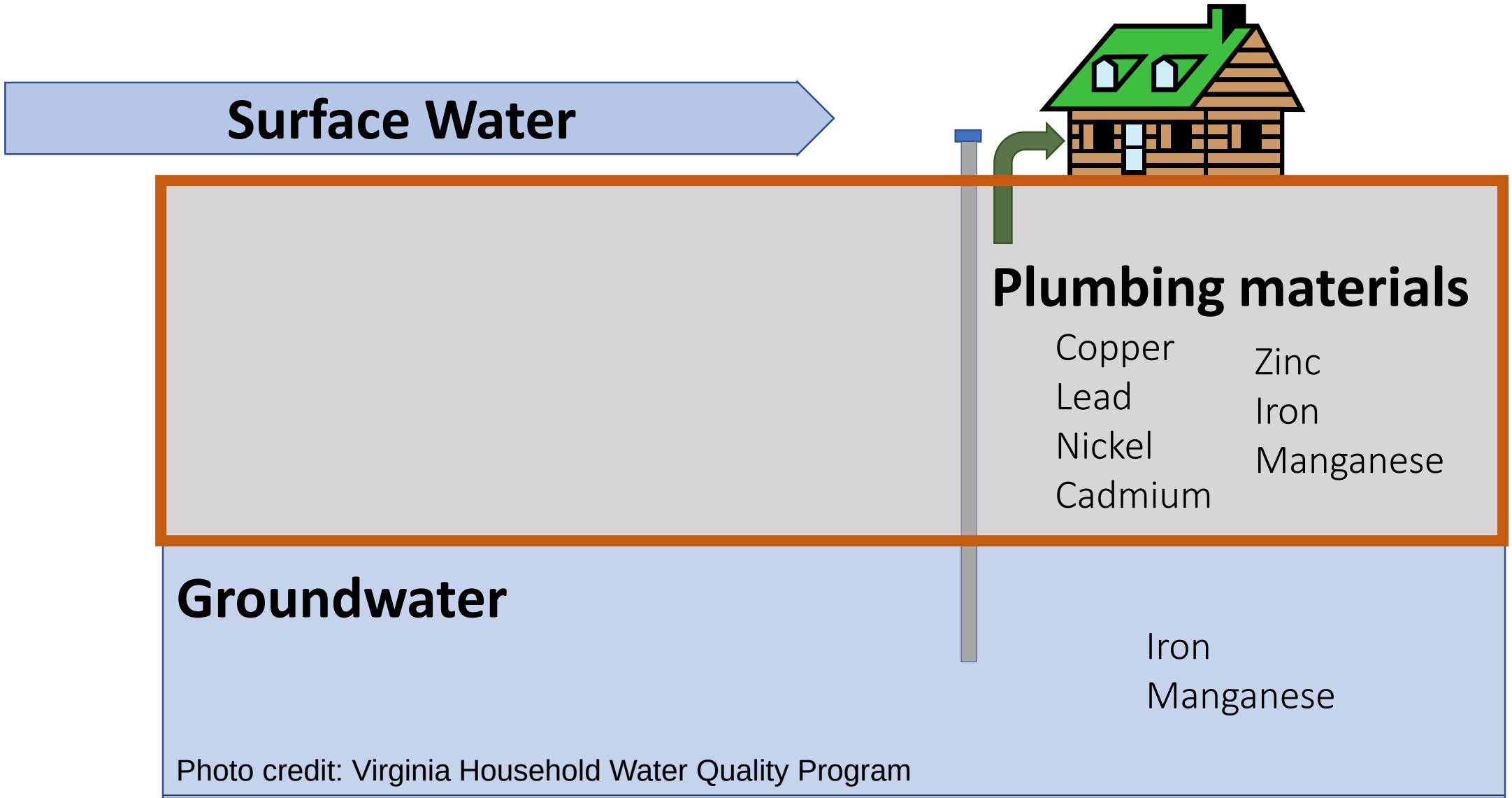


Photo credit: Virginia Household Water Quality Program

Metals in Water

Metals in Water

Water Quality Concerns

Metals in Water

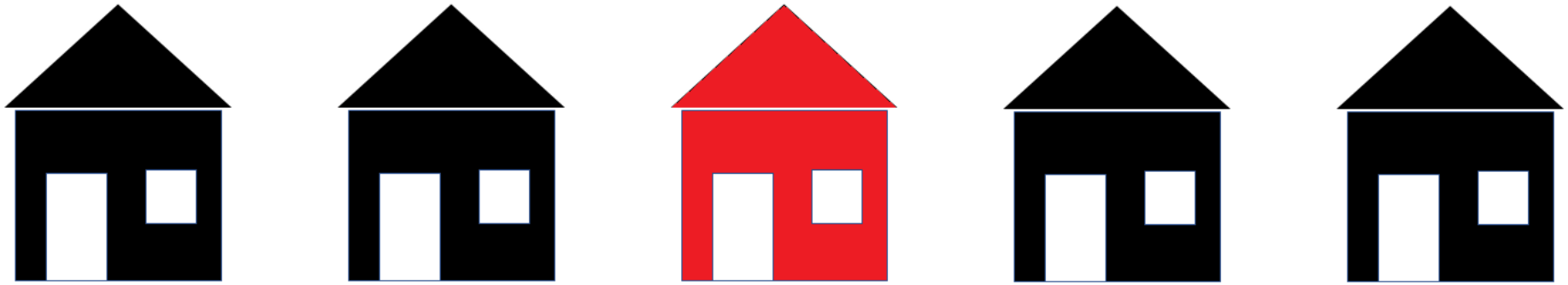
Water Quality Concerns

Plumbing & Appliance Concerns

Corrosion Problems are Not Uncommon in Wells

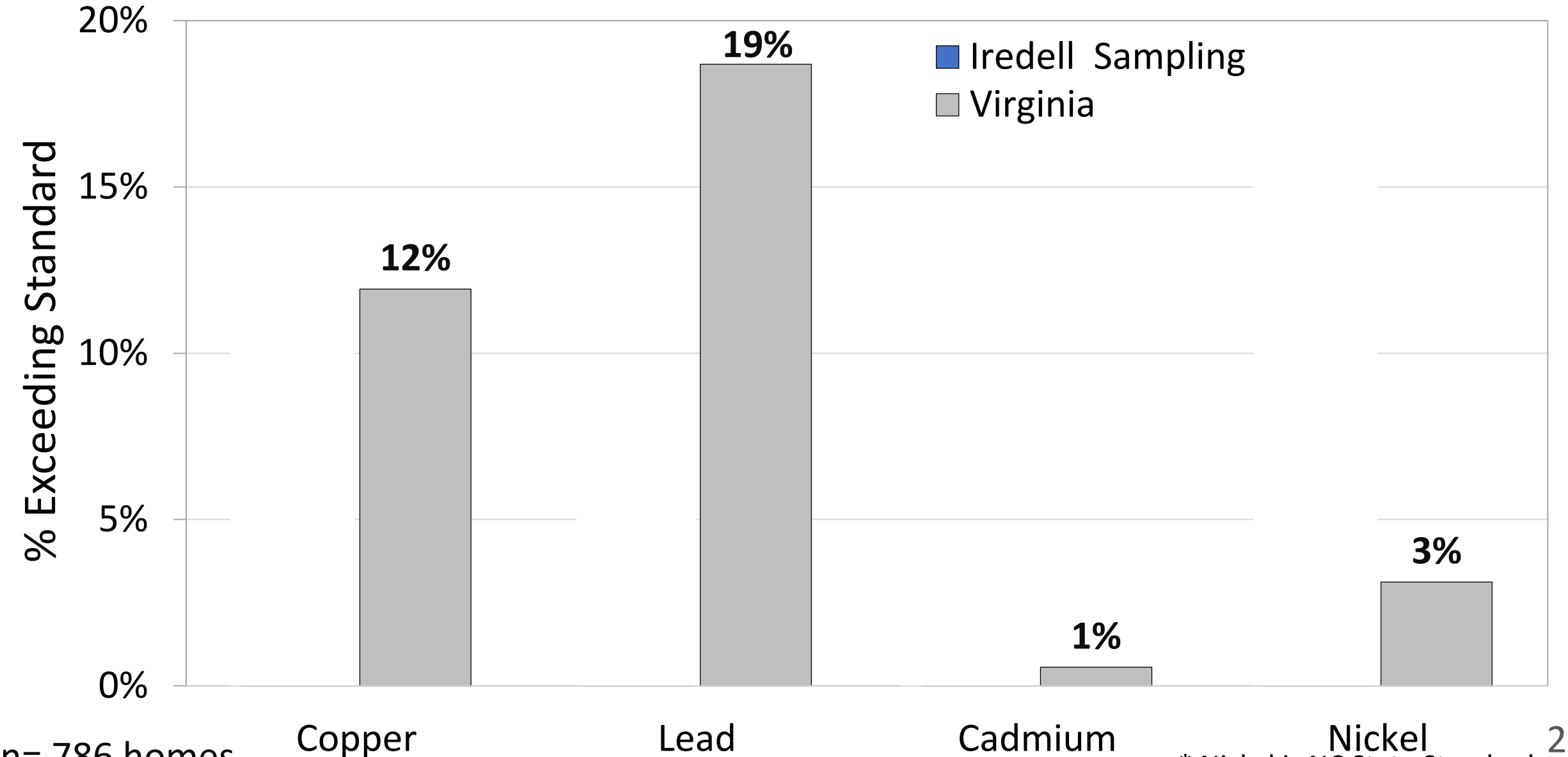
Corrosion Problems are Not Uncommon in Wells

VIRGINIA HOUSEHOLD WATER QUALITY PROGRAM



Of 2,144 Virginia wells tested 1 in 5 exceeded standards

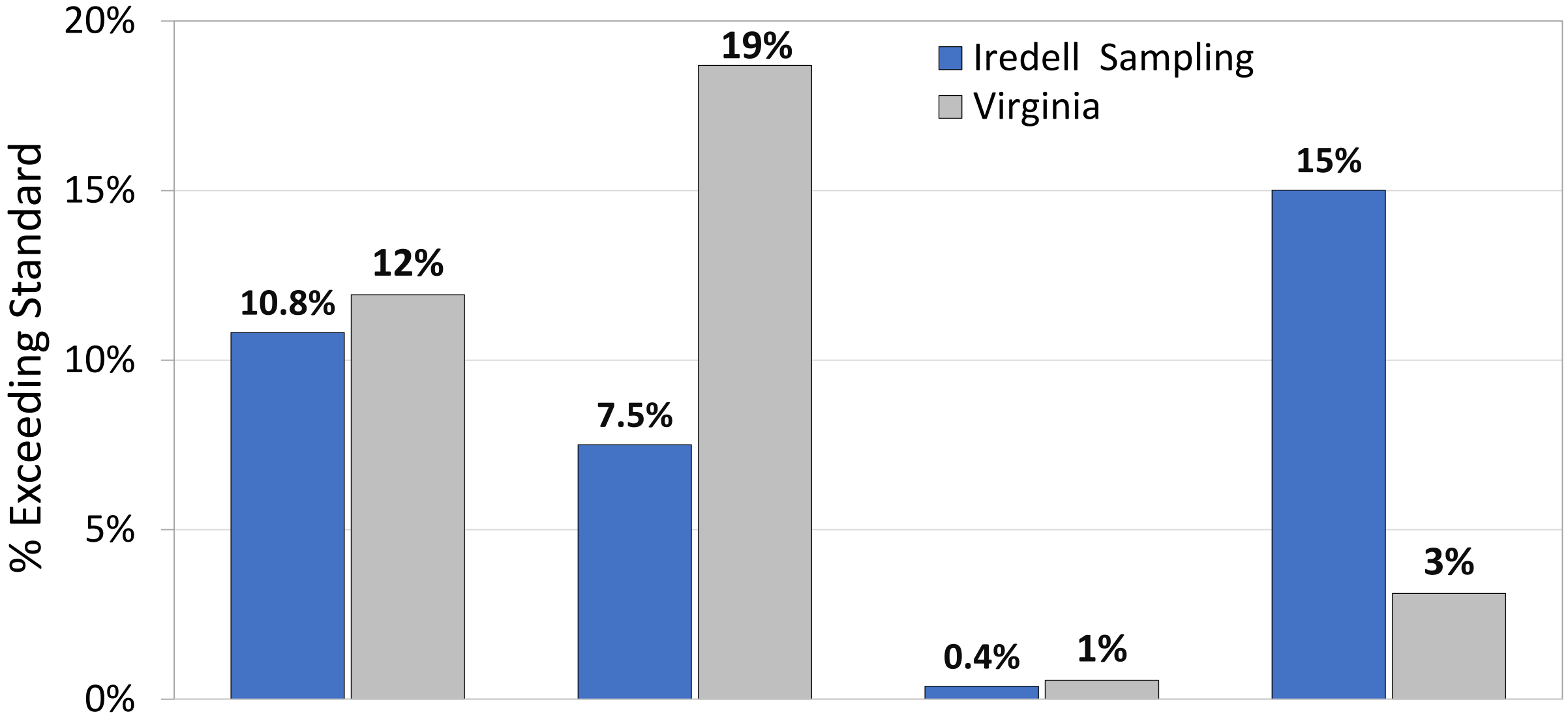
Corrosion Problems are Not Uncommon in Wells



n= 786 homes

* Nickel is NC State Standard

Corrosion Problems are Not Uncommon in Wells



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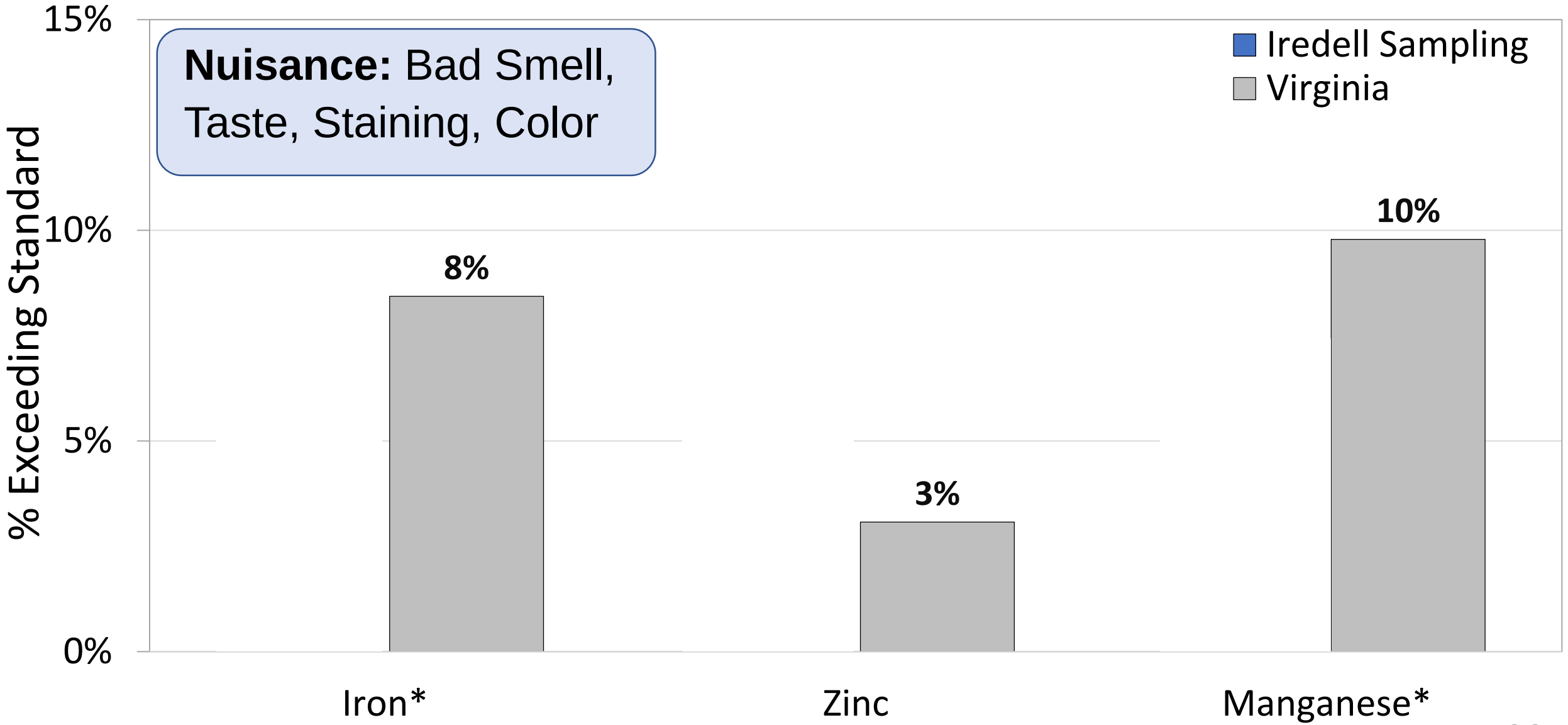
Few Wells Exceeded Nuisance-Based Standards

Nuisance: Bad Smell, Taste, Staining, Color

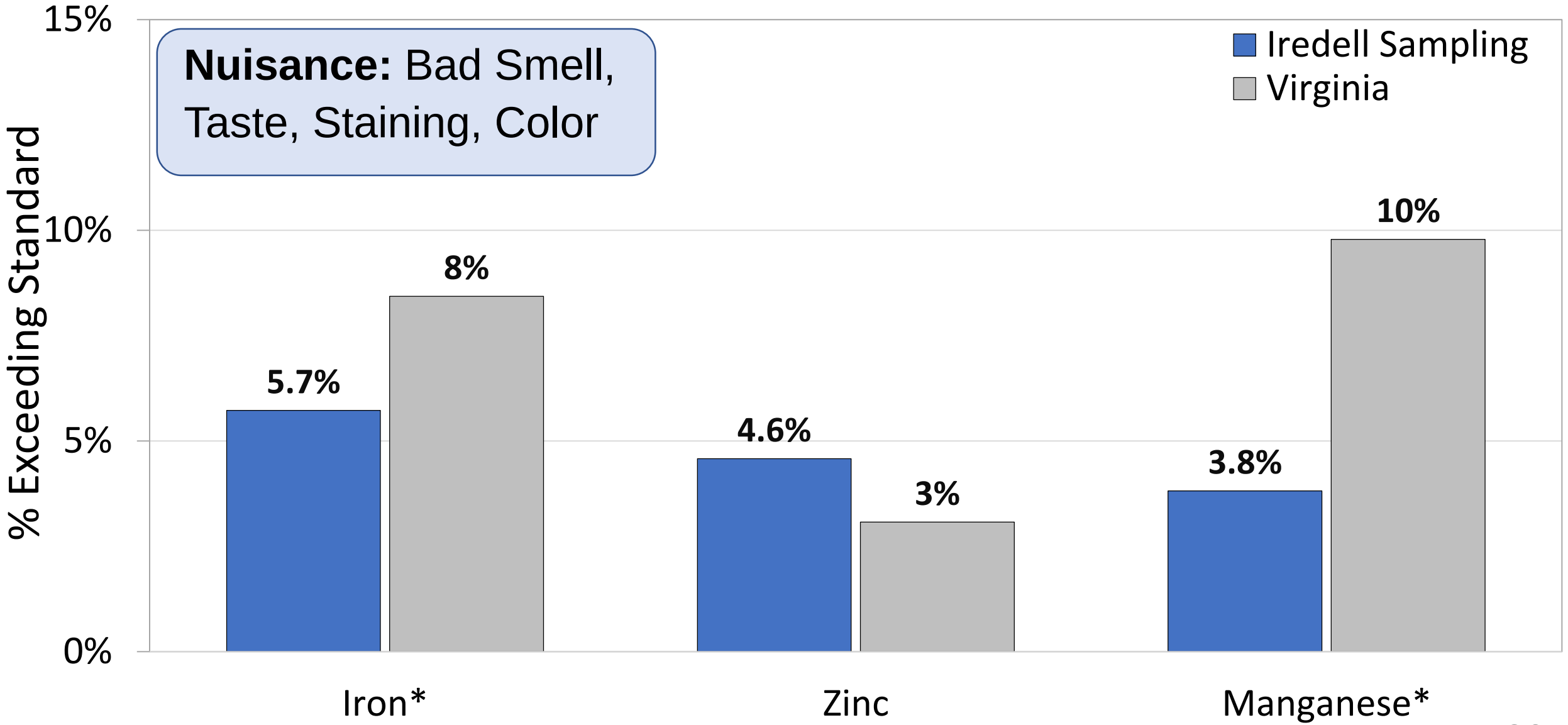
Few Wells Exceeded Nuisance-Based Standards



n= 786 homes

*After 5 minutes of flushing

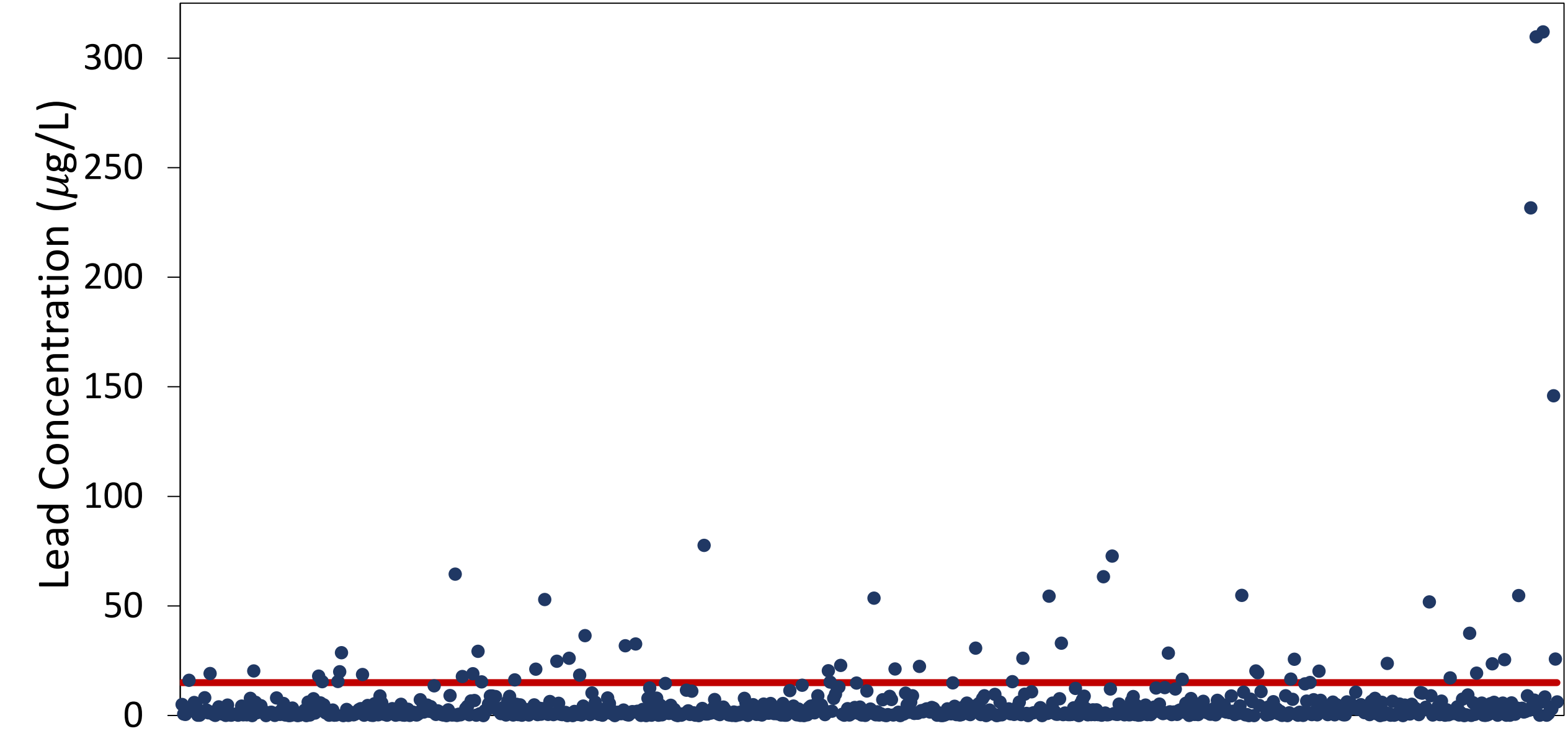
Few Wells Exceeded Nuisance-Based Standards



n= 786 homes

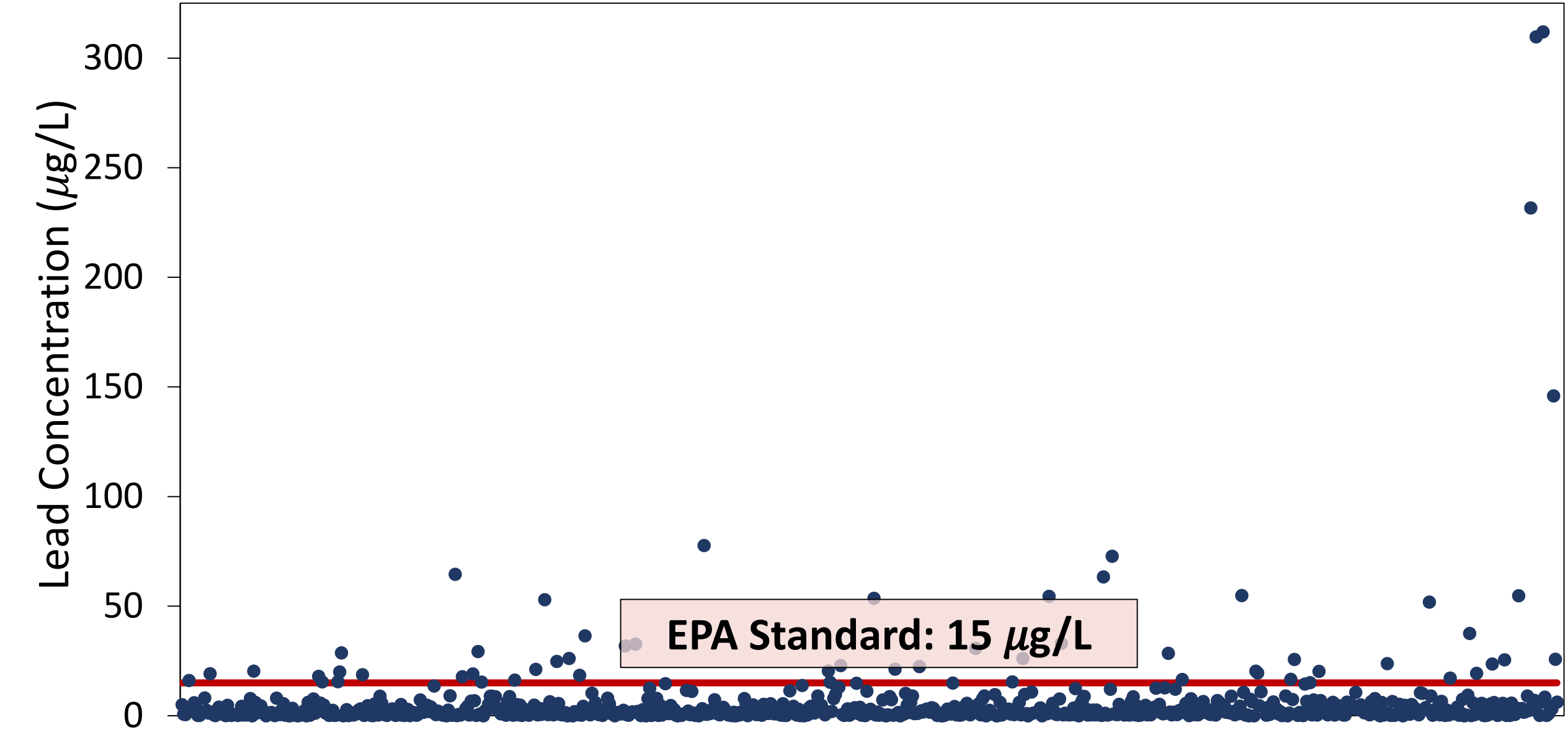
*After 5 minutes of flushing

Lead



n= 786 homes

Lead



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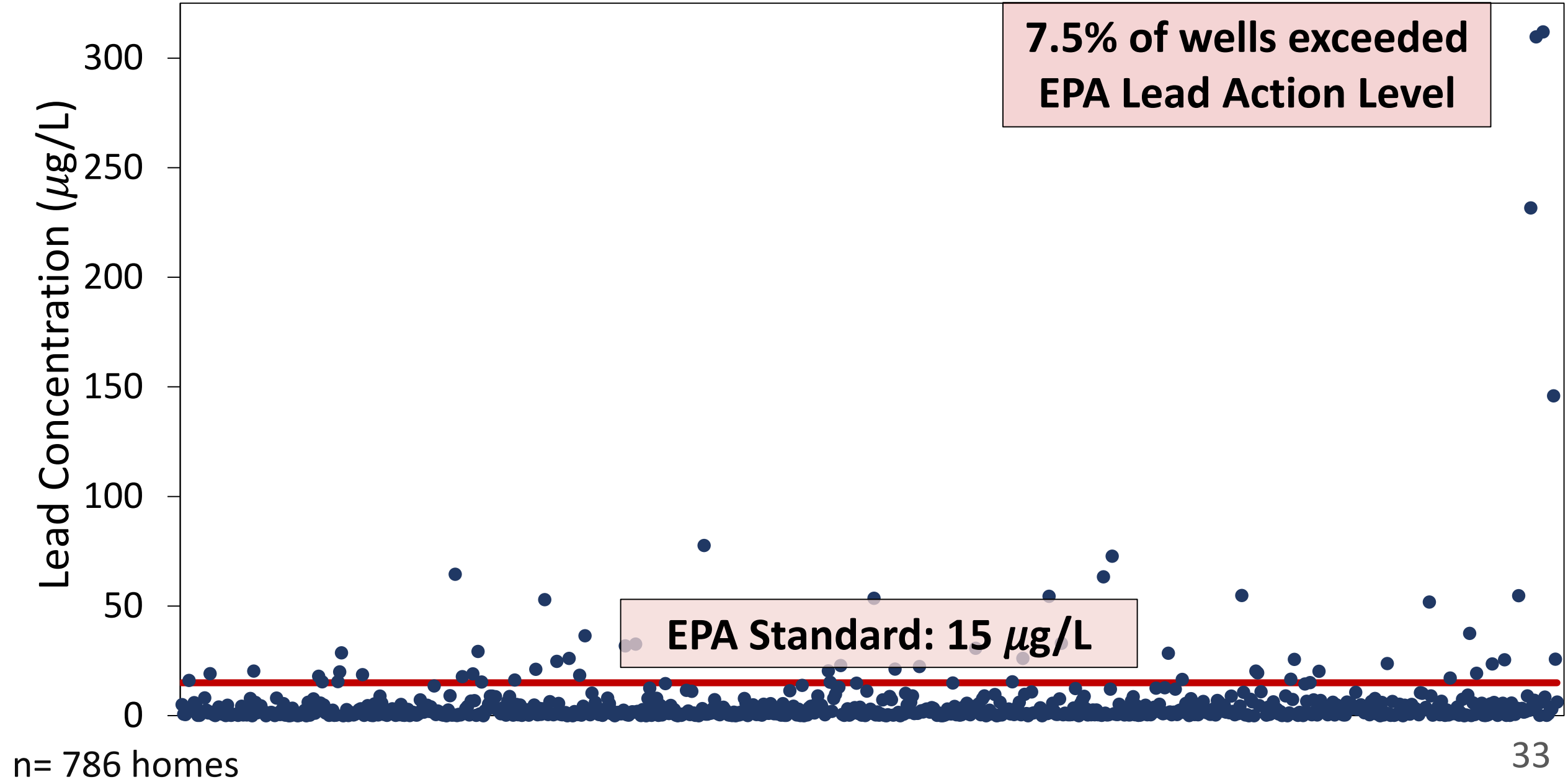
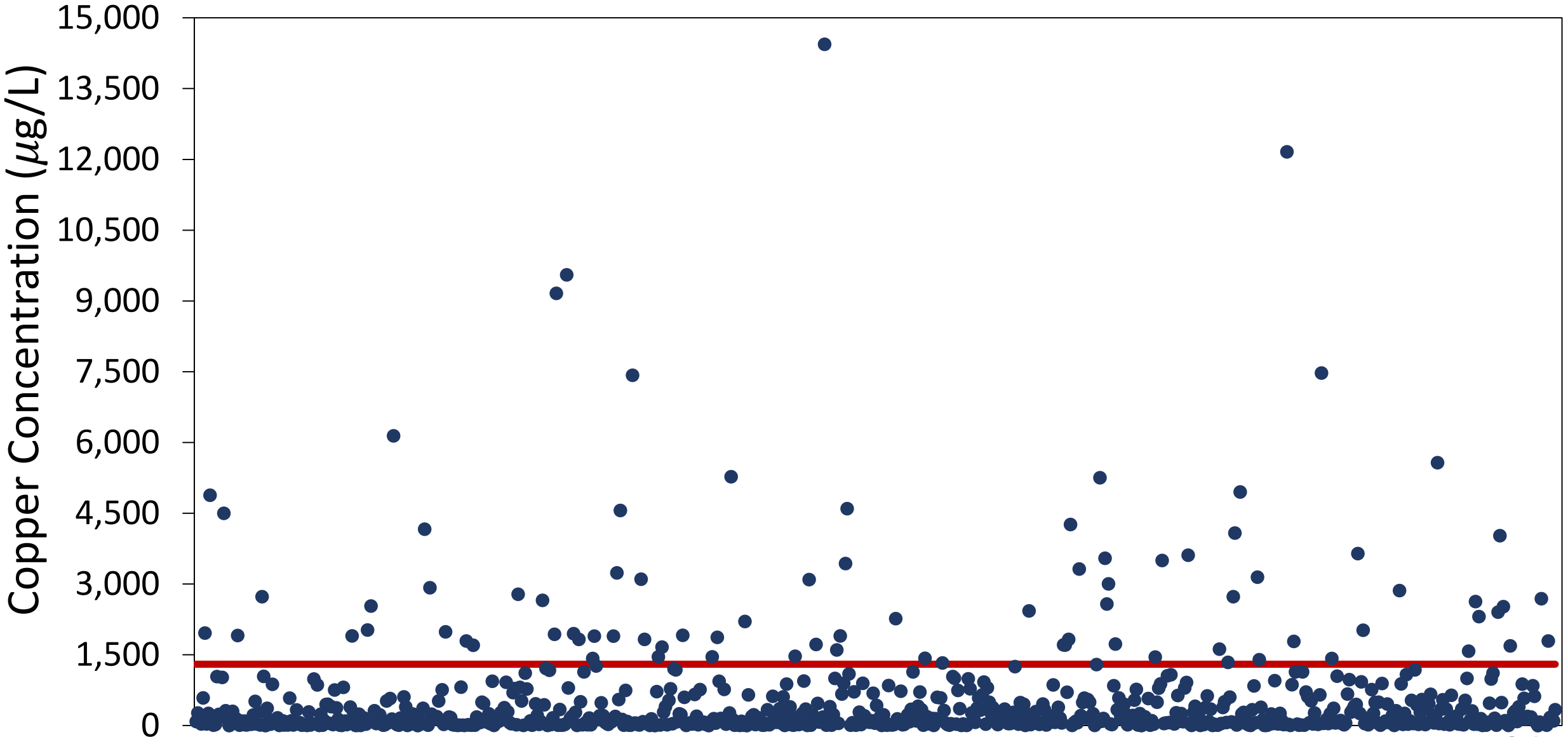
Lead



n= 786 homes

Copper



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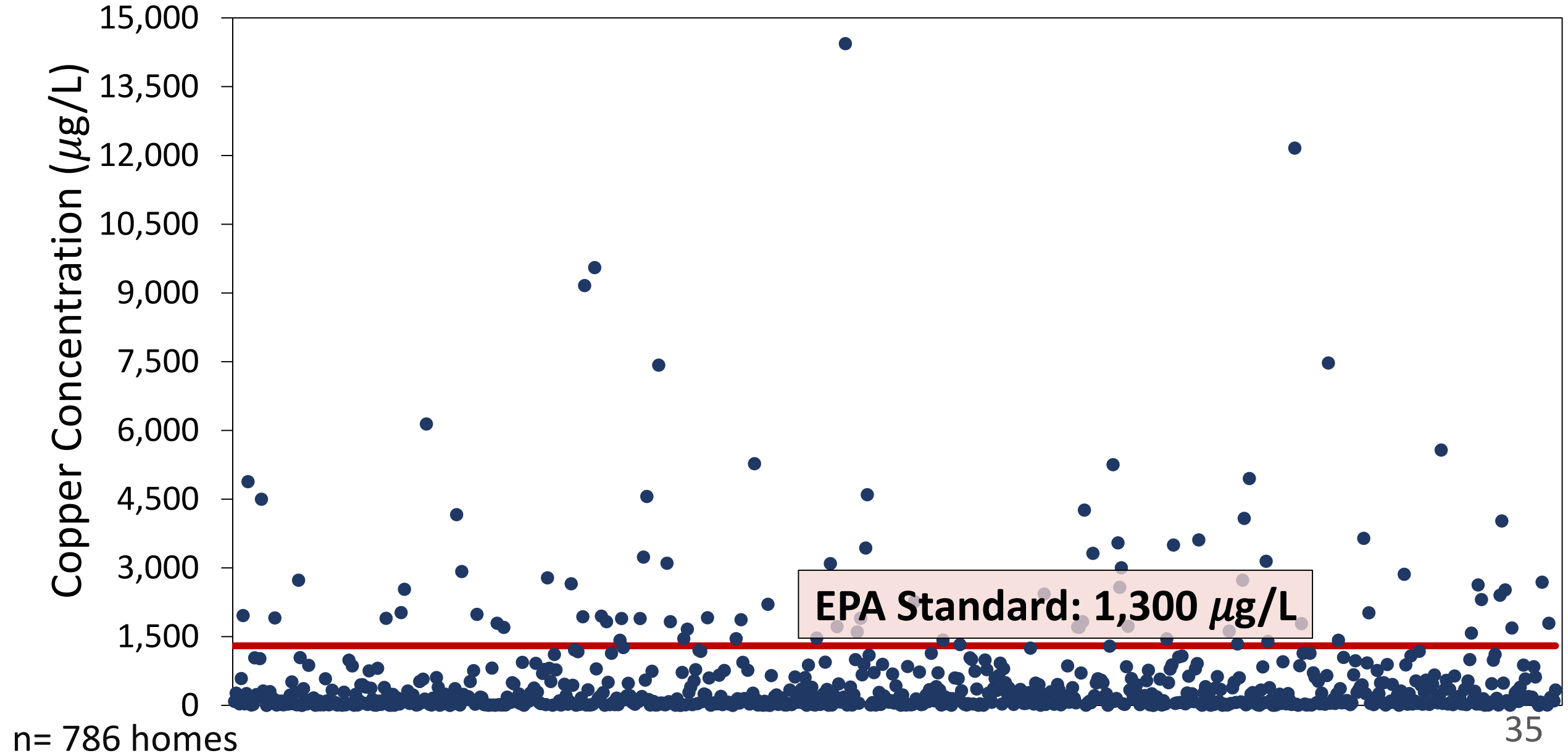
Copper



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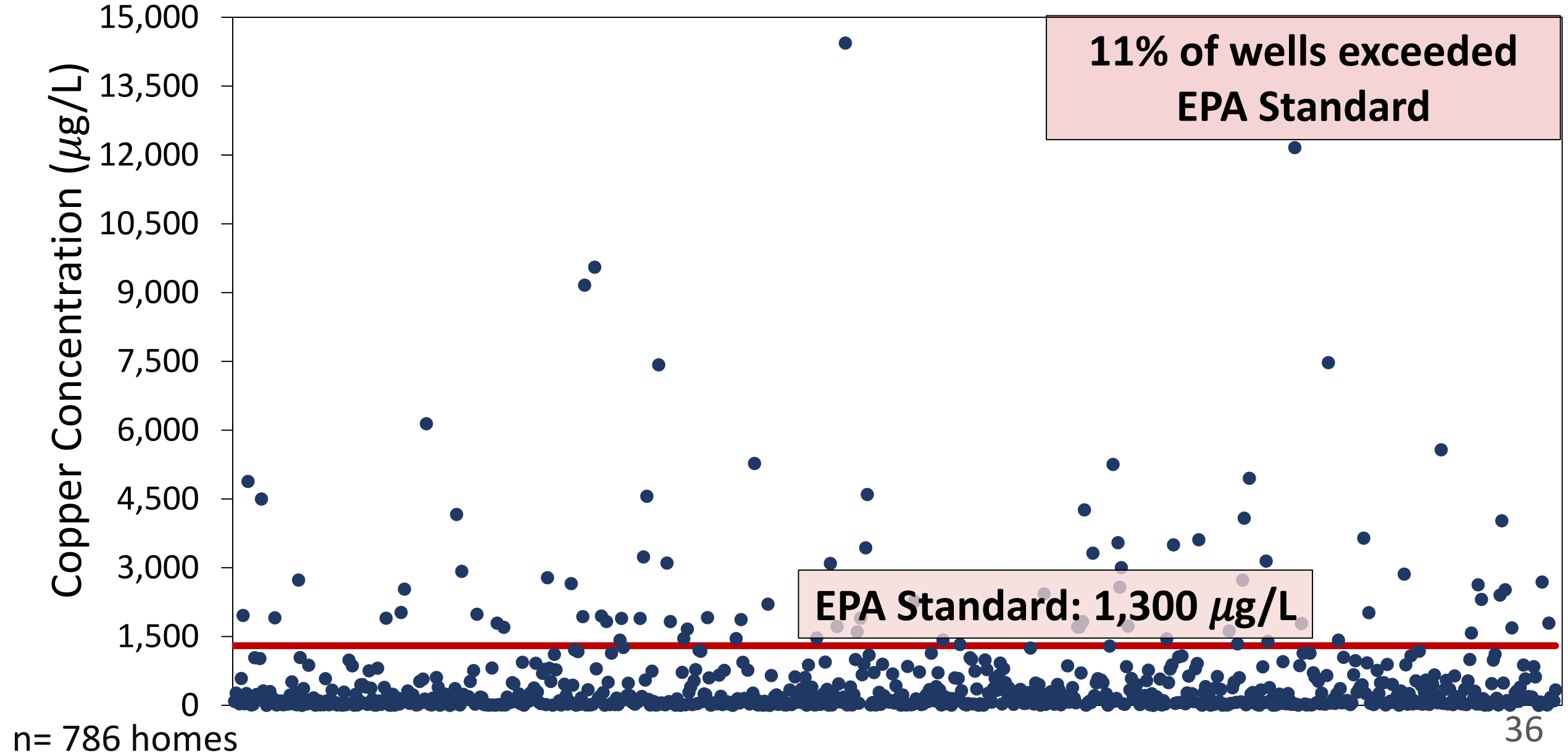

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How to Treat Metals in Water

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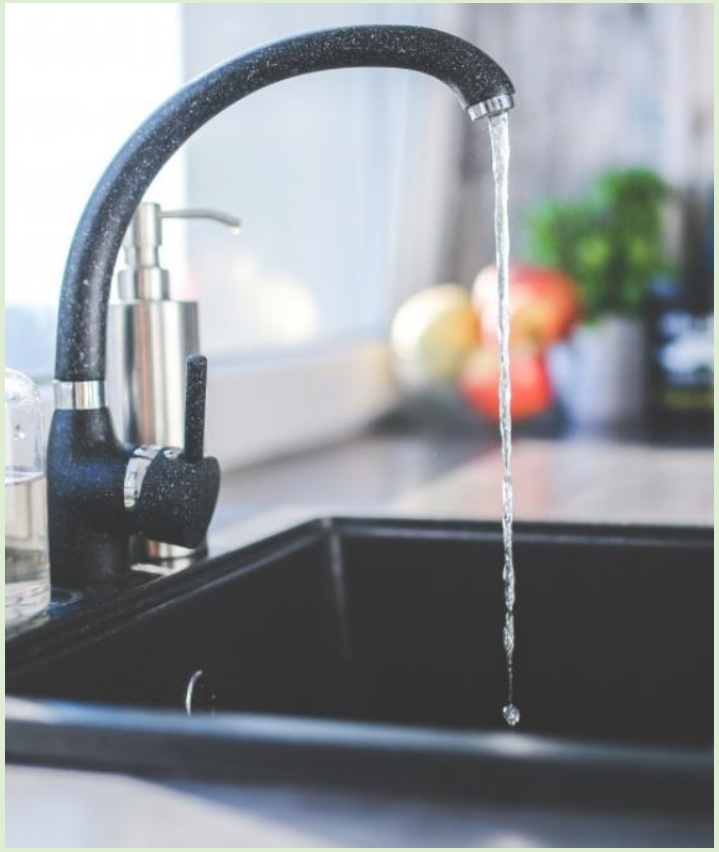

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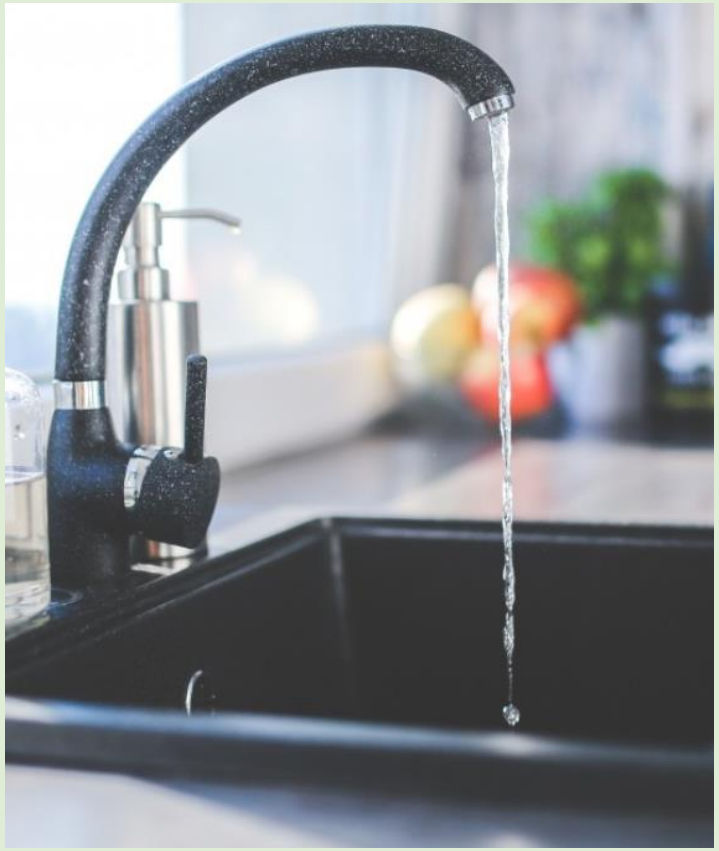

*NSF 53 Certified

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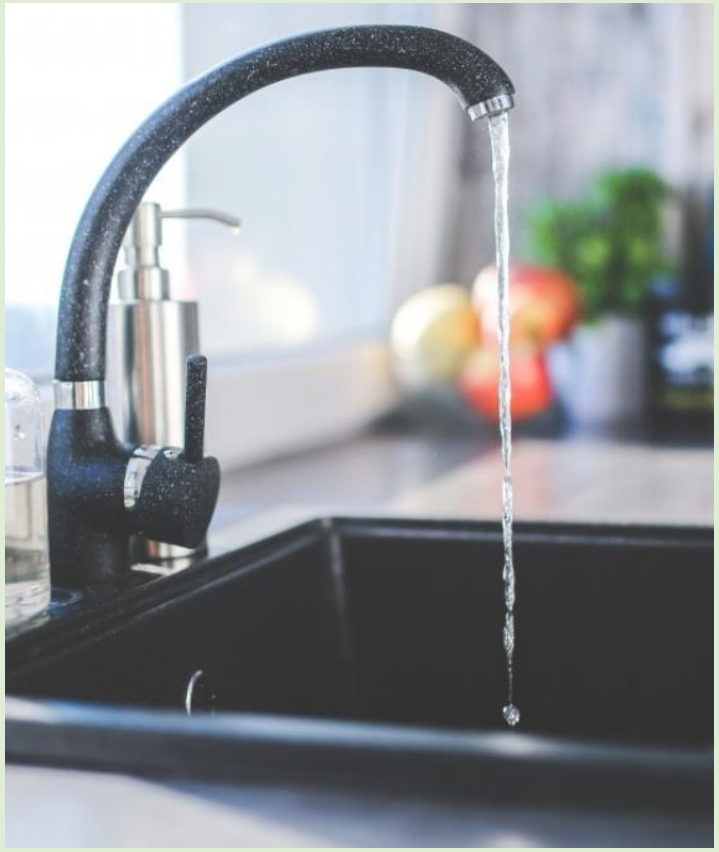

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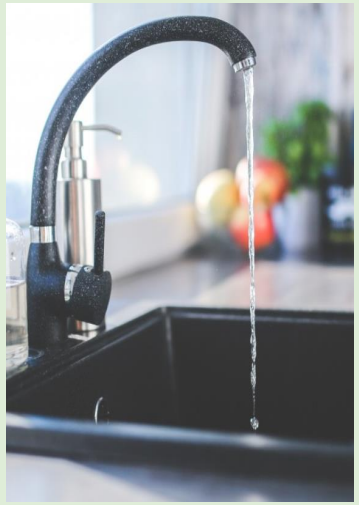
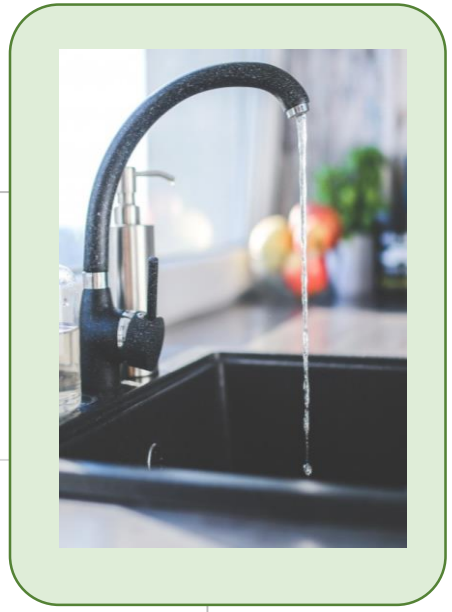
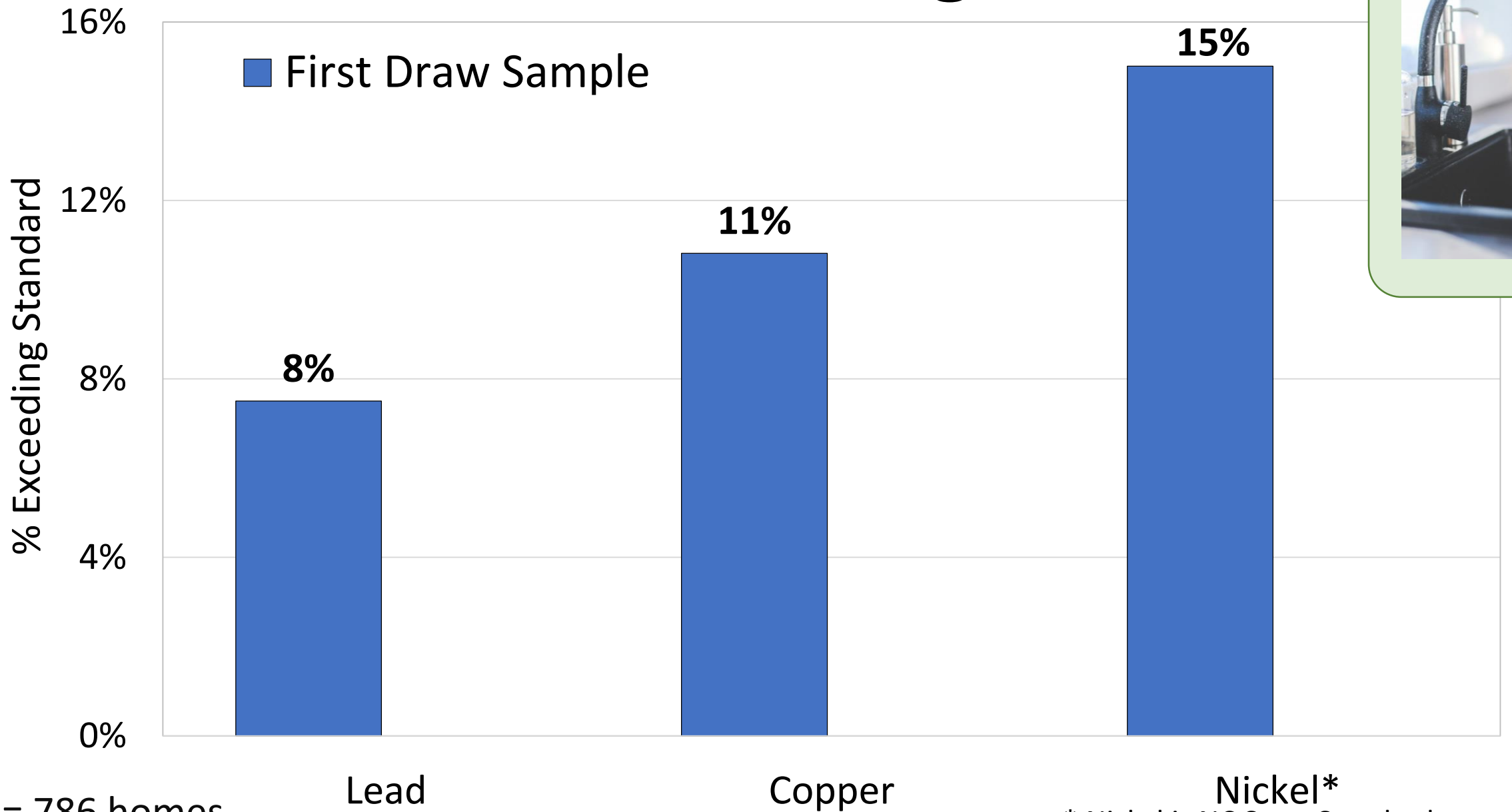
Flushing



Flushing

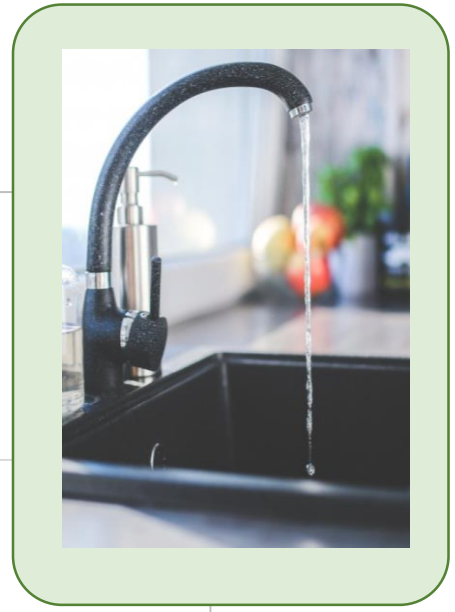


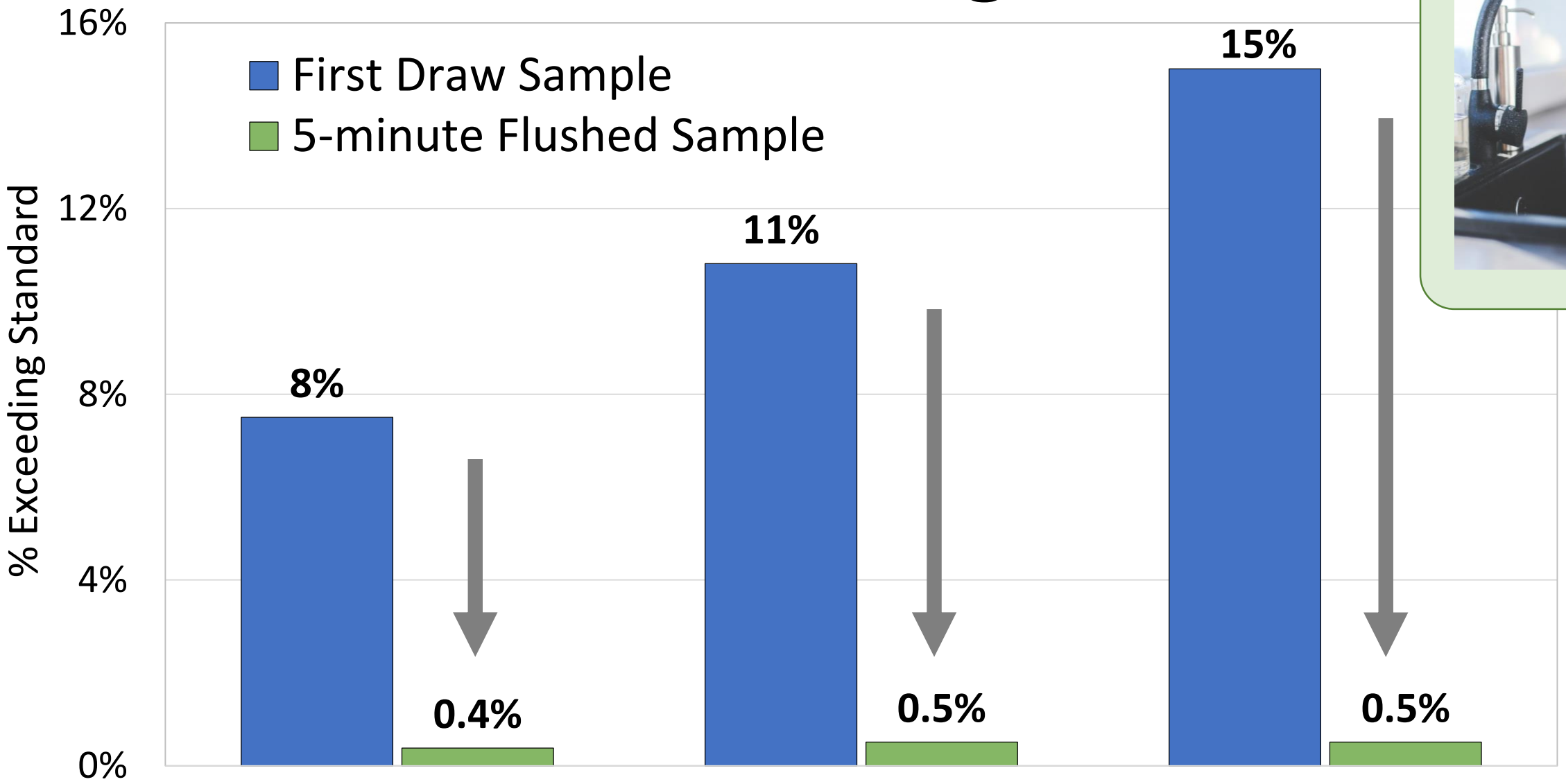


n= 786 homes

* Nickel is NC State Standard

Flushing





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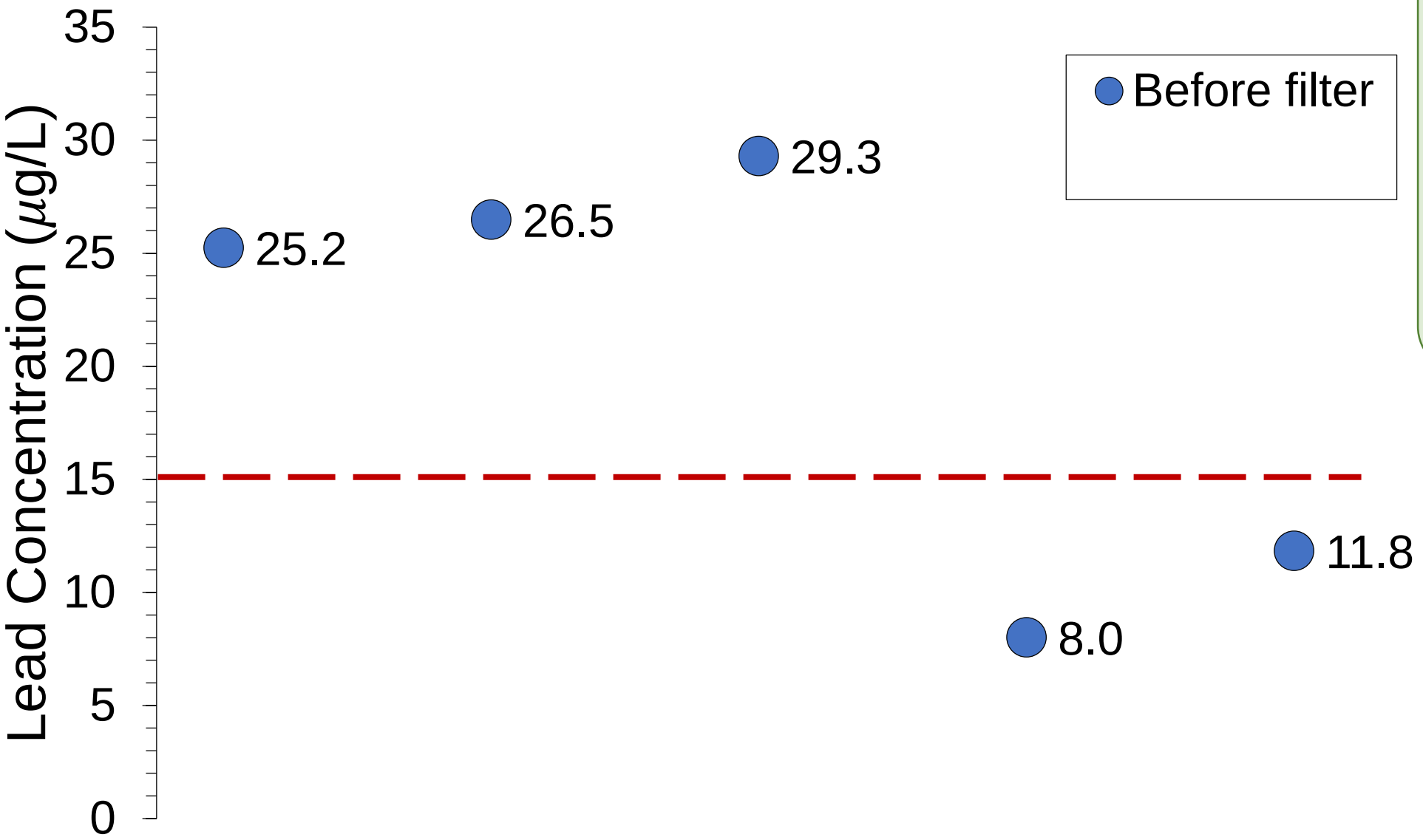
Lead removed by filter

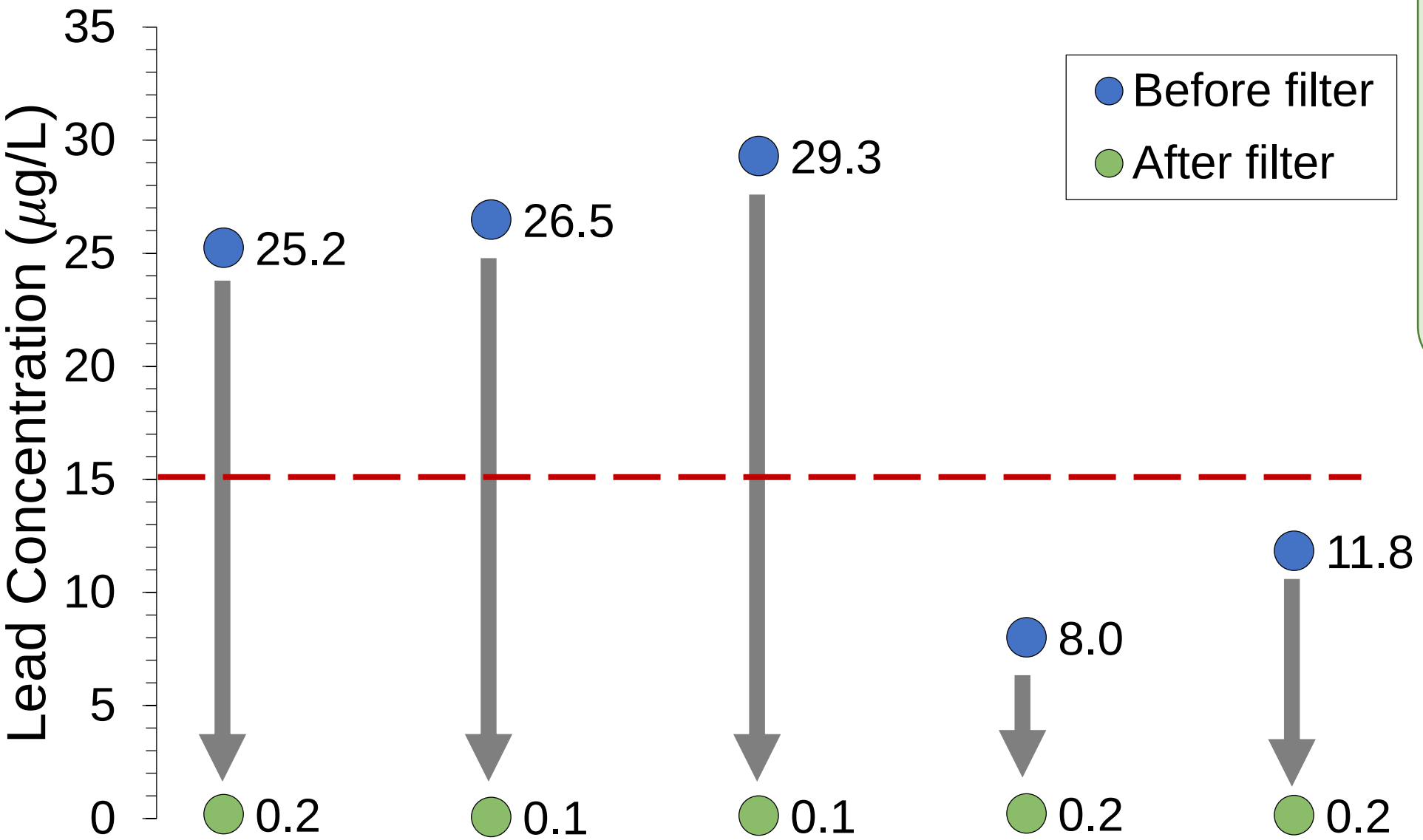
*NSF 53 Certified

Lead removed by filter



***NSF 53 Certified**

Lead removed by filter



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Sources of Potential Contaminants

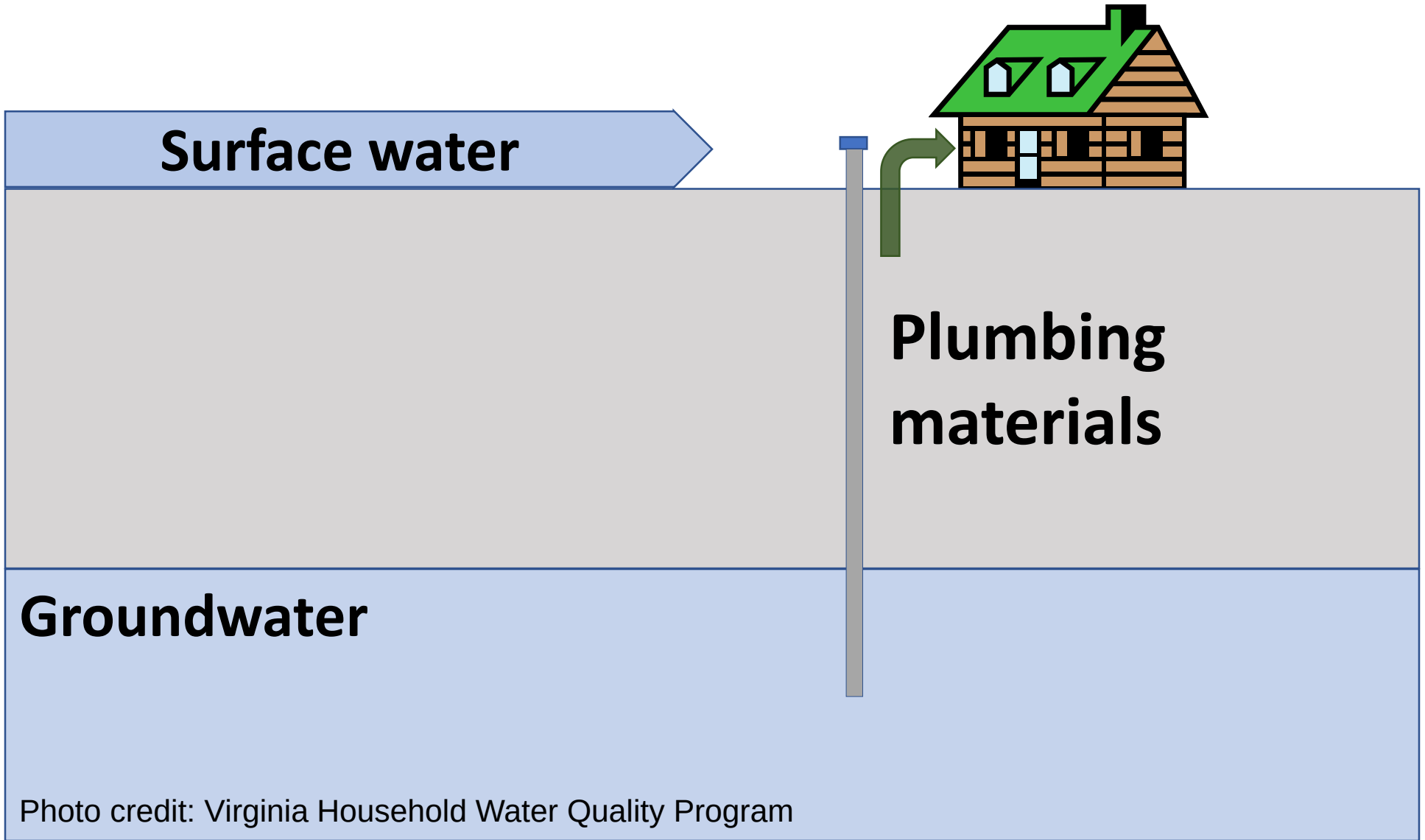
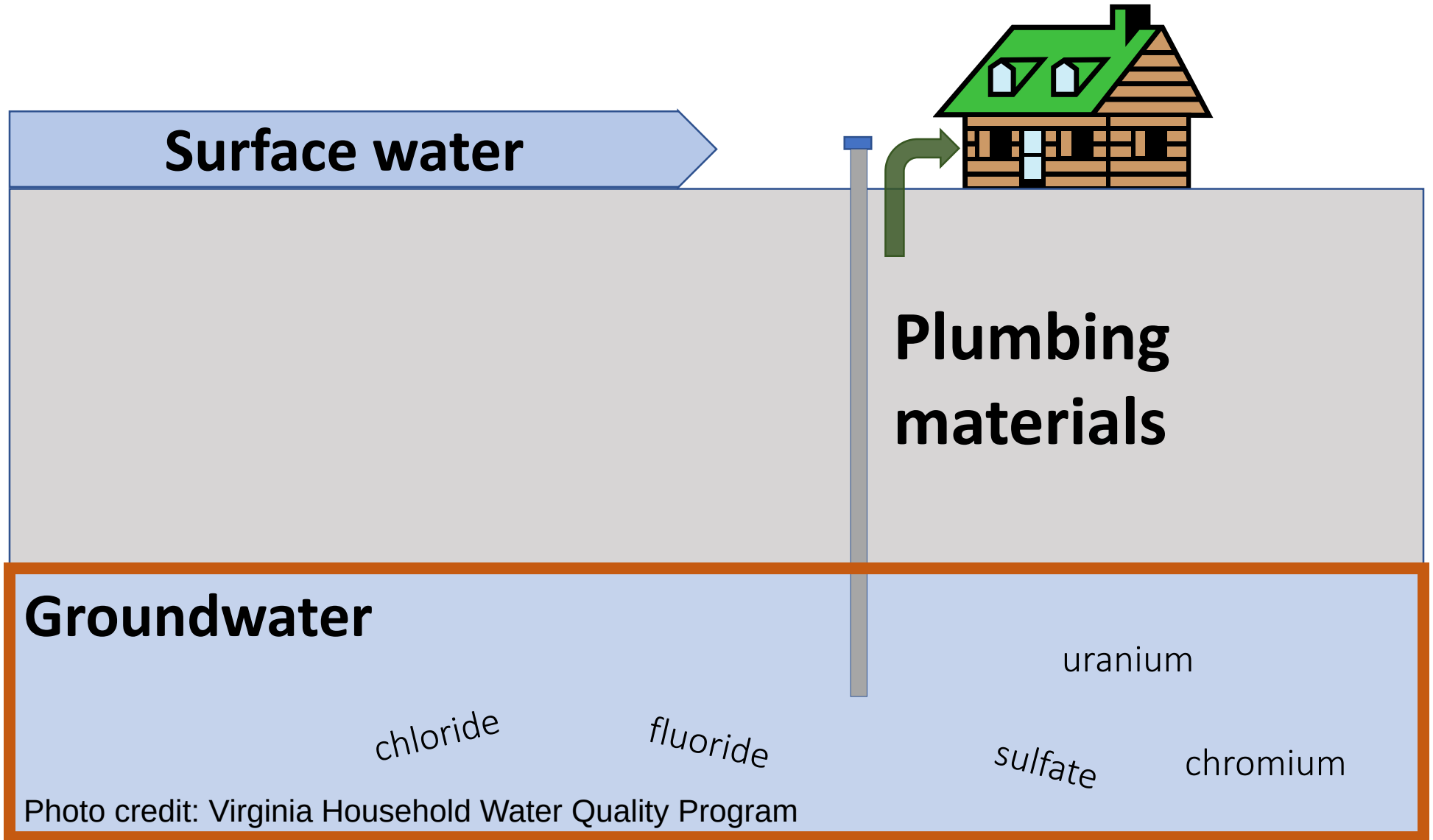


Photo credit: Virginia Household Water Quality Program

Sources of Potential Contaminants



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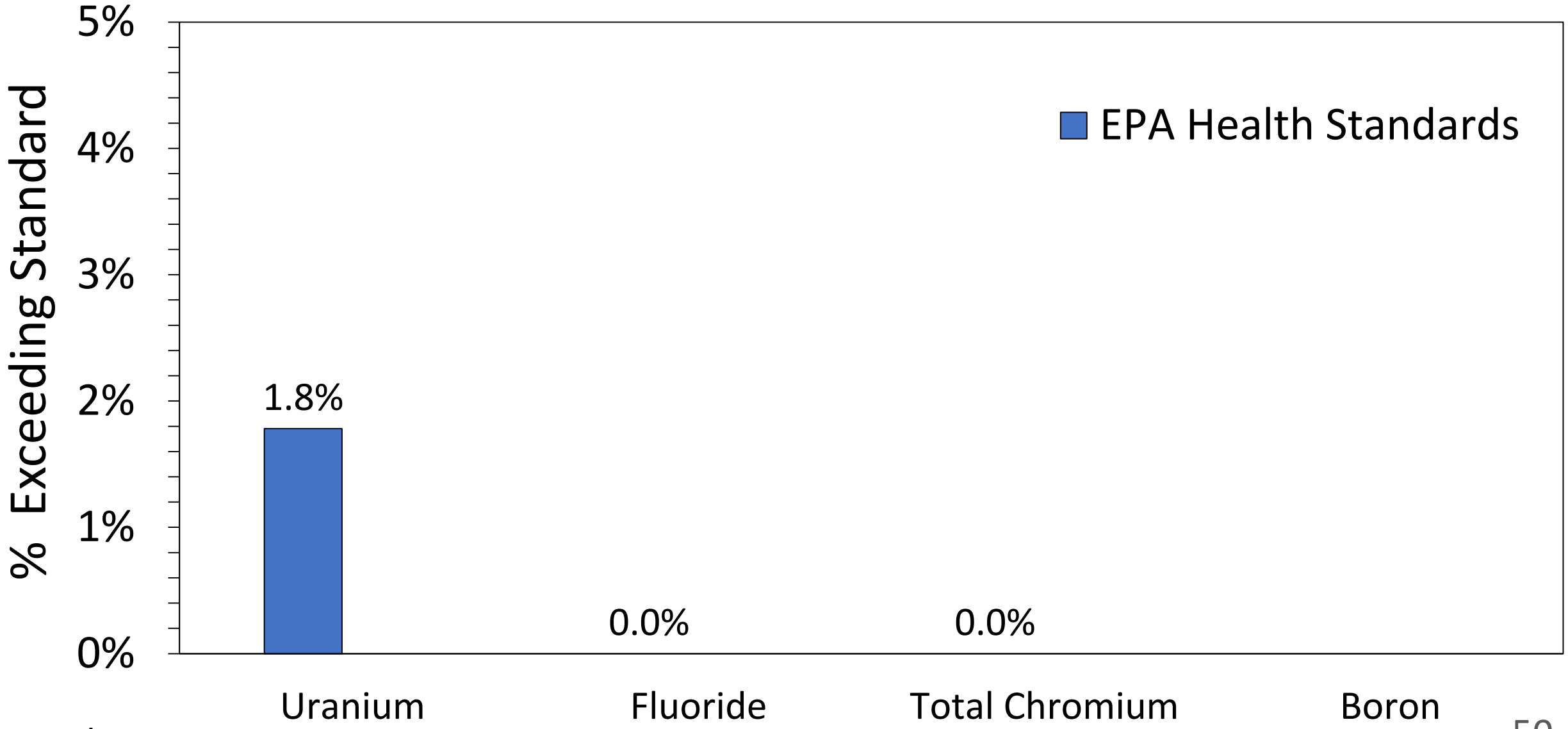
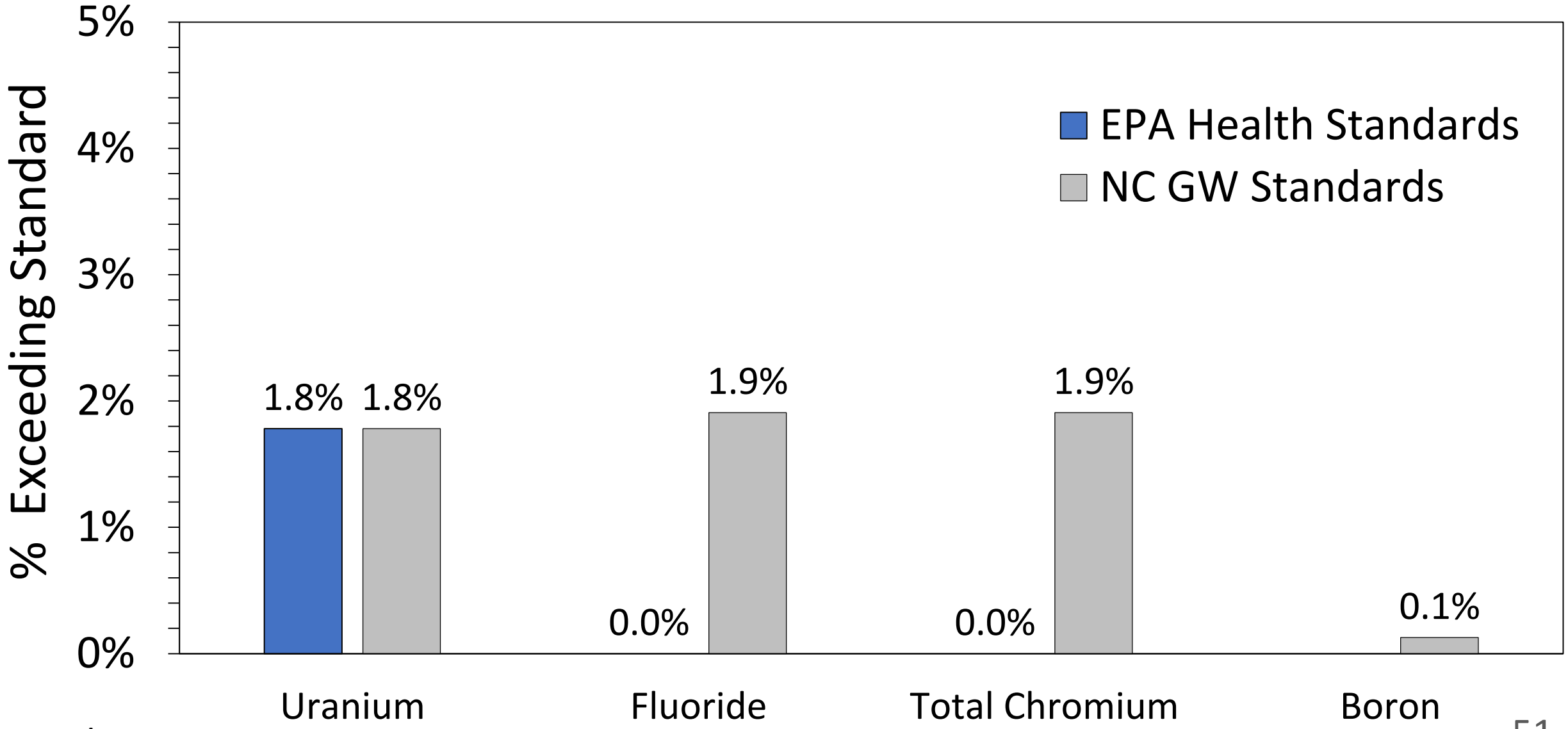
Few wells exceed EPA or NC regulations

Few wells exceed EPA or NC regulations



n= 786 homes

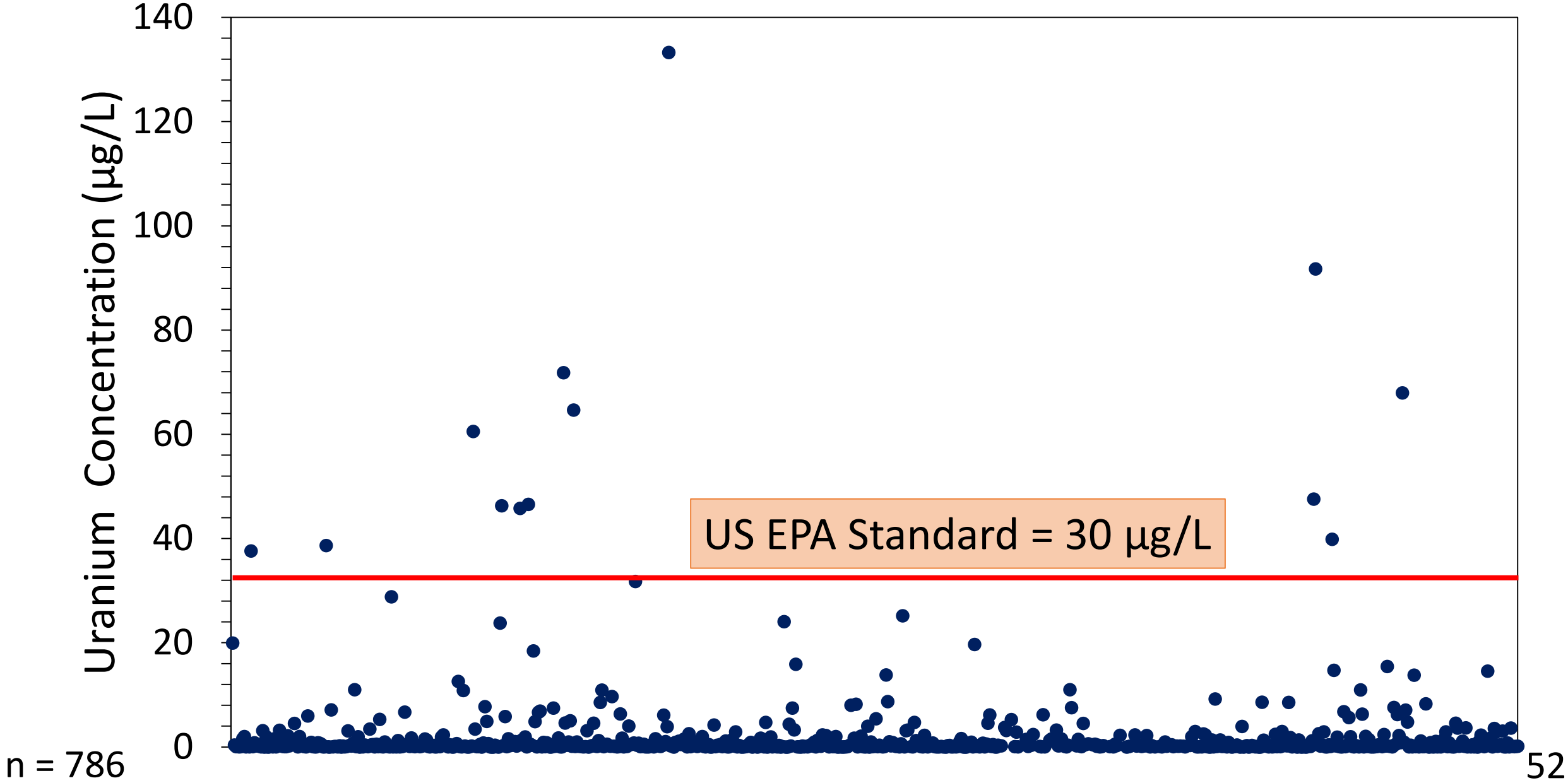
Few wells exceed EPA or NC regulations



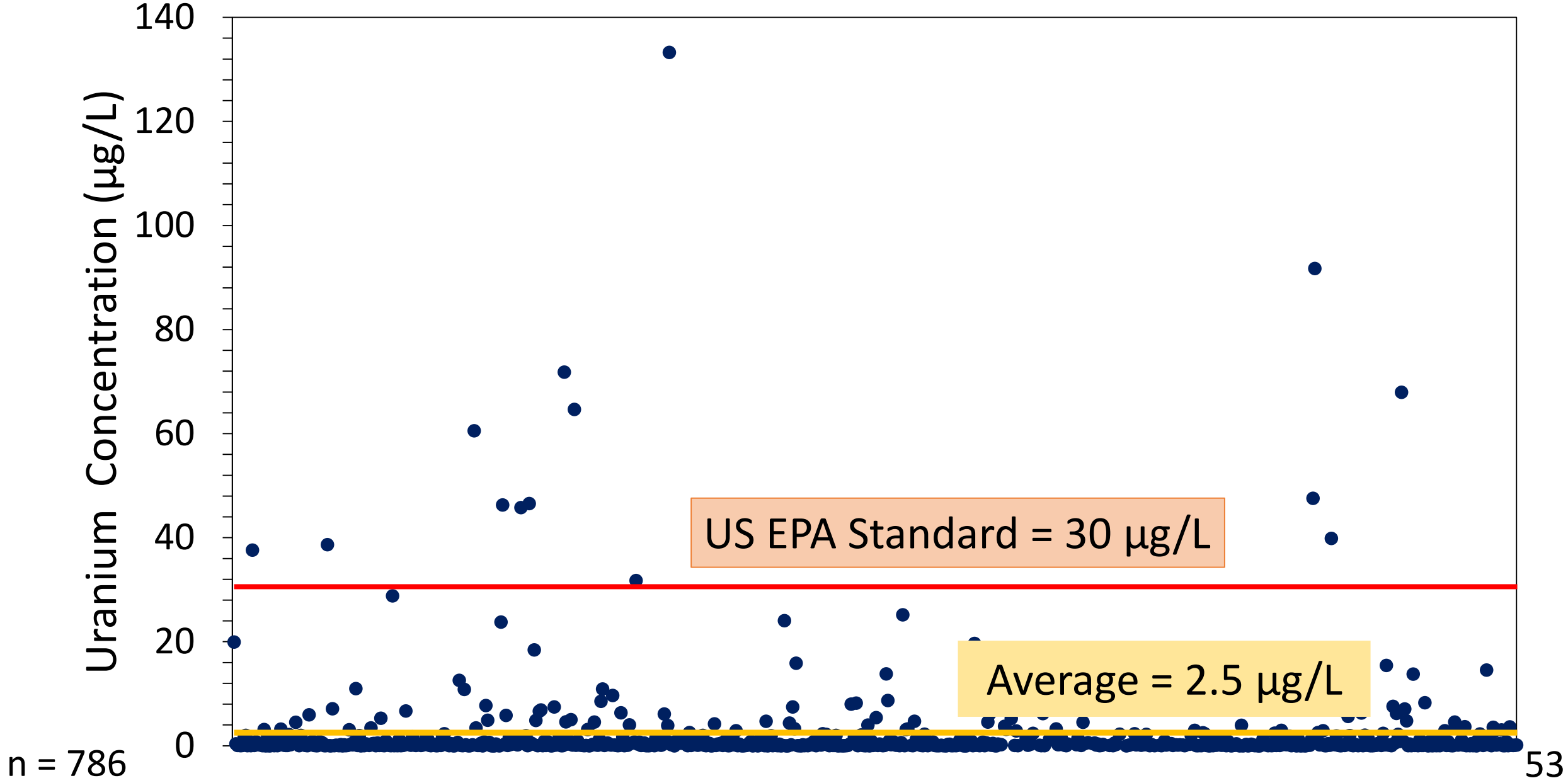
n= 786 homes

* Boron is NC State Standard

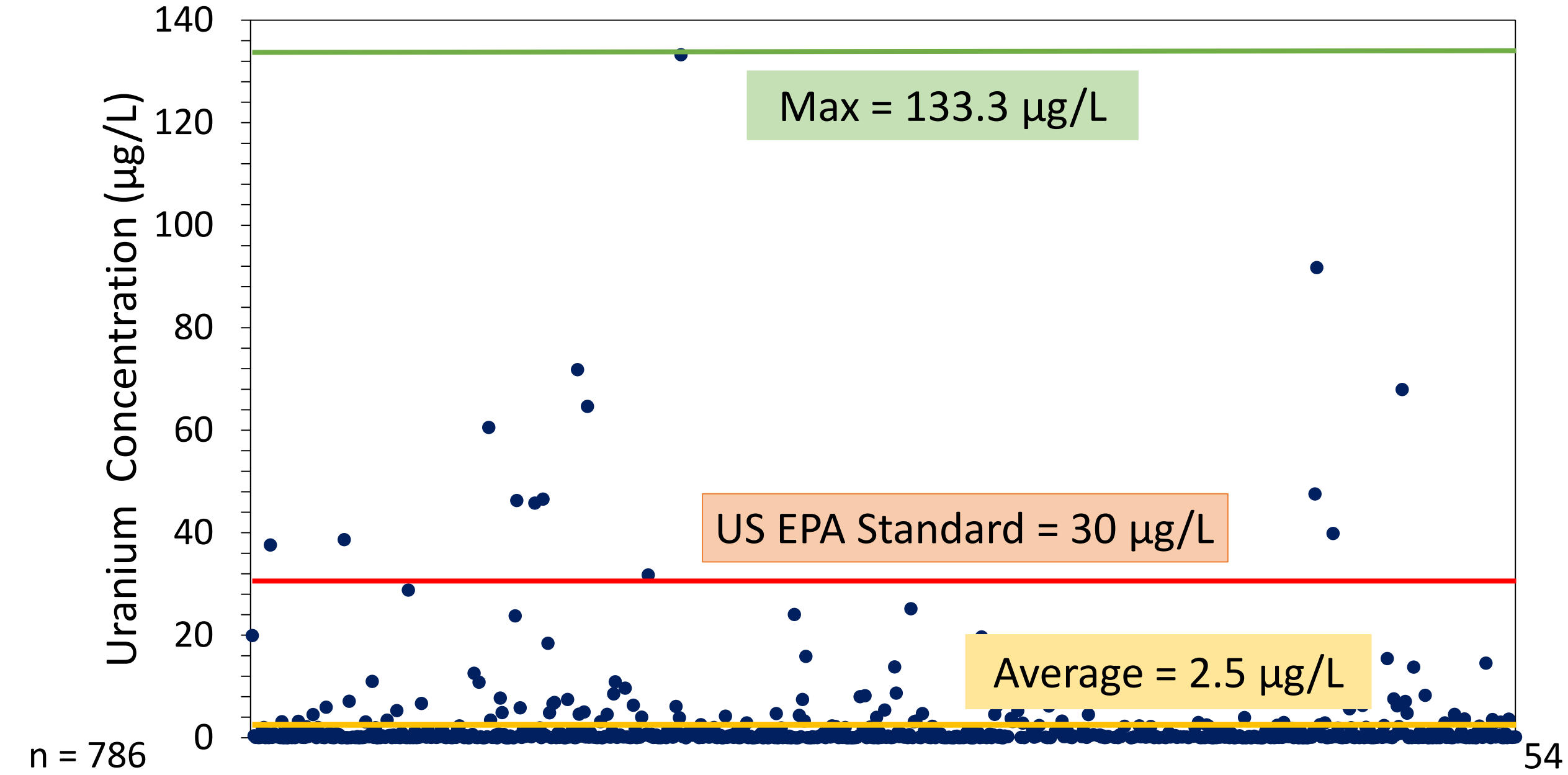
Uranium


Uranium Concentration (µg/L)
140
120
100
80
60
40
20
0
US EPA Standard = 30 µg/L
n = 786
52

Uranium


Uranium Concentration (µg/L)
140
120
100
80
60
40
20
0
US EPA Standard = 30 µg/L
Average = 2.5 µg/L
n = 786
53

Uranium

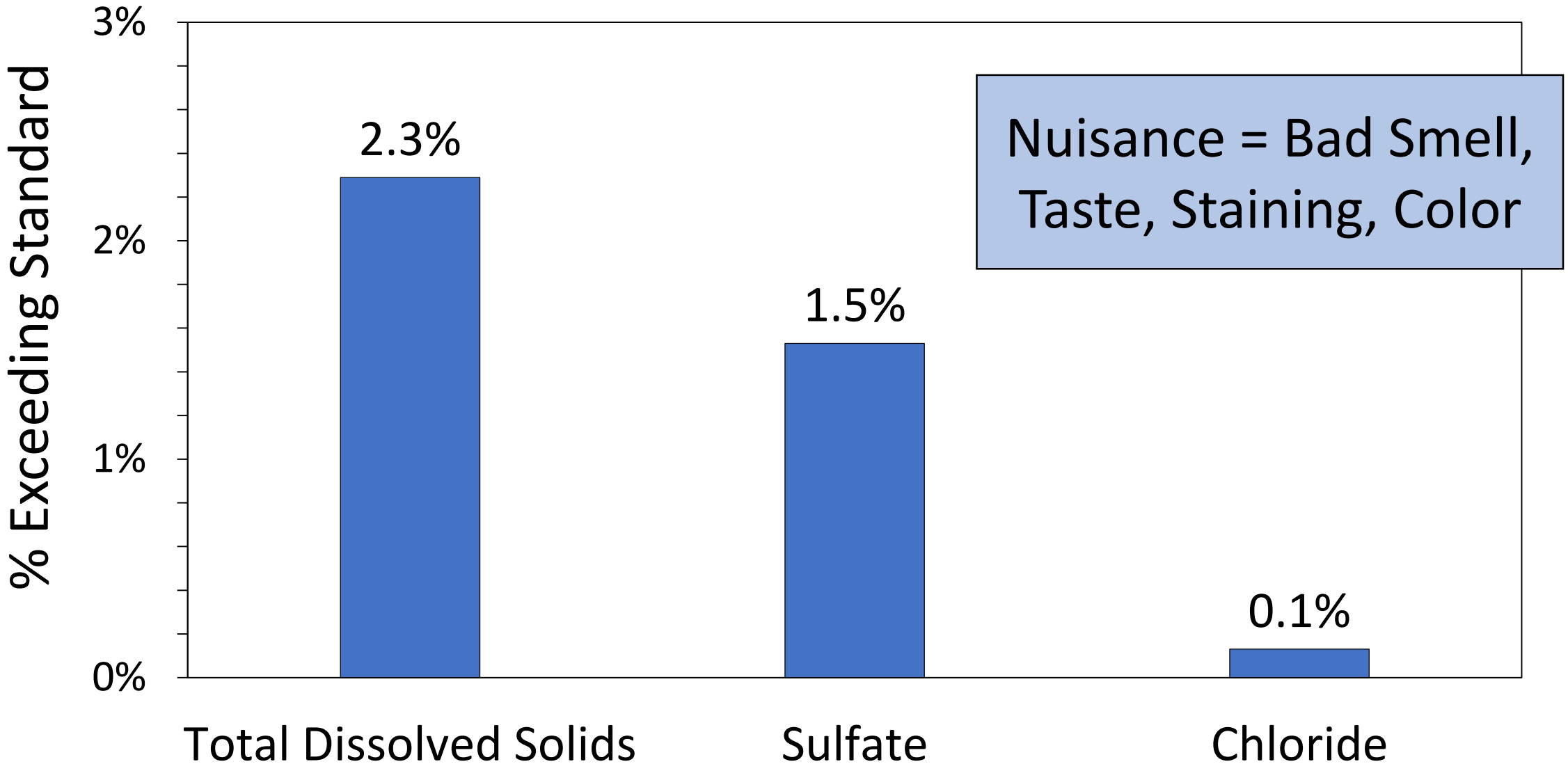

Uranium Concentration (µg/L)
140
120
100
80
60
40
20
0
Max = 133.3 µg/L
US EPA Standard = 30 µg/L
Average = 2.5 µg/L
n = 786
54

Few wells exceed nuisance based standards

Few wells exceed nuisance based standards

Nuisance = Bad Smell, Taste, Staining, Color

Few wells exceed nuisance based standards



n= 786 homes

Hexavalent Chromium (Chrome VI)

EPA

Total Chromium = 100 µg/L

Chrome VI = No health based standards

Hexavalent Chromium (Chrome VI)

EPA

Total Chromium = 100 µg/L

Chrome VI = No health based standards

NC

Total Chromium = 10 µg/L

Chrome VI = No regulatory standards

Hexavalent Chromium (Chrome VI)

EPA

Total Chromium = 100 µg/L

Chrome VI = No health based standards

NC

Total Chromium = 10 µg/L

Chrome VI = No regulatory standards

NC

Chrome VI Screening Level = 0.07 µg/L

Hexavalent Chromium (Chrome VI)

Data Source
School Survey (US state, not NC) (n = 141)
National Chrome VI Survey (n = 341)
Iredell Sampling Campaign (n = 786)
NCDHHS Well Database (n = 192)

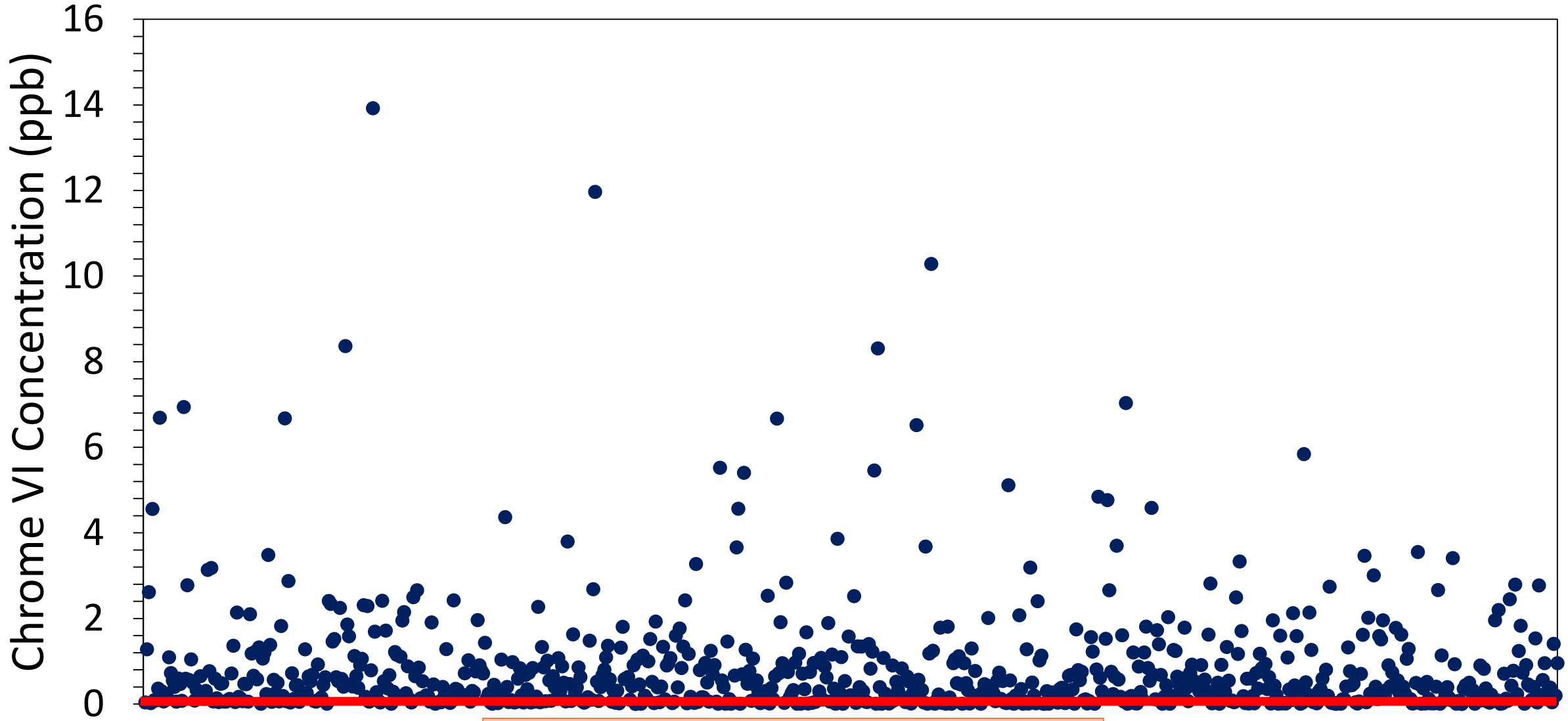
Hexavalent Chromium (Chrome VI)

Data Source	Average (µg/L)
School Survey (US state, not NC) (n = 141)	1.30
National Chrome VI Survey (n = 341)	1.08
Iredell Sampling Campaign (n = 786)	0.84
NCDHHS Well Database (n = 192)	0.64

Hexavalent Chromium (Chrome VI)

Data Source	Average (µg/L)	Maximum (µg/L)
School Survey (US state, not NC) (n = 141)	1.30	16.7
National Chrome VI Survey (n = 341)	1.08	52.6
Iredell Sampling Campaign (n = 786)	0.84	13.9
NCDHHS Well Database (n = 192)	0.64	12.3

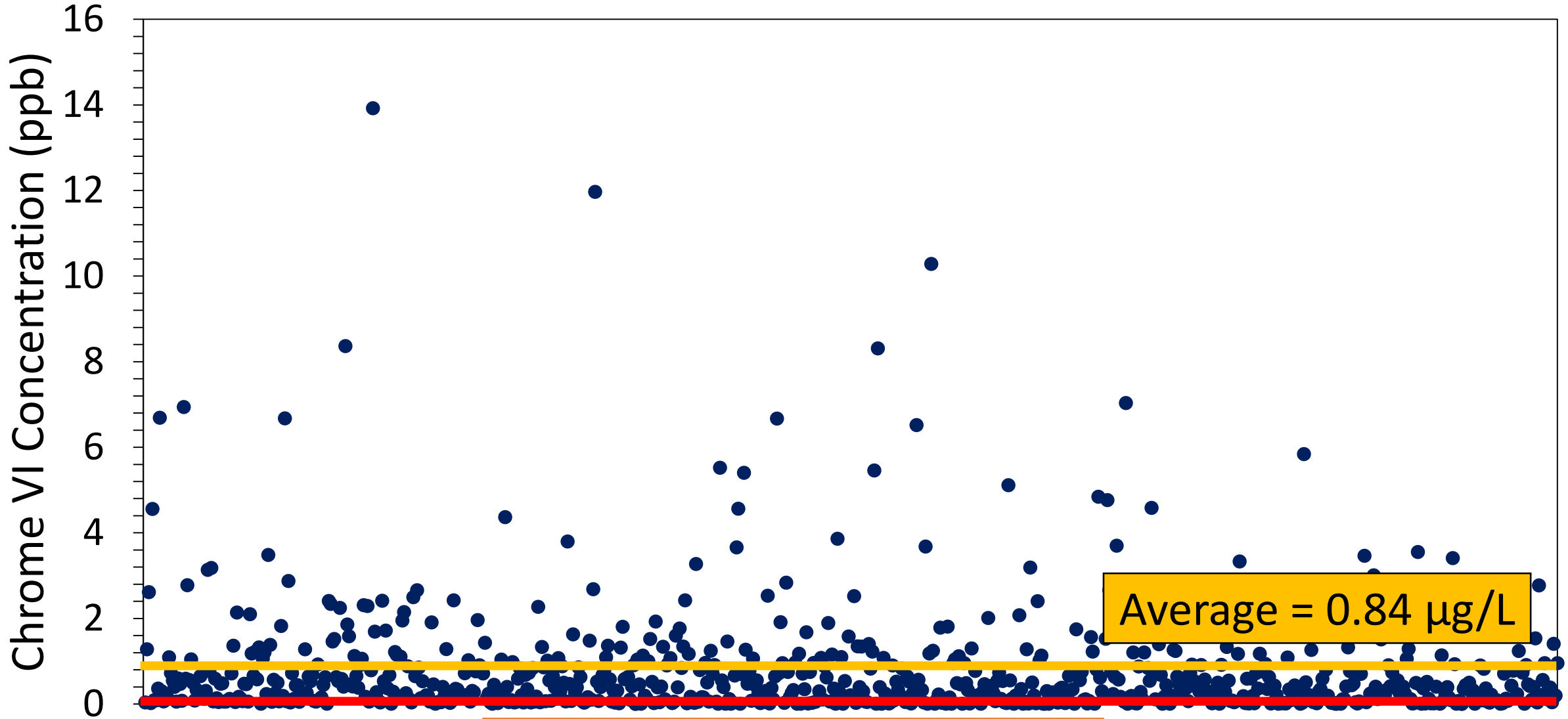
Hexavalent Chromium (Chrome VI)



DHHS health goal = 0.07 µg/L

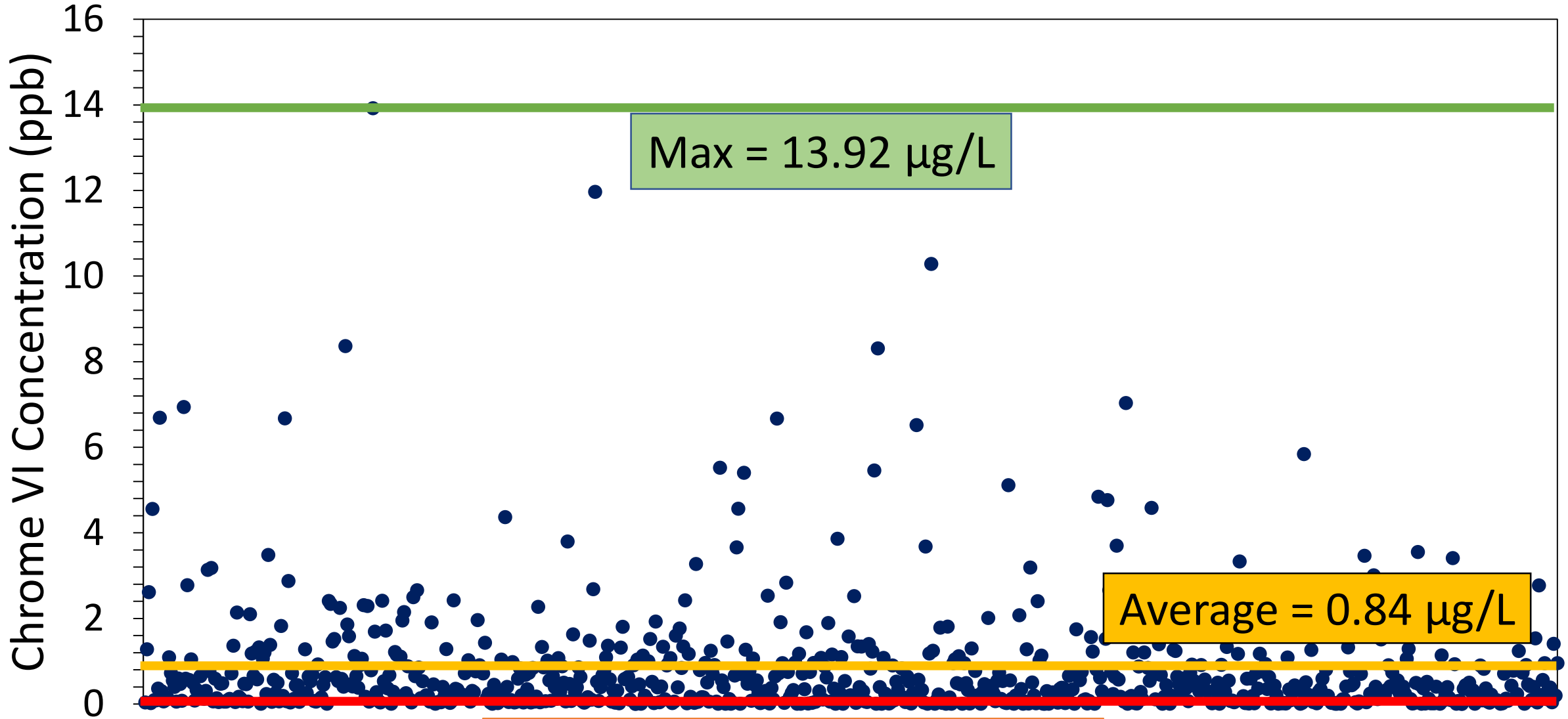
n= 786 homes

Hexavalent Chromium (Chrome VI)



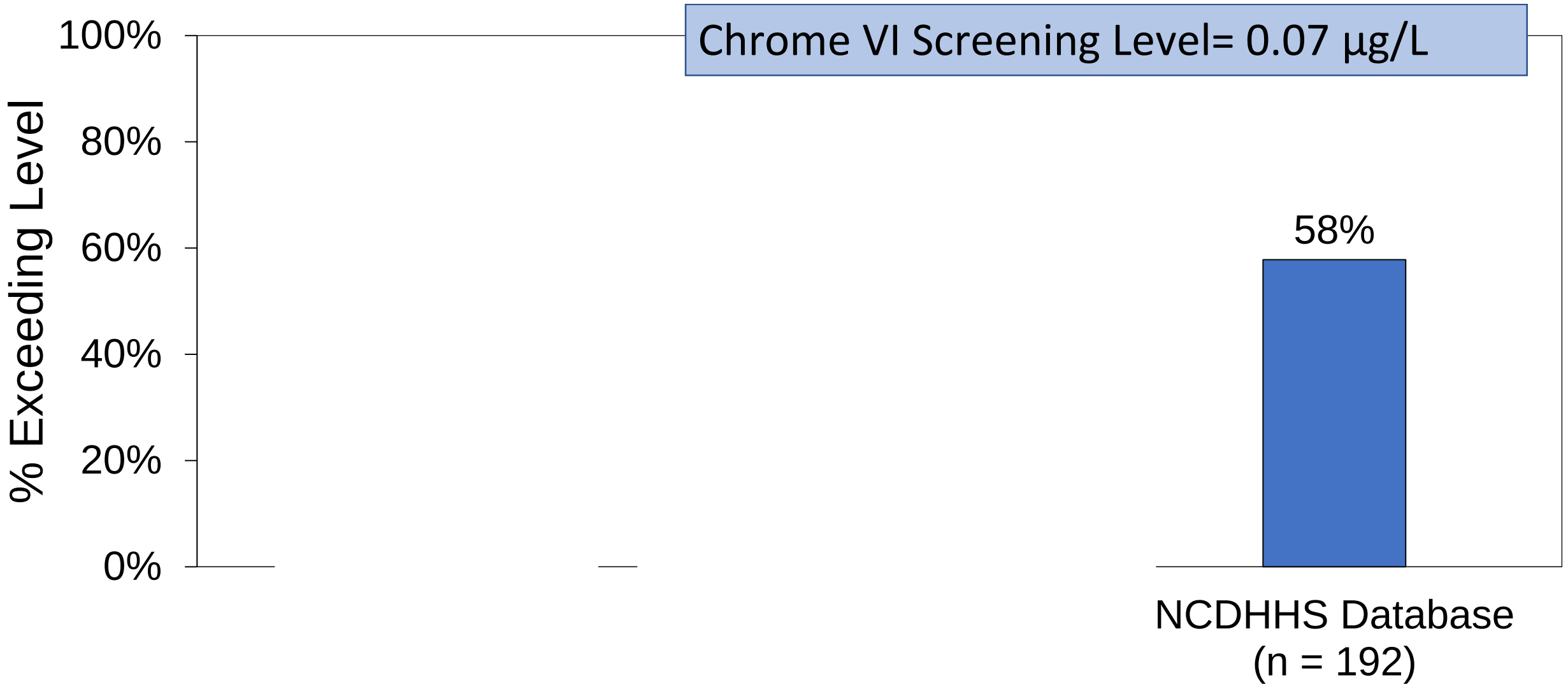
n= 786 homes

Hexavalent Chromium (Chrome VI)

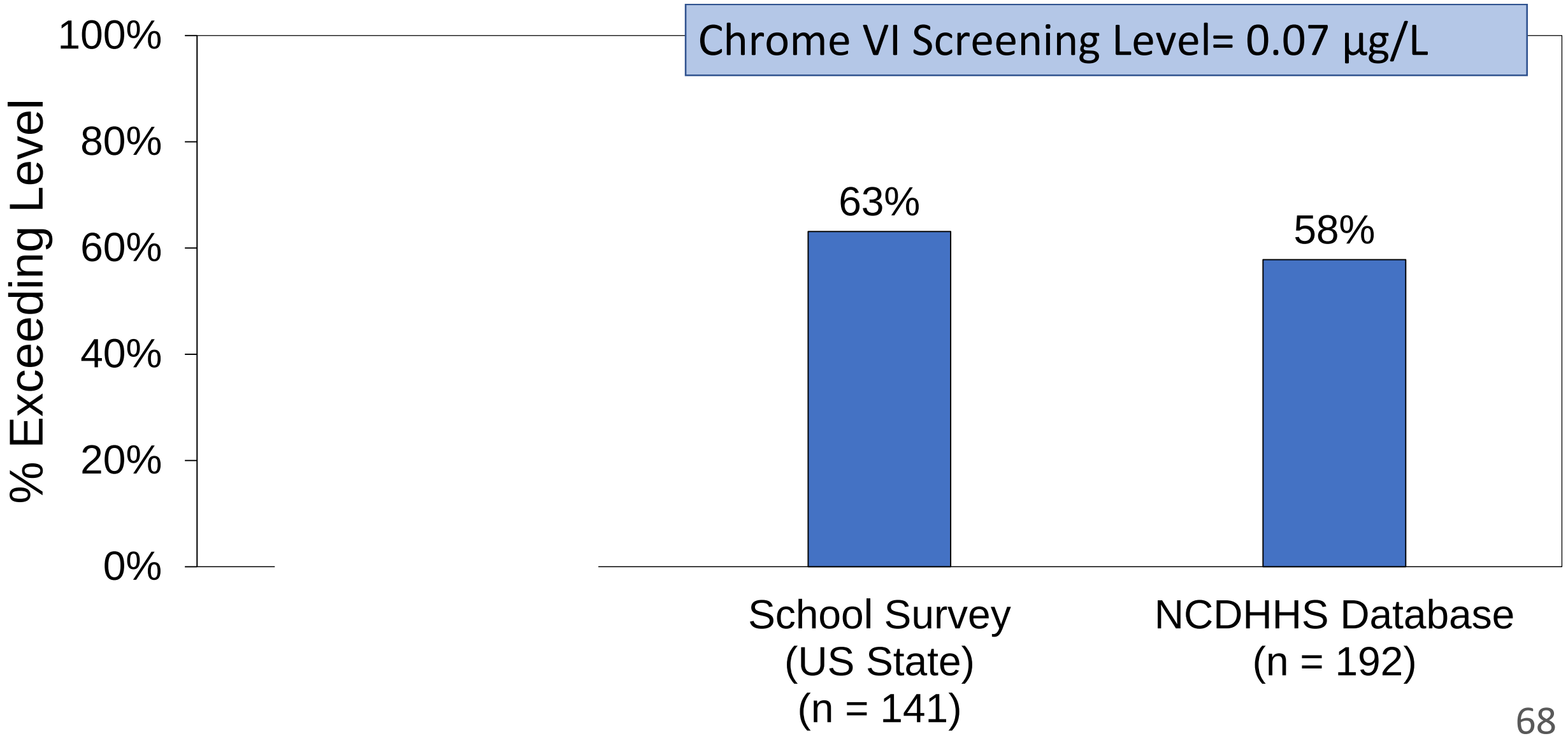


n= 786 homes

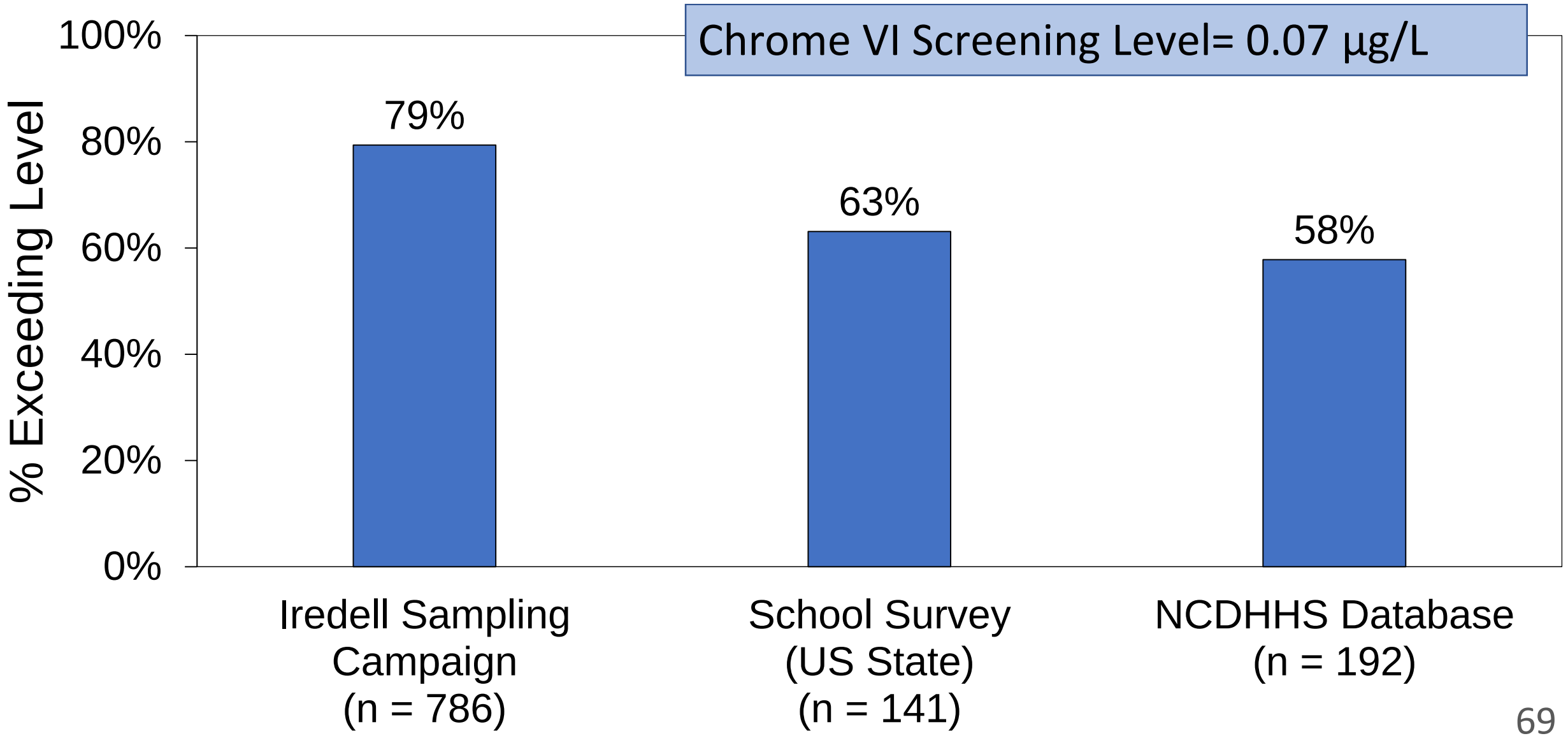
Hexavalent Chromium (Chrome VI) Screening Level



Hexavalent Chromium (Chrome VI) Screening Level



Hexavalent Chromium (Chrome VI) Screening Level



Vanadium

EPA

No regulatory standard

n= 786 homes

Vanadium

EPA	NC
No regulatory standard	No regulatory standard

n= 786 homes

Vanadium

EPA
No regulatory standard

NC
No regulatory standard

NC
Interim Maximum Allowable Concentration = 0.3 µg/L

n= 786 homes

Vanadium

Data Source	Average (µg/L)
Iredell Sampling Campaign (n = 786)	4.2
School Survey (US State, not NC) (n = 138)	4.9

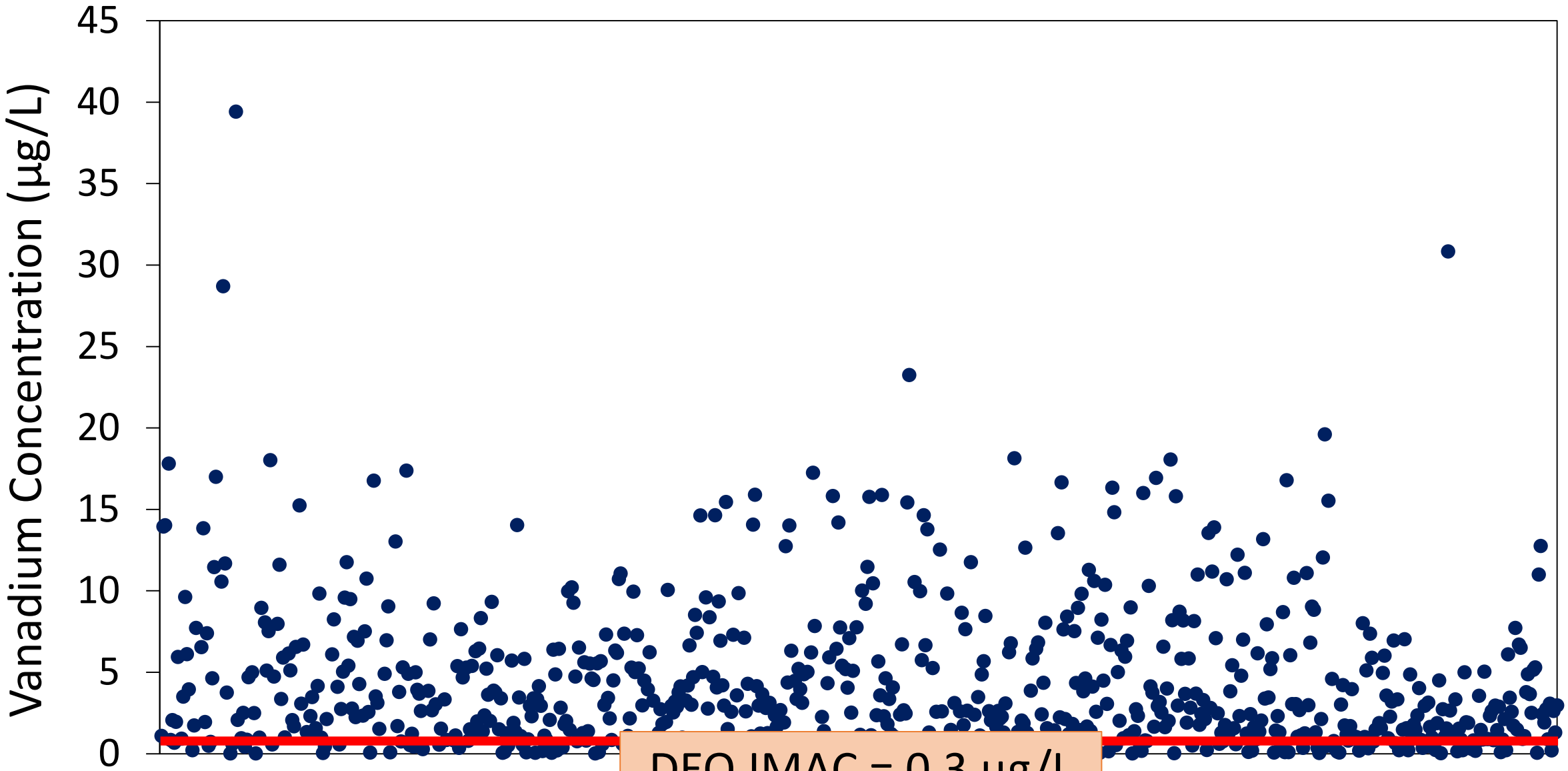
Vanadium

Data Source	Average (µg/L)	Maximum (µg/L)
Iredell Sampling Campaign (n = 786)	4.2	39.4
School Survey (US State, not NC) (n = 138)	4.9	47.7

Vanadium

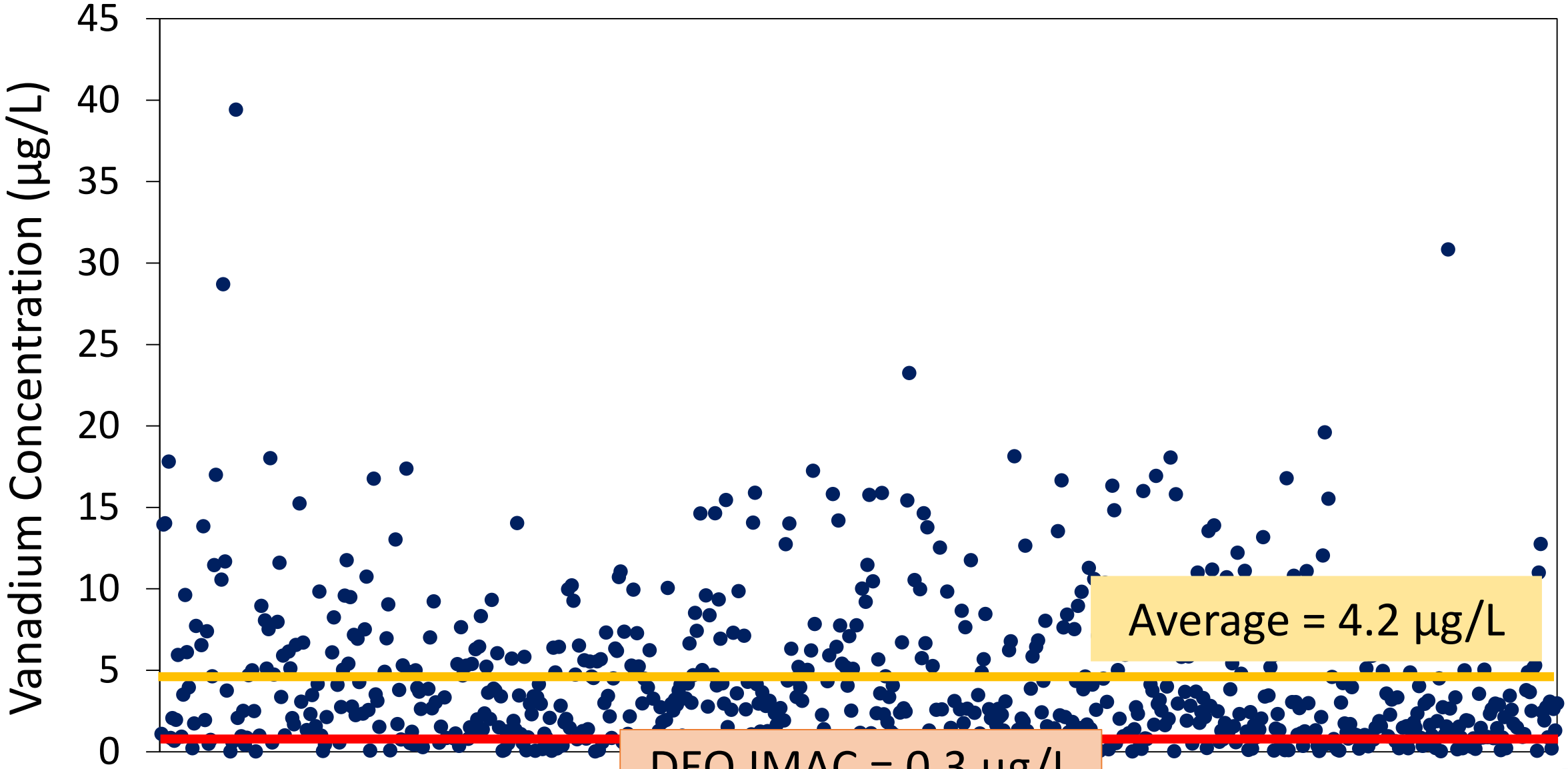
Data Source	Average (µg/L)	Maximum (µg/L)	Above 0.3 µg/L
Iredell Sampling Campaign (n = 786)	4.2	39.4	86.0%
School Survey (US State, not NC) (n = 138)	4.9	47.7	76.1%

Vanadium



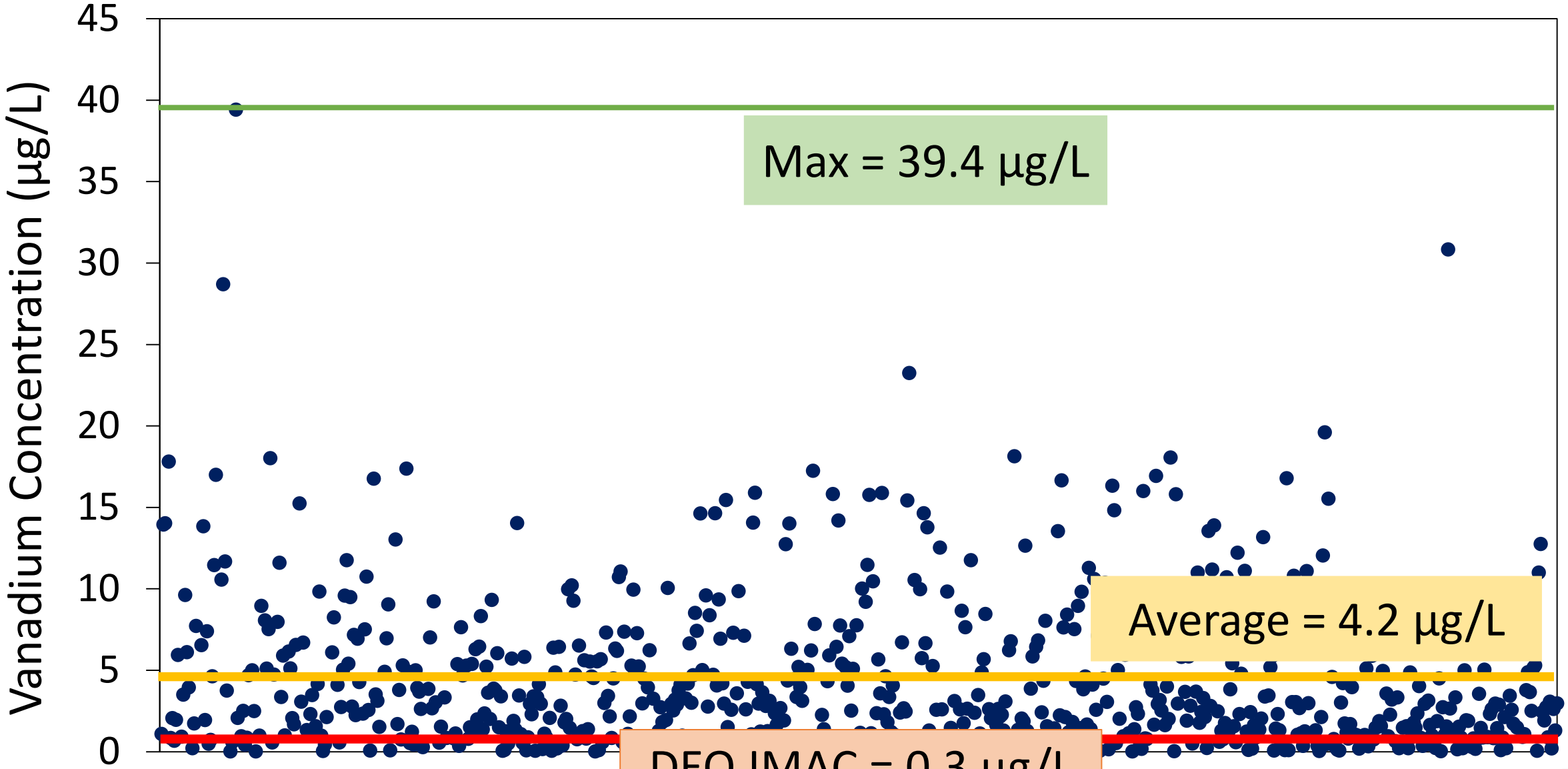
n= 786 homes

Vanadium



n= 786 homes

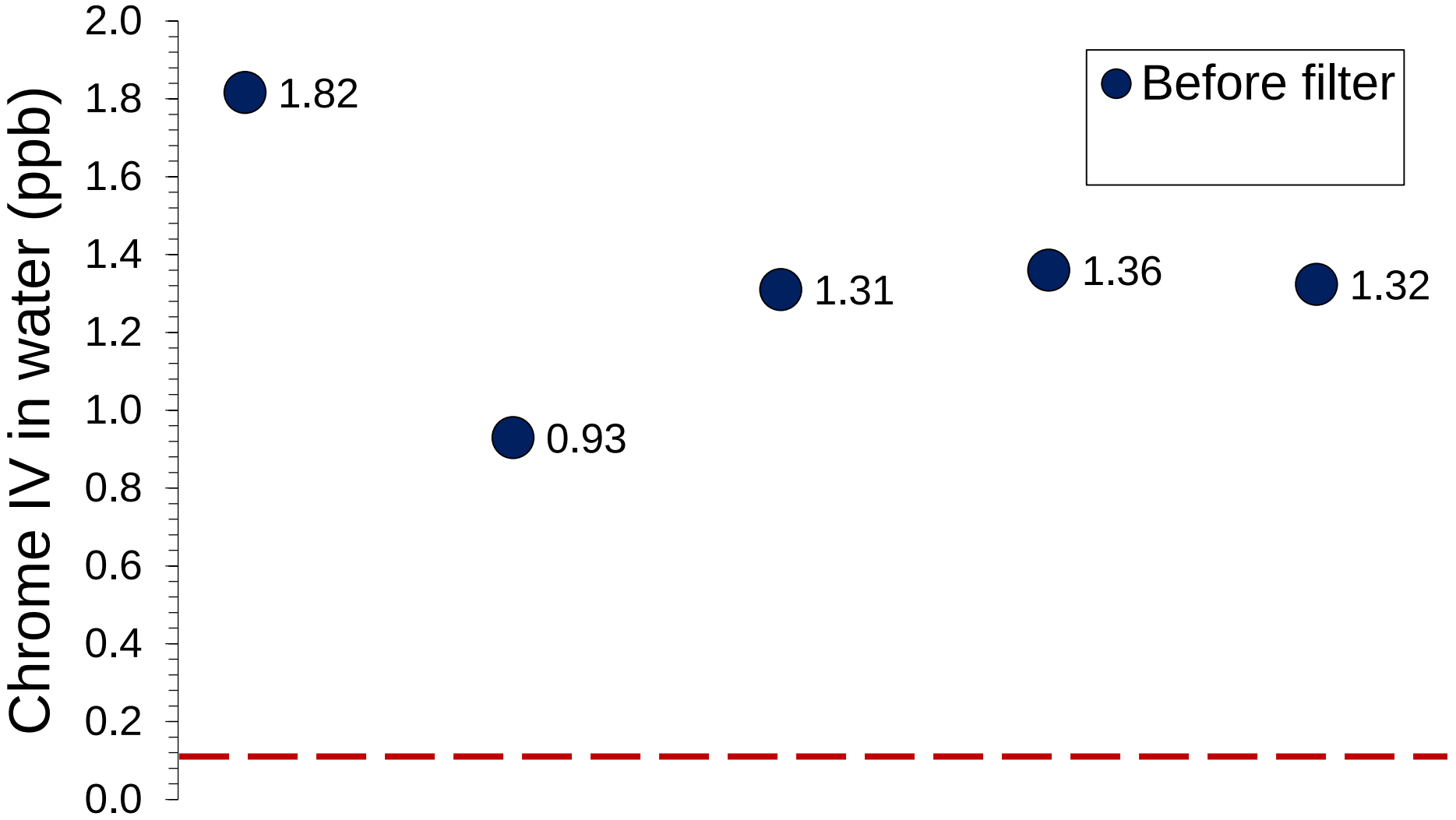
Vanadium



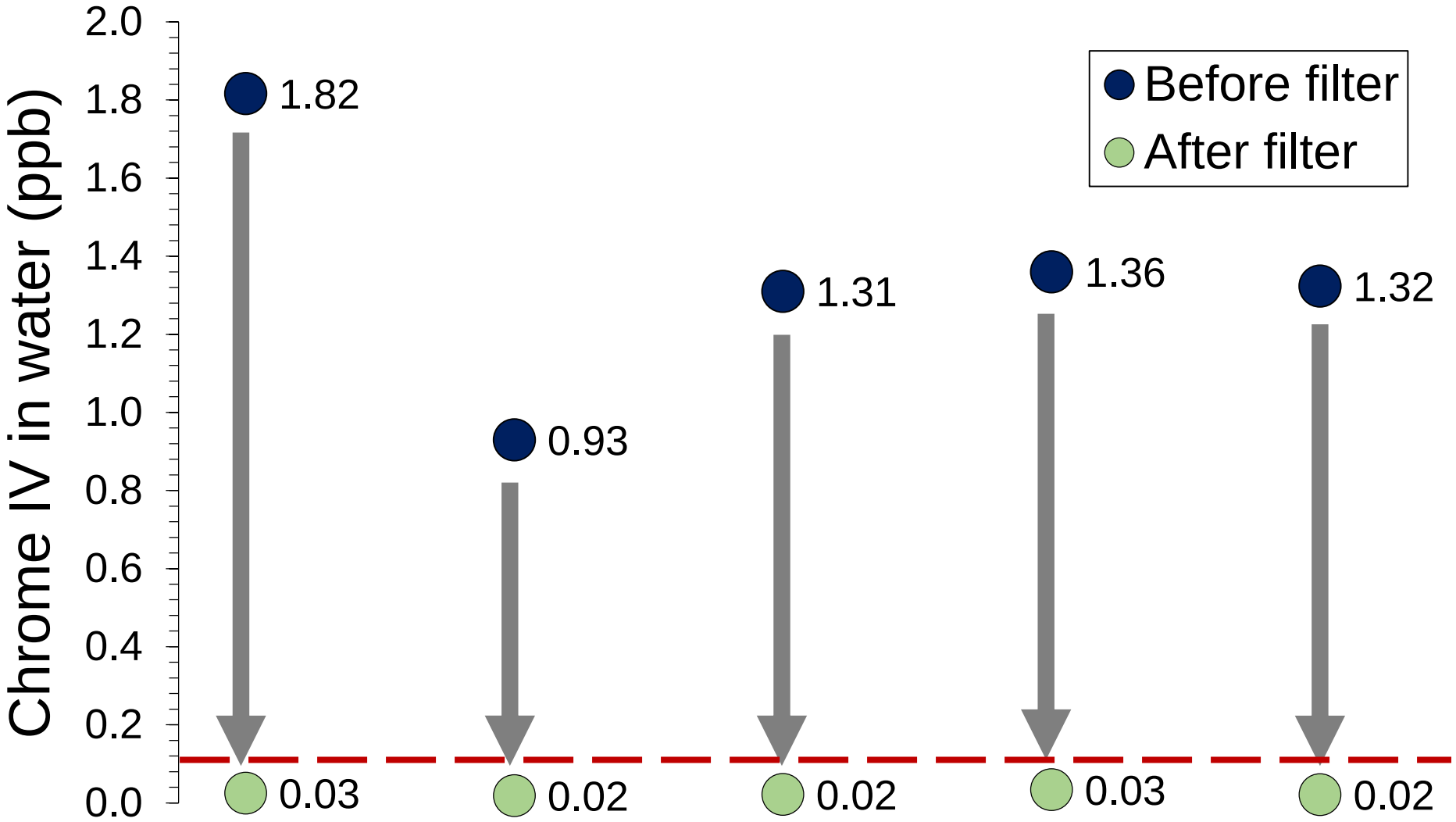
n= 786 homes

Hexavalent chromium (Chrome VI) removed by filter

Hexavalent chromium (Chrome VI) removed by filter



Hexavalent chromium (Chrome VI) removed by filter



Drinking Water Treatment

Wilson Mize, R.E.H.S.
Environmental Health Regional Specialist
On-Site Water Protection Branch

Sources of Potential Contaminants

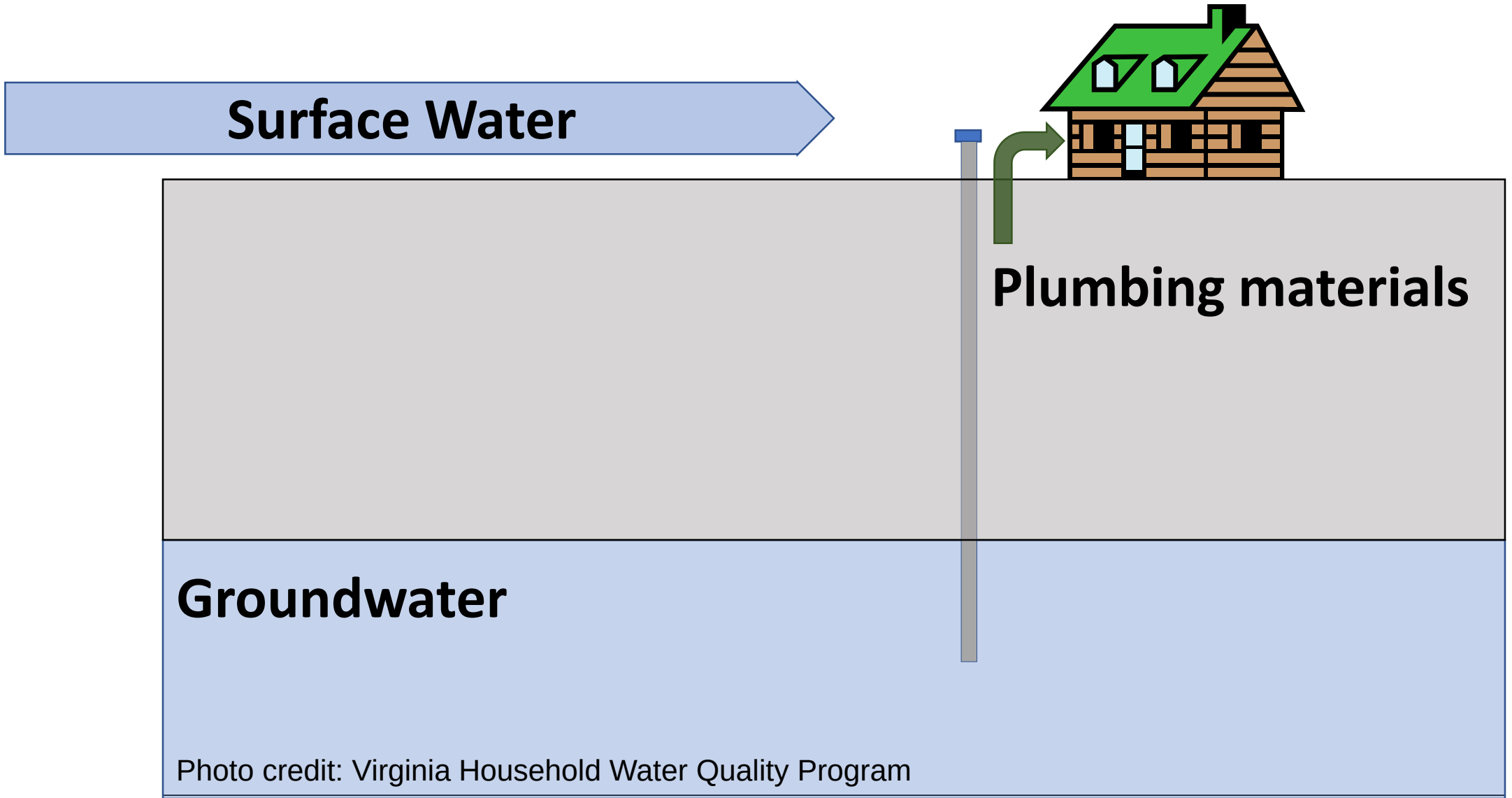


Photo credit: Virginia Household Water Quality Program

Treat water at the kitchen tap

Treat water in the whole house

Physical treatment

Chemical treatment

Alternative source

Treatment options for corrosion problems

Flushing for 1 min.

NSF 53 carbon filter

Reverse Osmosis

Treatment options for uranium

Reverse Osmosis

Anion Exchange

Treatment options for chromium VI

ZeroWater™ pitcher filter (anion exchange)

Reverse Osmosis

Anion exchange

Treatment options for vanadium

- Ion exchange has been shown to remove vanadium from groundwater
  - Not NFS approved at this time

Ion exchange

Recommendations:

- Contact a minimum of 3 water treatment specialists/companies
- Explain or provide water sample results
- Compare pricing and recommended systems!

Do your homework!

- You can find out if a particular product is certified to perform as advertised by visiting: www.nsf.org

- Test and certify drinking water treatment equipment.

Please send us your questions

Website: pollEV.com/iredell
Text: IREDELL to 22333

Virginia Tech: Marc Edwards and Kelsey Pieper

UNC: Kathleen Gray and Andrew George

Iredell Health Department: Jane Hinson, Susan Robertson, Brady Freeman

Department of Health and Human Services: Nancy Deal, Wilson Mize, John Brooks, Virginia Guidry, Kennedy Holt

Department of Environmental Quality: Linda Culpepper, Brandy Costner, Ellen Lorscheider, Mercedes Hernandez