

Flint Water Press Conference

December 2, 2016



Virginia Tech
Invent the Future

Flint Hospital 2015 vs. 2016

What a difference a year makes.....



2015: Flint River without Corrosion Control



2016: Detroit Water with Enhanced Corrosion Control

Photographs: Zhu "Joyce" Ni, Min Tang, Pan Ji, Mariah Gnegy

1) Fourth round of lead in water testing
(led by Ms. LeeAnne Walters, Flint residents and
funded by EPA)

2) A special study of Legionella and Shigella testing
(led by William Rhoads and funded by the State of
Michigan)

3) Fourth round of disinfection by-product testing
(led by Dr. Susan D. Richardson, a team at the
University of South Carolina and funded by the EPA)

Flint resident sampling: August 2015 - November 2016

Min Tang, Kelsey Pieper
and Marc Edwards



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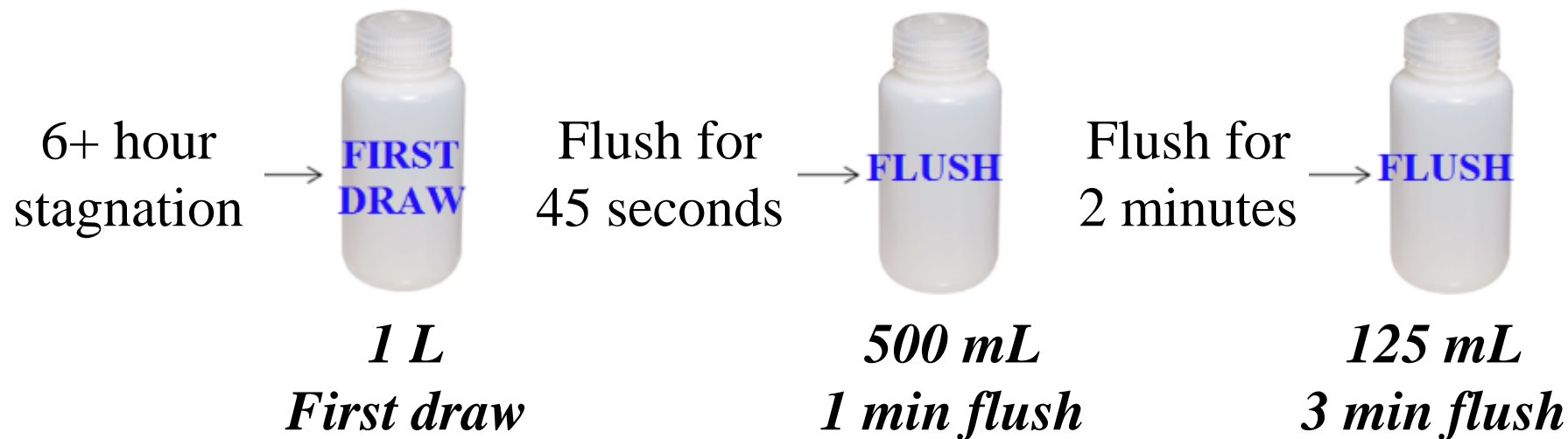
Sampling in November 2016

Sampling organized by LeeAnne Walters and the Flint citizen science team



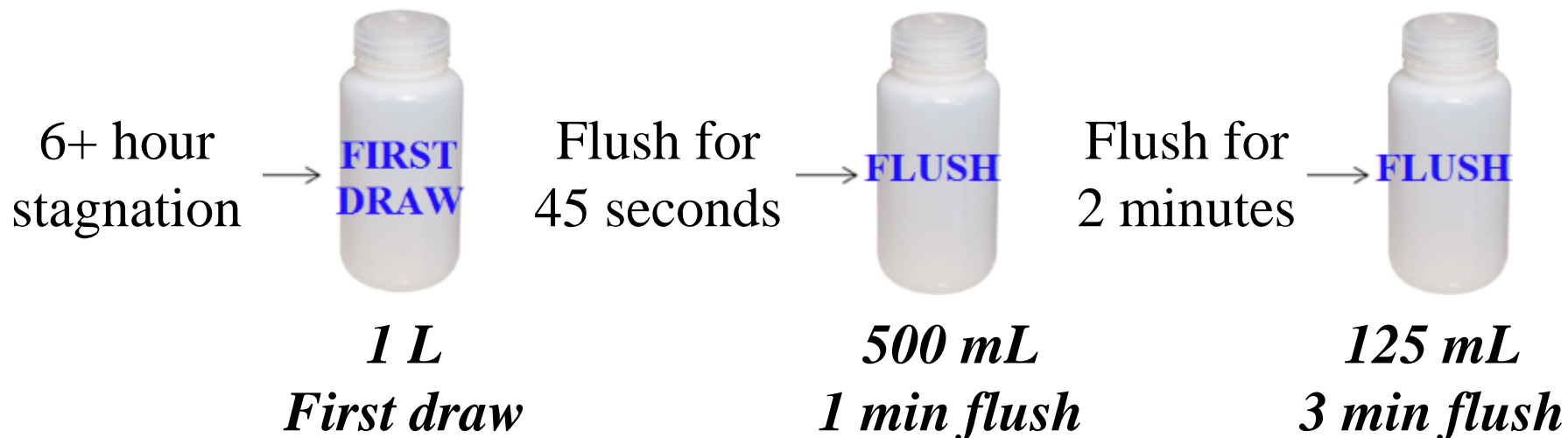
Sampling protocol

Collected water samples from a cold water tap that is **used for drinking water**



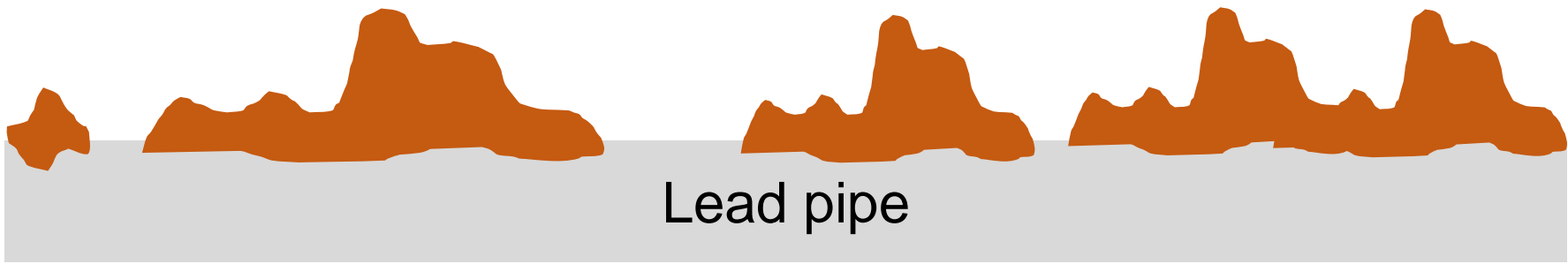
Sampling protocol

*154 homes participated
in all 4 sampling efforts*



April 2014: Flint discontinued corrosion control

Water flow without corrosion inhibitors

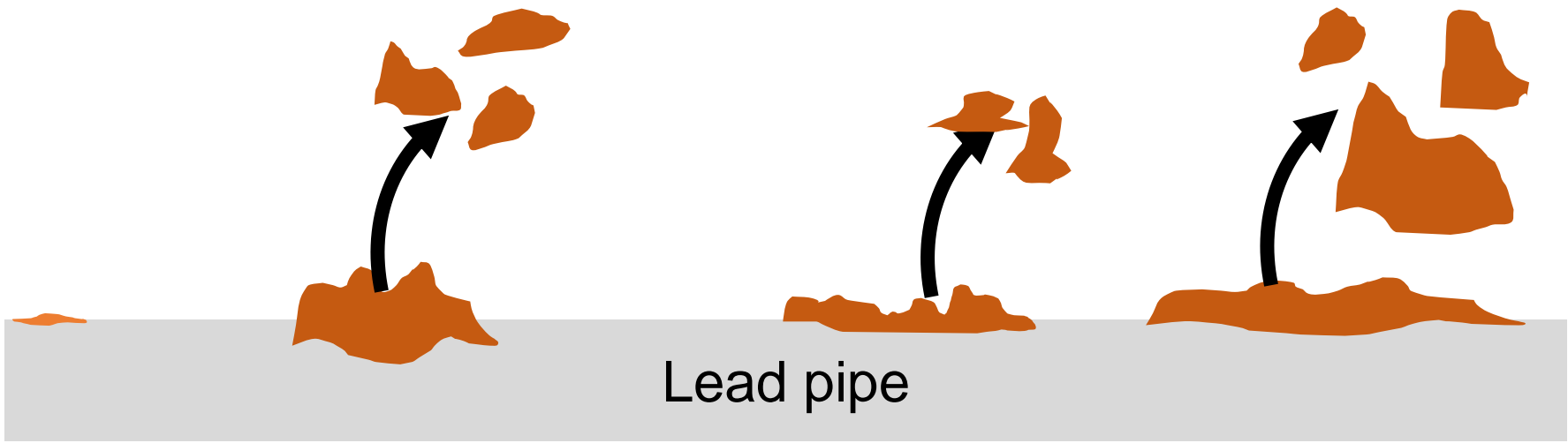


April 2014: Flint discontinued corrosion control

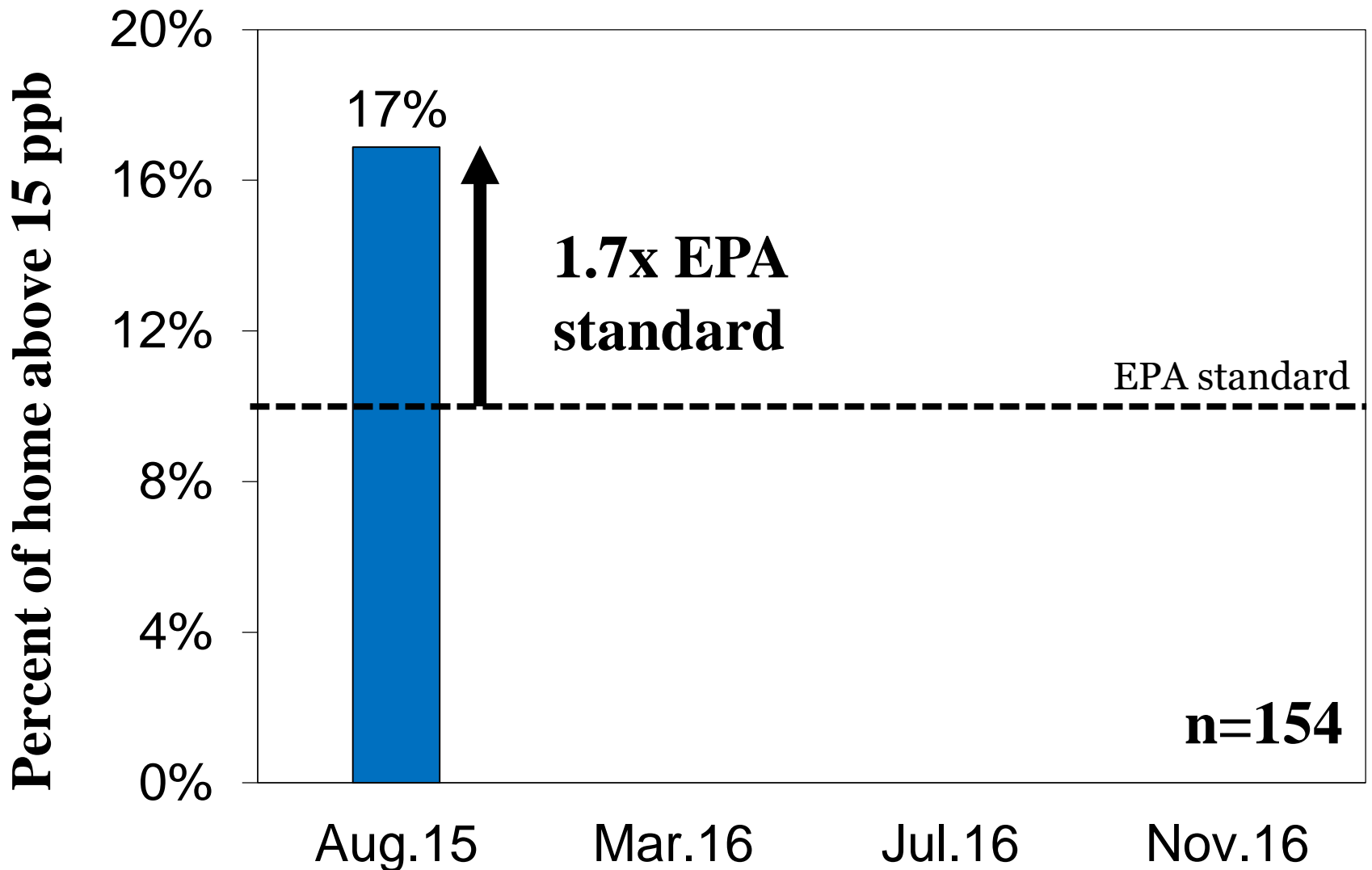
Water flow without corrosion inhibitors



Mobilization of corrosion rust layers

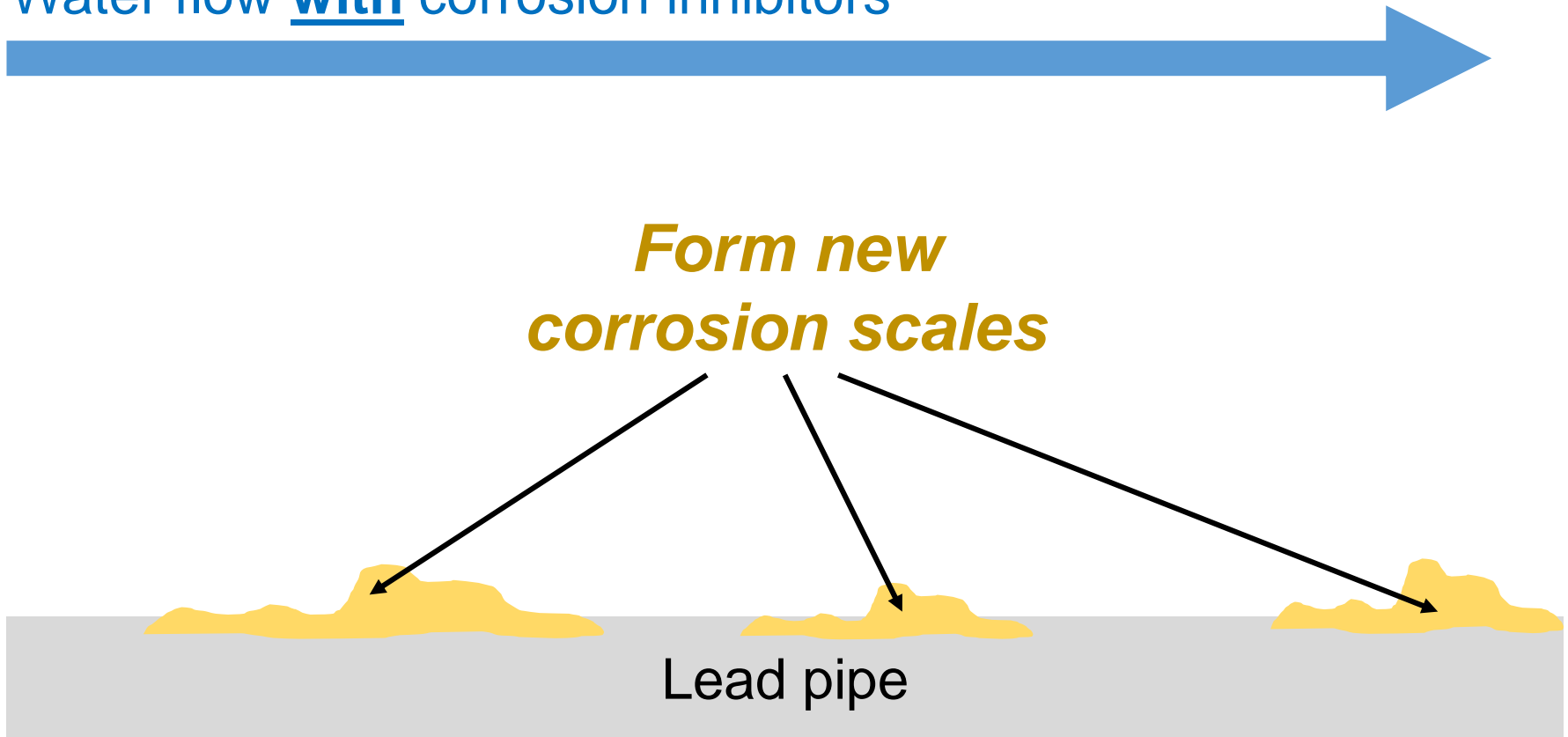


First draw lead in August 2015

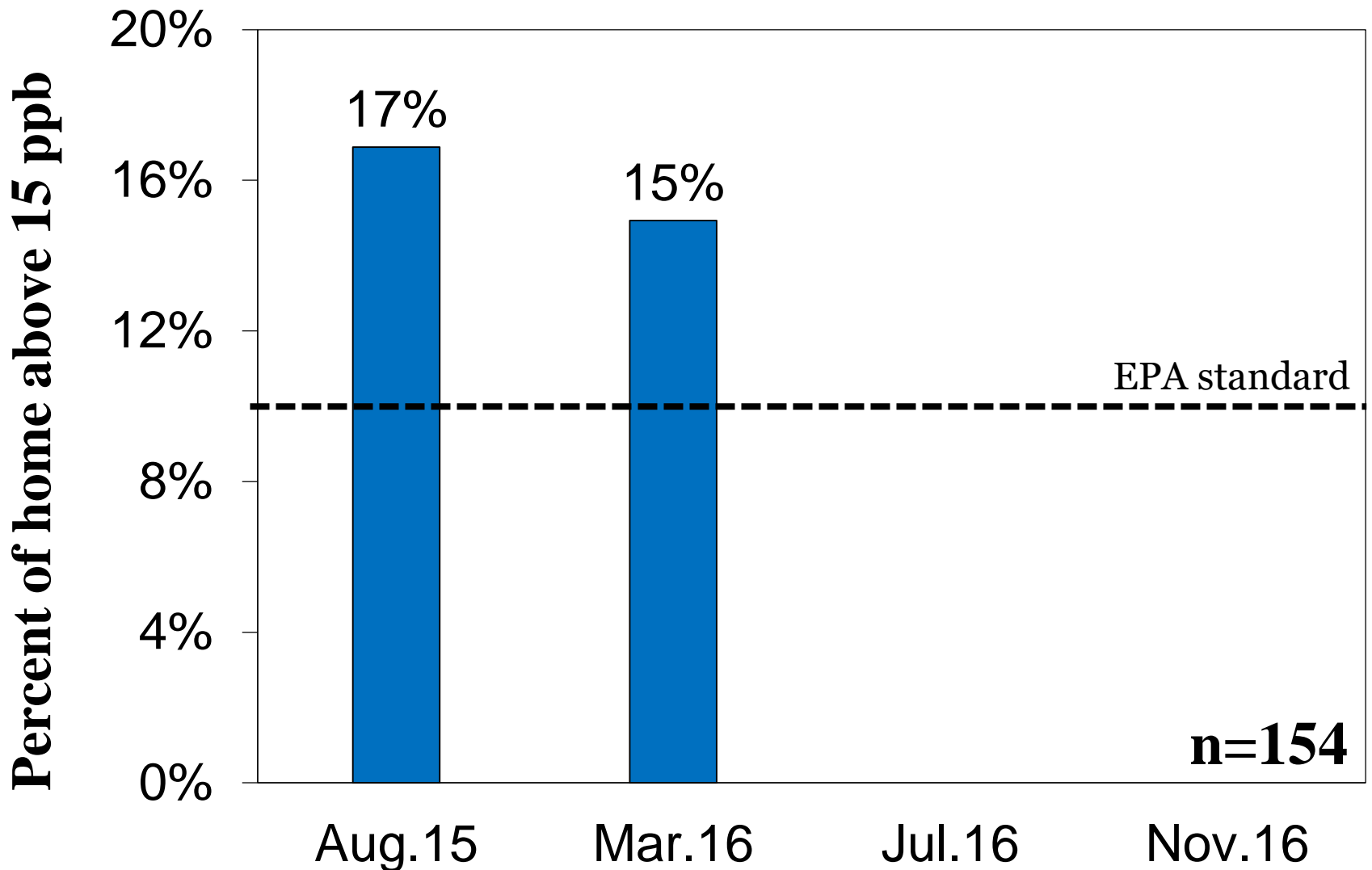


Oct-Dec 2015: Connected to DWSD and added extra corrosion treatment

Water flow with corrosion inhibitors

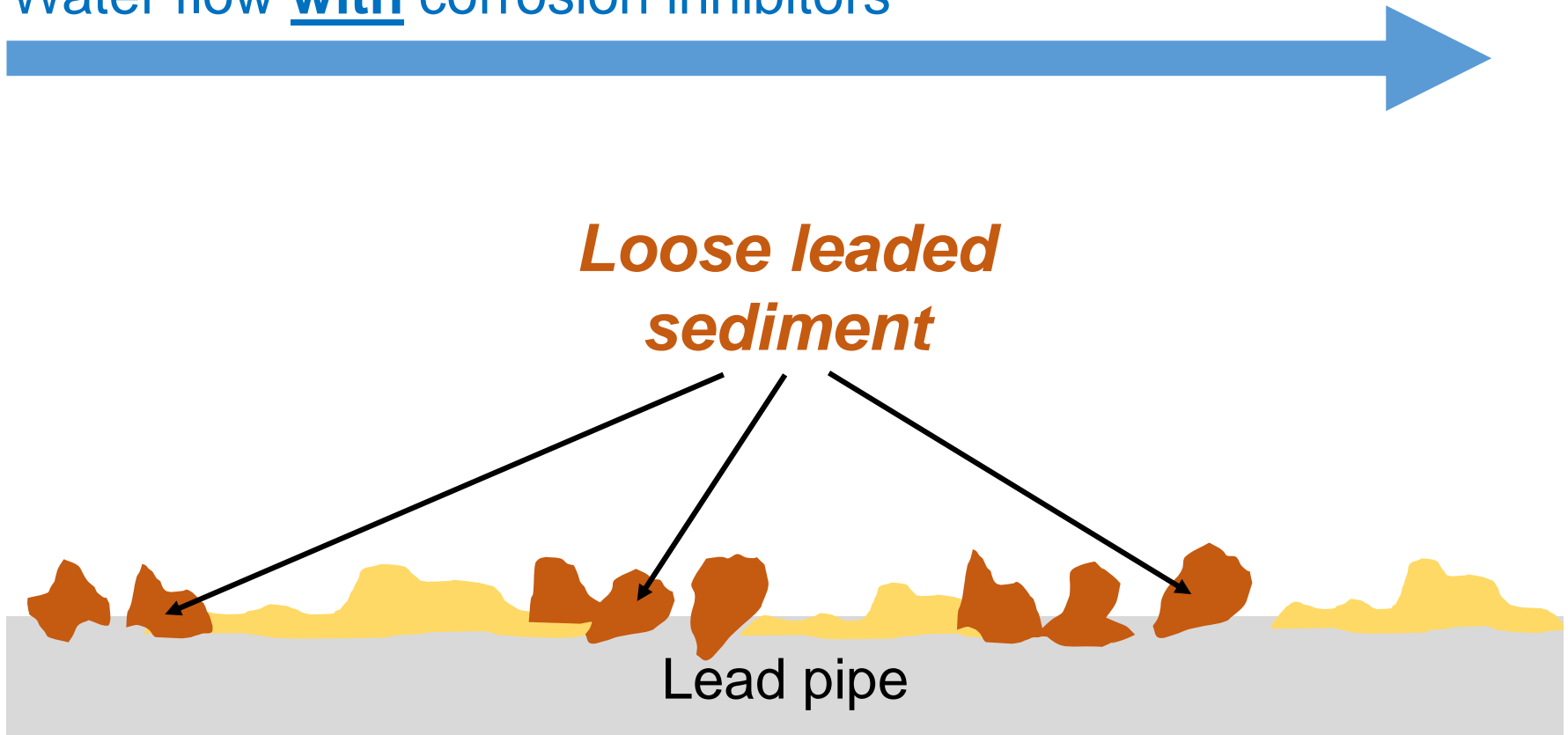


First draw lead in March 2016

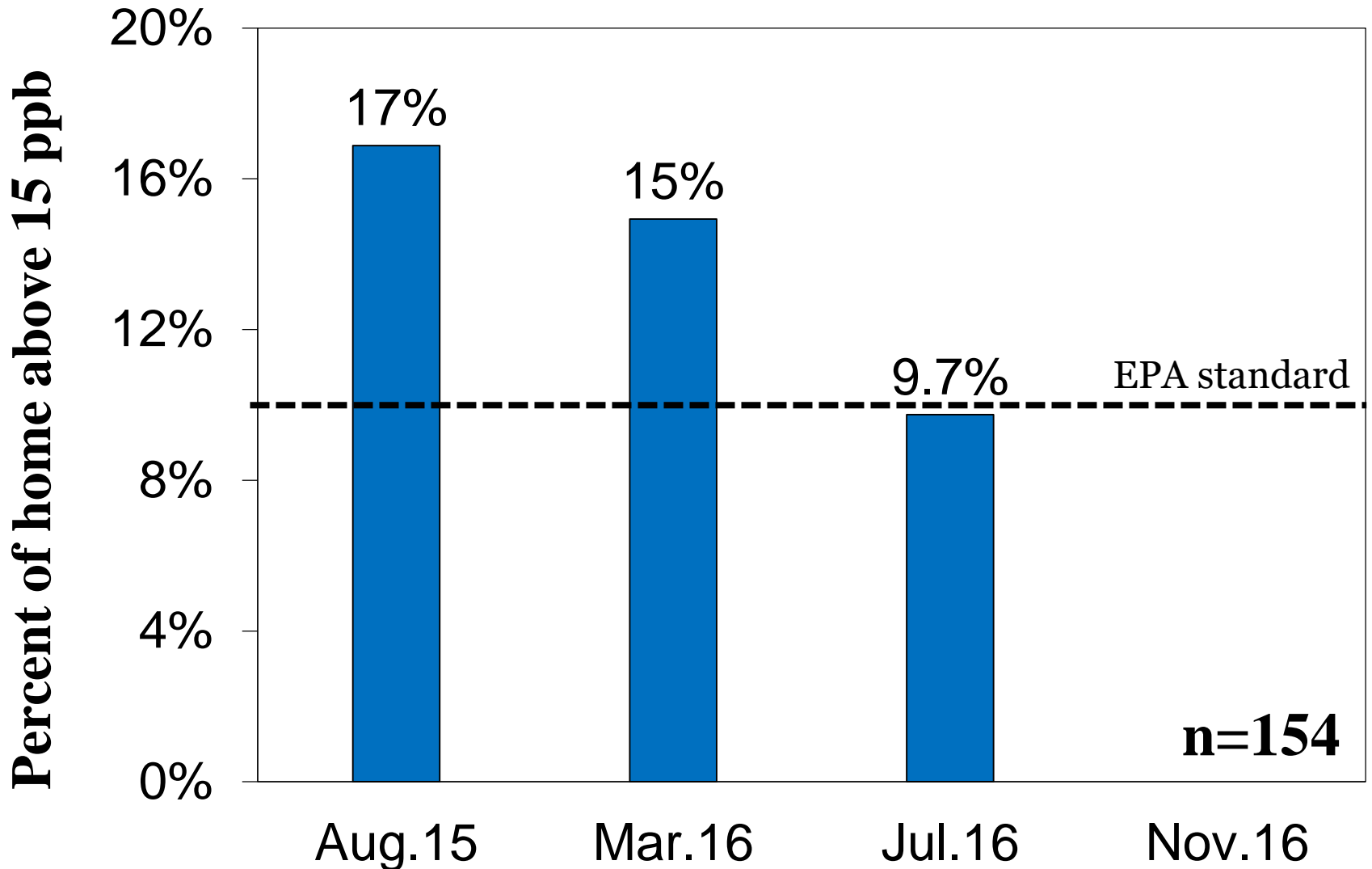


May 2016: Promoted high-flow flushing to remove loose sediment

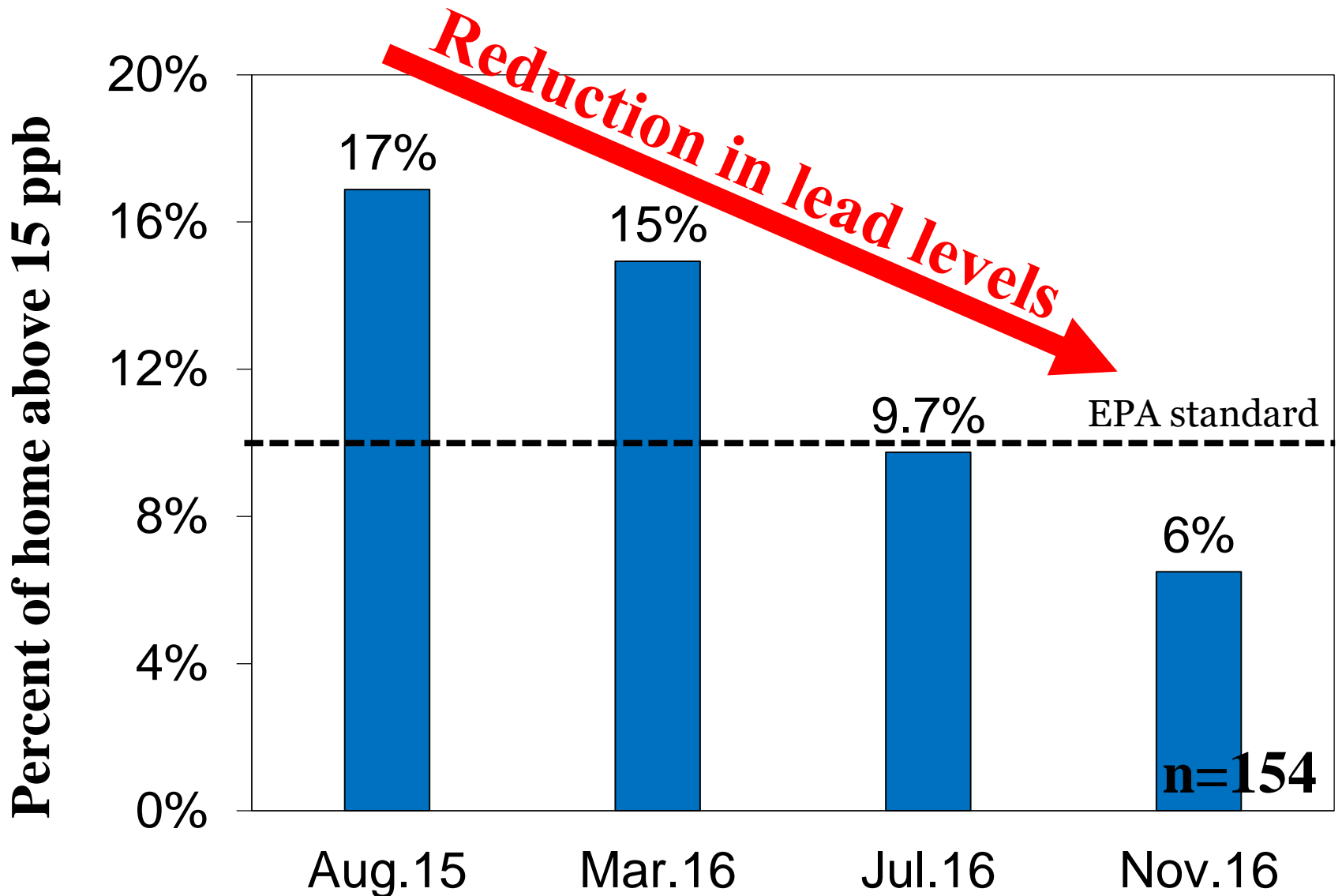
Water flow with corrosion inhibitors



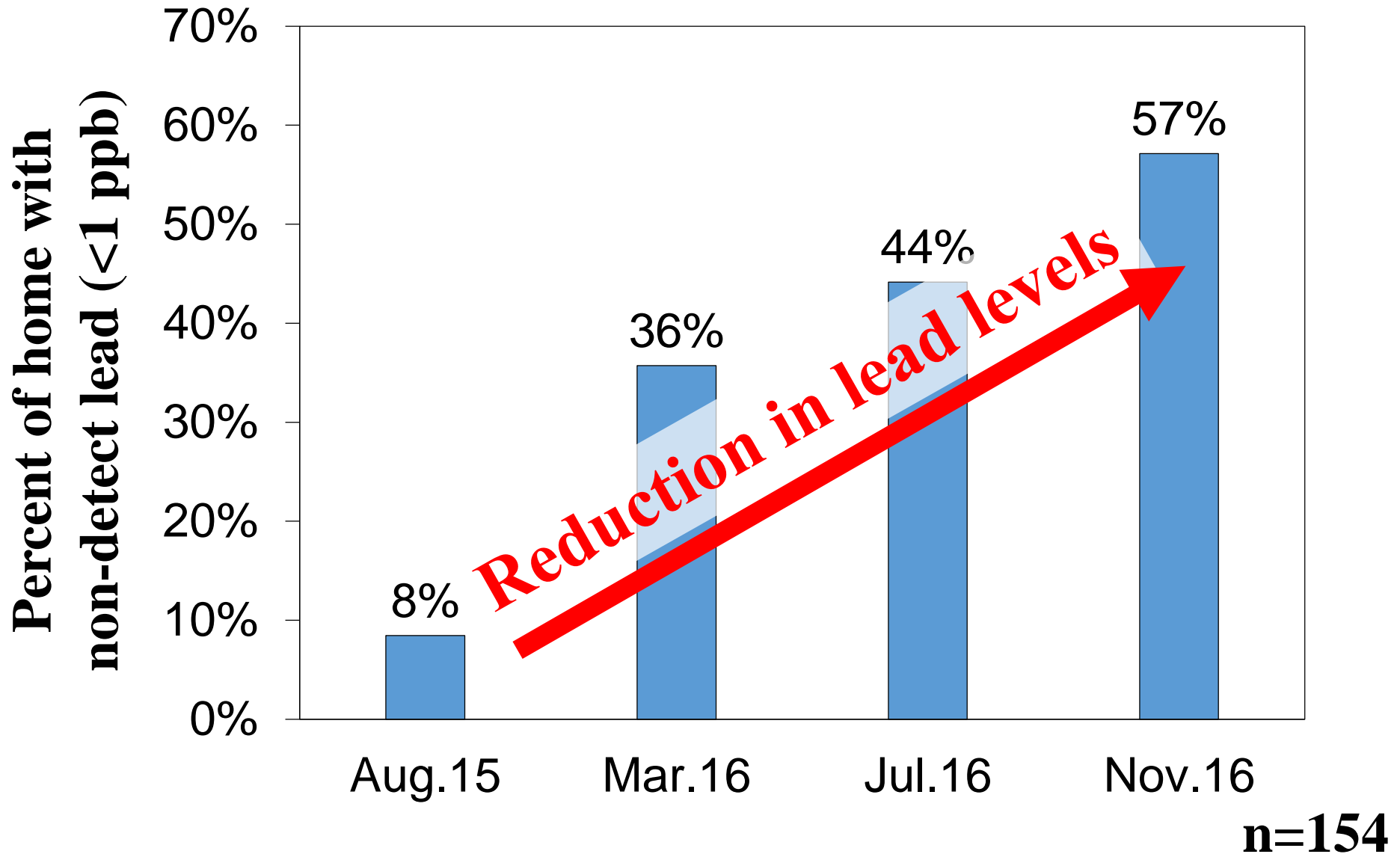
First draw lead in July 2016



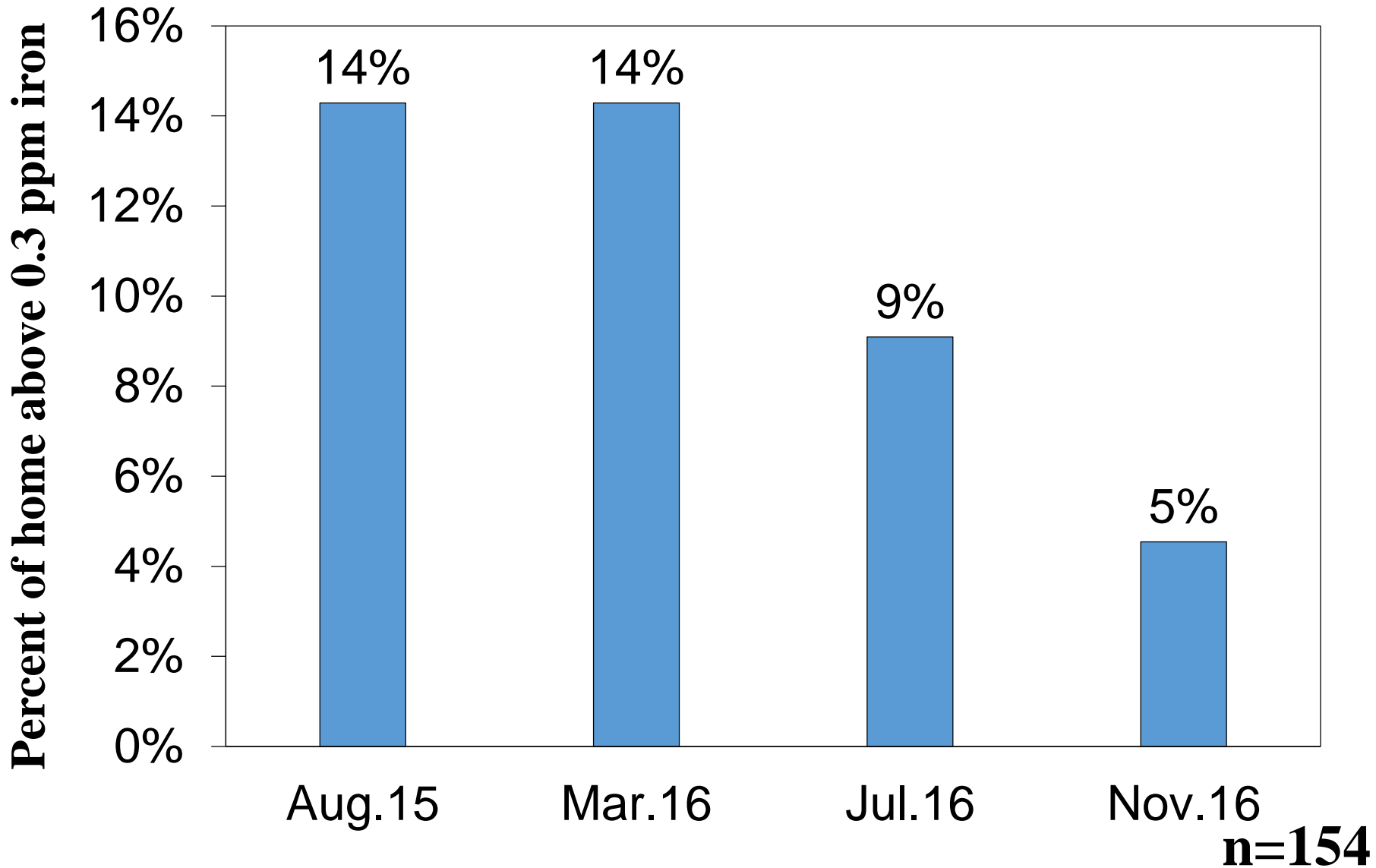
First draw lead in November 2016



Non-detectable first draw lead



First draw iron concentrations



Flint Hospital 2015 vs. 2016

What a difference a year makes.....



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Photographs: Zhu "Joyce" Ni, Min Tang, Pan Ji, Mariah Gnegy

Conclusions

1. It is likely that Flint is meeting the lead action level
 - However, this is not an approved LCR sampling pool
2. Lead and iron levels have continued to decrease since July 2016
3. Residents should use lead filters or bottled water until further notice from the State or EPA

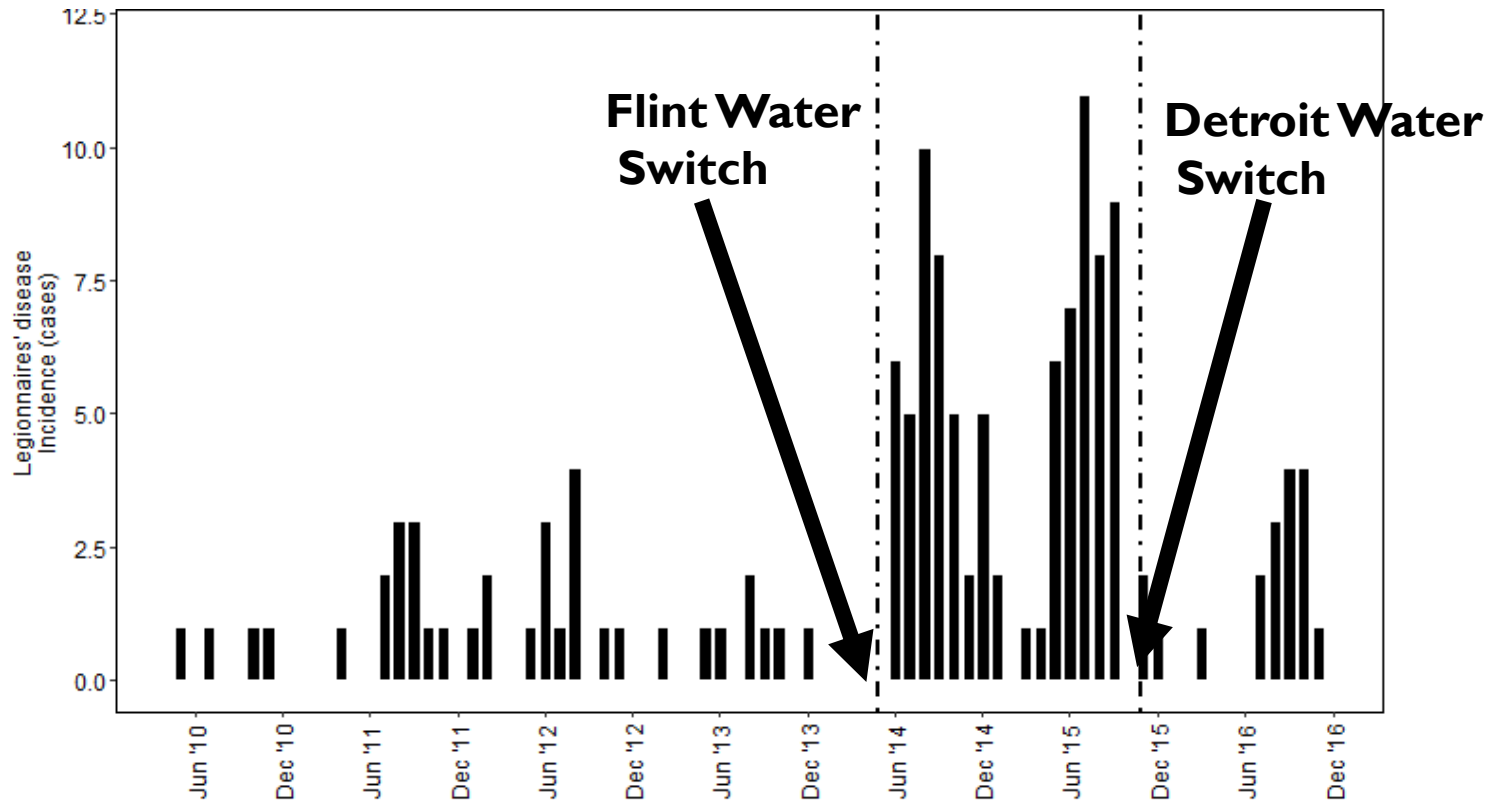
Water Heater Study: Update

William Rhoads, Taylor Bradley,
Amy Pruden and Marc Edwards

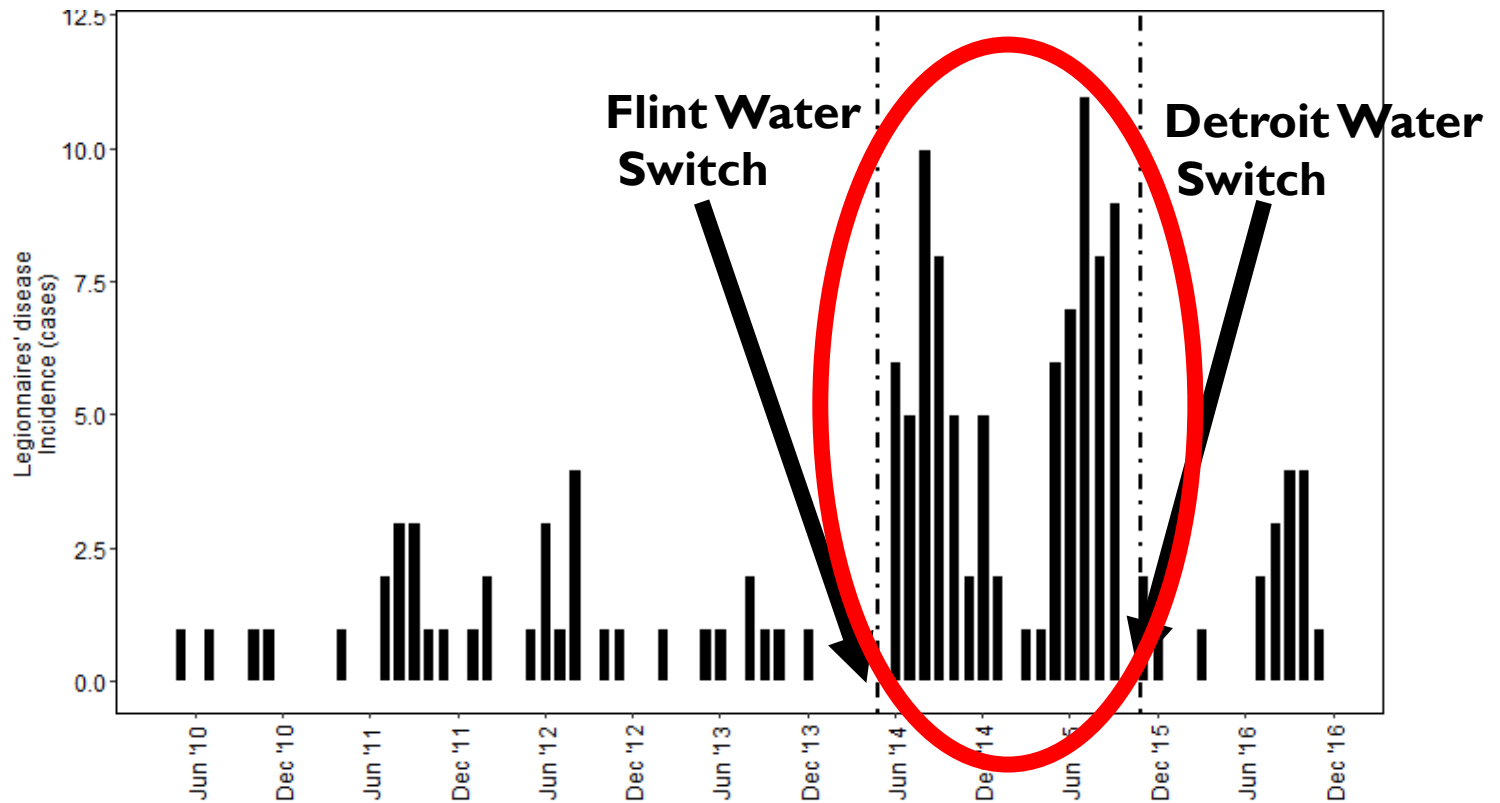


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Legionella bacteria is the cause of Legionnaires' disease and Pontiac fever



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L. pneumophila serogroup 1 – identified in 85% of clinical isolates

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- Monoclonal Antibodies (MAb)

Legionella bacteria is the cause of Legionnaires' disease and Pontiac fever

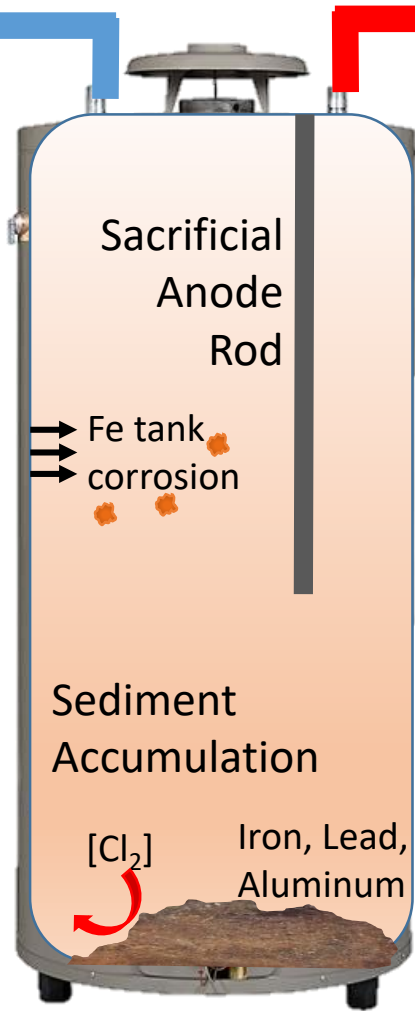
L. pneumophila serogroup 1 – identified in 85% of clinical isolates

- Monoclonal Antibodies (MAb)

L. pneumophila serogroup 1 MAb2 – observed in 94% of outbreak cases

Water Quality Testing in Homes

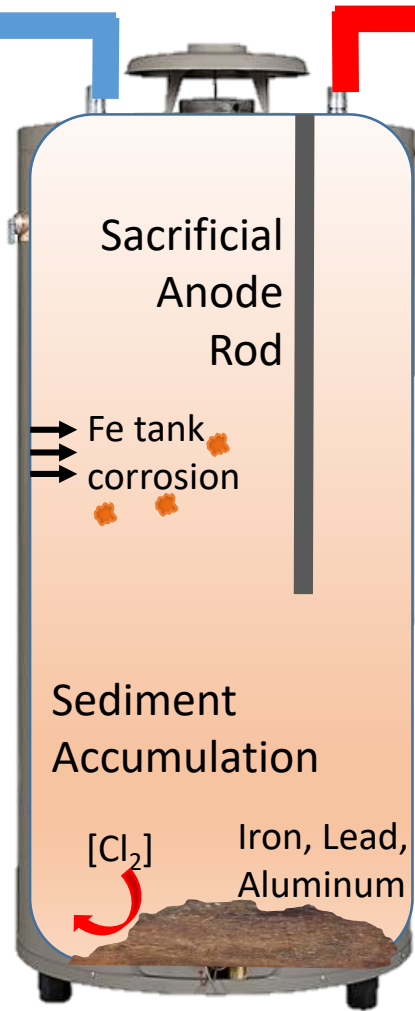
June 2016 – 30 Homes



Water Quality Testing in Homes

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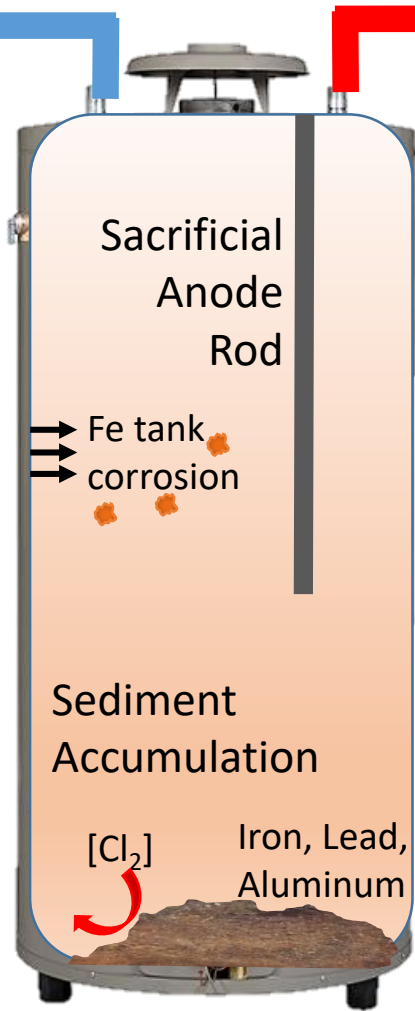
- Tested water
 - Metals (Pb, Fe, Al, Cu)
 - Chemistry (Cl_2 , pH, temperature)
 - *Legionella*



Water Quality Testing in Homes

June 2016 – 30 Homes

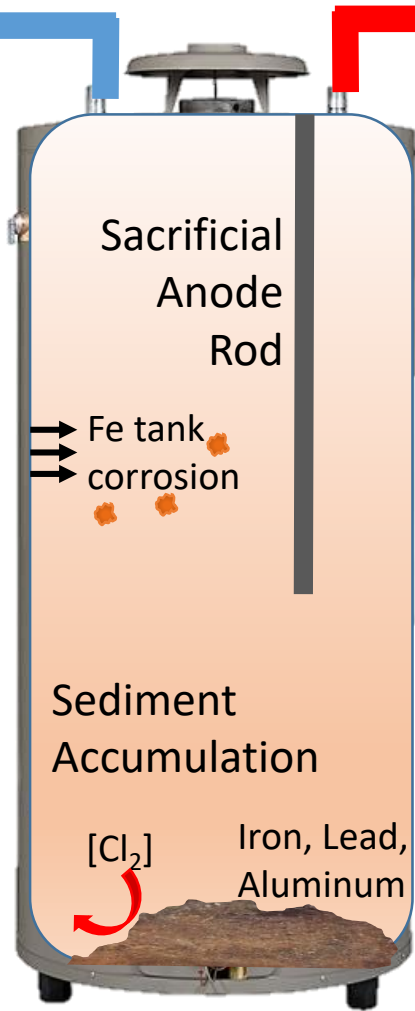
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 - Metals (Pb, Fe, Al, Cu)
 - Chemistry (Cl_2 , pH, temperature)
 - *Legionella*
- Extensive tank cleaning
 - Flush, drain, scour out sediment



Water Quality Testing in Homes

June 2016 – 30 Homes

- Tested water
 - Metals (Pb, Fe, Al, Cu)
 - Chemistry (Cl_2 , pH, temperature)
 - *Legionella*
- Extensive tank cleaning
 - Flush, drain, scour out sediment
- Re-tested water



Key Conclusions Regarding *Legionella*

- *Legionella* colonization rates were very low relative to levels of concern
 - 2 of 30 homes had culturable *L. pneumophila* serogroup 1, that was MAb 2 positive
- Chlorine levels reaching homes were relatively high

Follow-Up Sampling in One of the Homes

Culture *L. pneumophila* serogroup 1, MAb2 positive?

<u>Kitchen Tap:</u>	<u>June</u>	<u>Nov.</u>
Cold Water	Yes	
Hot Water	Yes	

BQL = “Below quantification limit” (i.e., present, but in very low concentration)

BD = “Below detection” (i.e., none detected)

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L. pneumophila concentration (gene copies/mL)

<u>Kitchen Tap:</u>	<u>June</u>	<u>Nov.</u>
Cold Water	BQL	
Hot Water	323	

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<u>Hose Bib:</u>	<u>June</u>	<u>Nov.</u>
“Distribution System Water”	Yes	

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<u>Hose Bib:</u>	<u>June</u>	<u>Nov.</u>
“Distribution System Water”	1121	

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“Distribution System Water”	Yes	No

L. pneumophila concentration (gene copies/mL)

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“Distribution System Water”	1121	BD

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Possible Explanations for Improved Water Quality with Respect to *Legionella*

- Amount of time back on Detroit water
 - Generally improved water quality stability
 - Chlorine residuals throughout system
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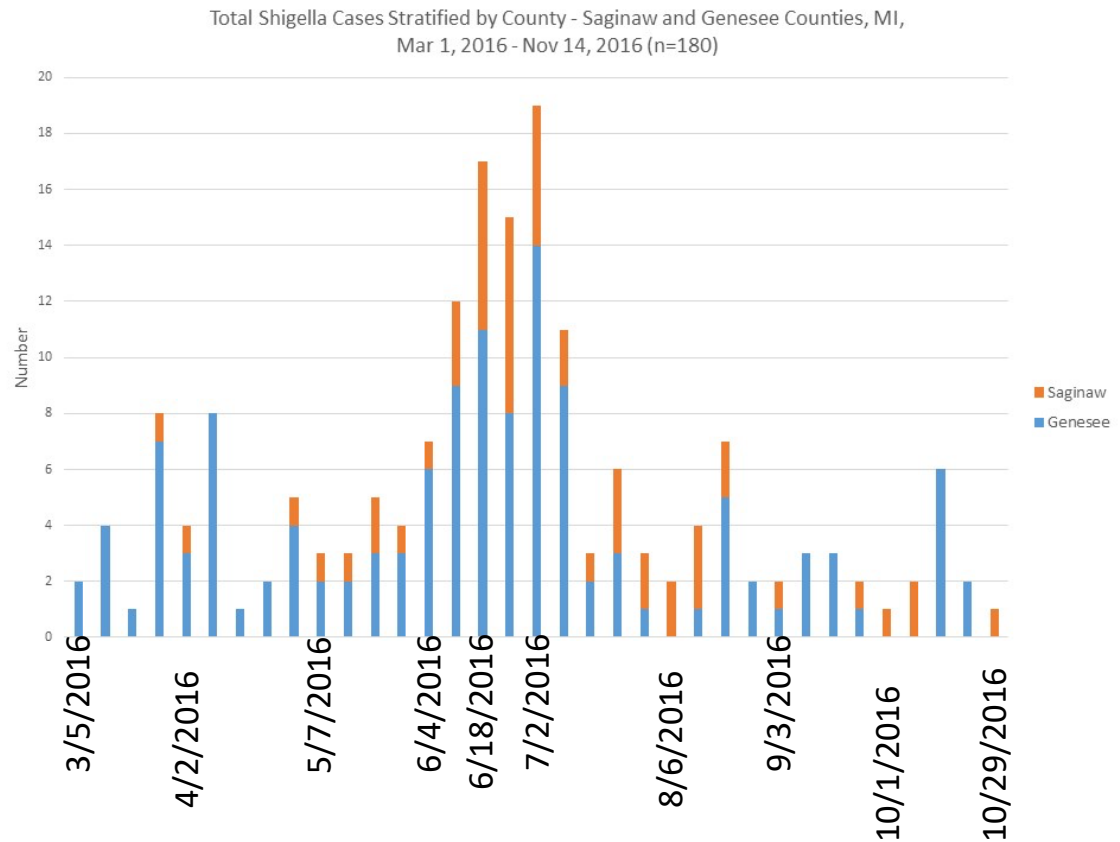
Reflects high quality distribution system operations overseen by EPA and MDEQ

The Saginaw & Genesee County *Shigella* Outbreak

Owen Strom, William Rhoads, Emily
Garner, Amy Pruden, and Marc Edwards

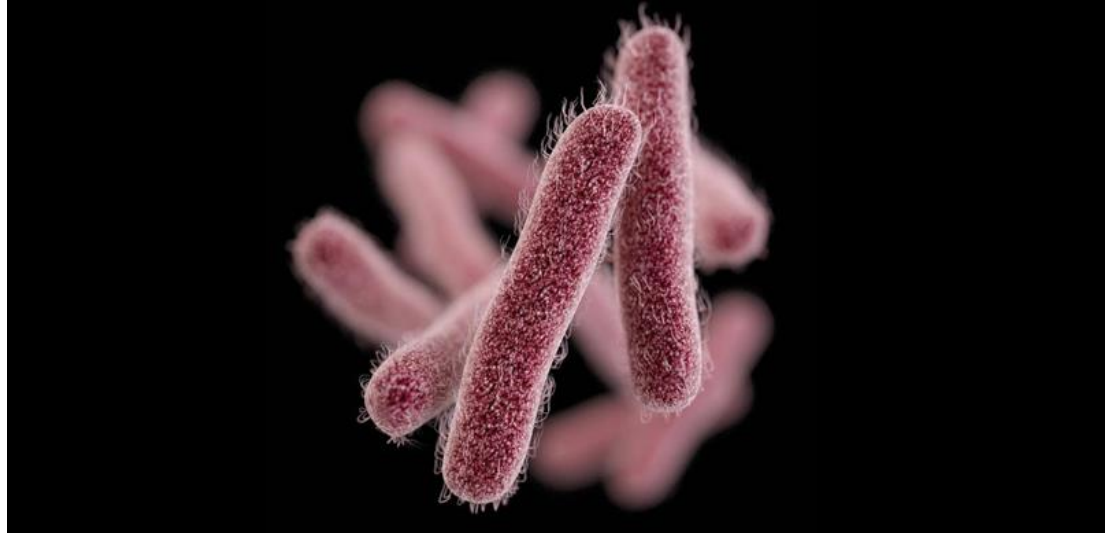
2016 Outbreak of *Shigella*

- Saginaw & Genesee counties
- Starting March 1, 2016
- 180 cases as of November 14th
- Public concern that drinking water could be the source of the outbreak.
- MDHHS and CDC investigating



Shigella

- Bacteria
- Symptoms
 - Severe Diarrhea
 - Abdominal pain
 - Fever



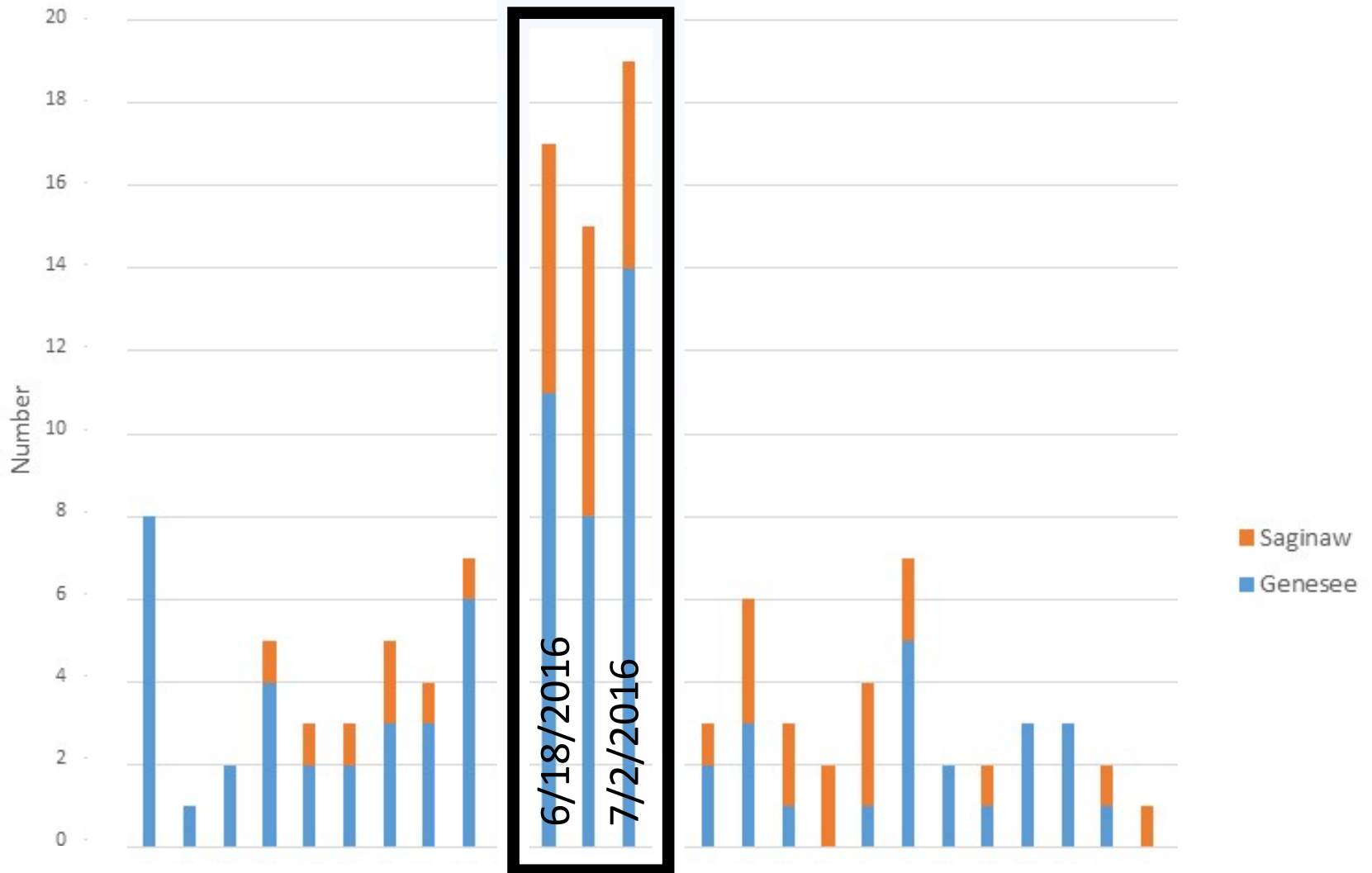
<http://www.cdc.gov/shigella/index.html>

- Infected through ingestion of contaminated fecal matter
 - Touching a contaminated surface then touching mouth or food
 - Consuming contaminated food and drinking water

Detection in Water

- Samples from June 2016
- 30 houses across town
- 5 types of samples
 - 1 Liter
 - Hot, cold, stagnant, flushed, main
- Kitchen faucet, shower head, and hose bib
- Total of 150 samples tested

Total Shigella Cases Stratified by County - Saginaw and Genesee Counties, MI,
Mar 1, 2016 - Nov 14, 2016 (n=180)



Results

- Tested Presence/Absence of DNA from common pathogenic *Shigella*
- Endpoint polymerase chain reaction (PCR)
 - Identifies DNA from once living or dead *Shigella*
 - Sensitive to the four pathogenic *Shigella* species
- All 150 samples **negative**



*Matrix spike to confirm inhibition was not present.

CDC and MDHHS Investigation

- Initial Conclusion 1

- “*Shigella* does NOT appear to be spreading through a drinking water system”
 - 90% of sick individuals drank only bottled water
 - 65% use only bottled water to brush teeth
 - No common drinking water source among infected
 - multiple water system with 15% on private wells

- Initial Conclusion 2

- “*Shigella* bacteria appear to be spreading in the community from person to person”
 - 51% of sick were 9 years old or younger
 - 59% of sick “wore diapers, changed diapers, or came in contact with a person wearing diapers in the week before they became ill.”

Is There a Disinfection By-Product Problem in Flint?

Joshua M. Allen

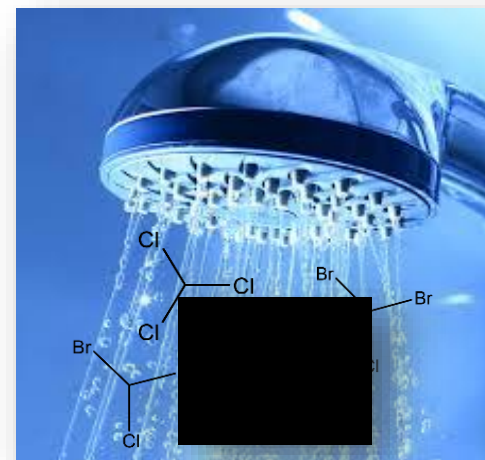
Amy A. Cuthbertson, Susana Y. Kimura, Hannah K. Liberatore,

Meghan E. Franco, Susan D. Richardson



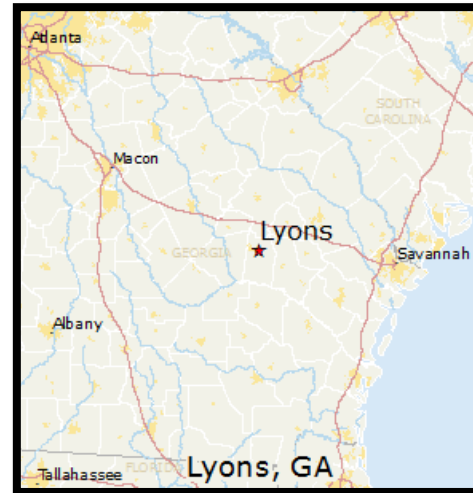
UNIVERSITY OF
SOUTH CAROLINA

- **Key Question: Are there chemicals/DBPs present at levels that could be causing skin rashes?**

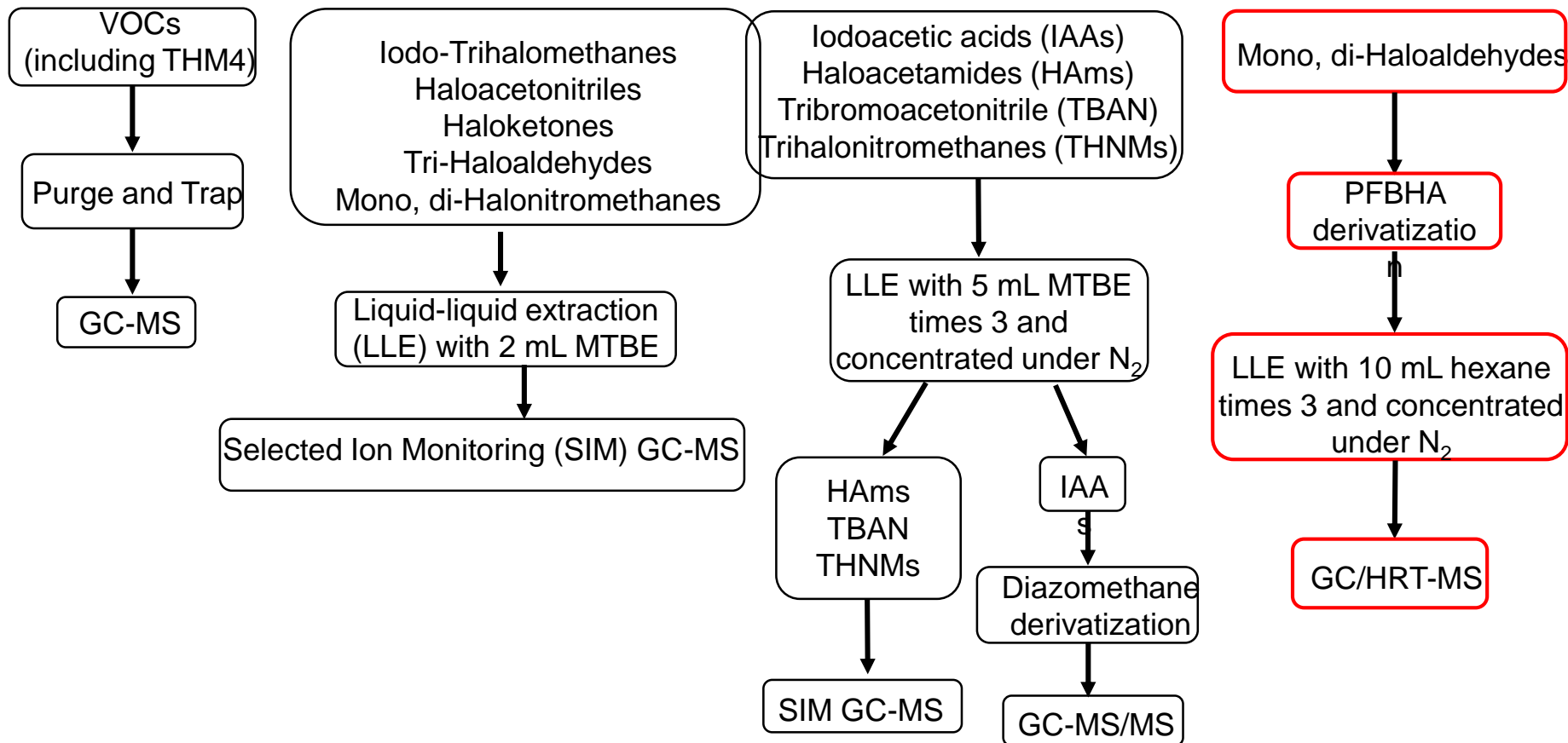


Strategy

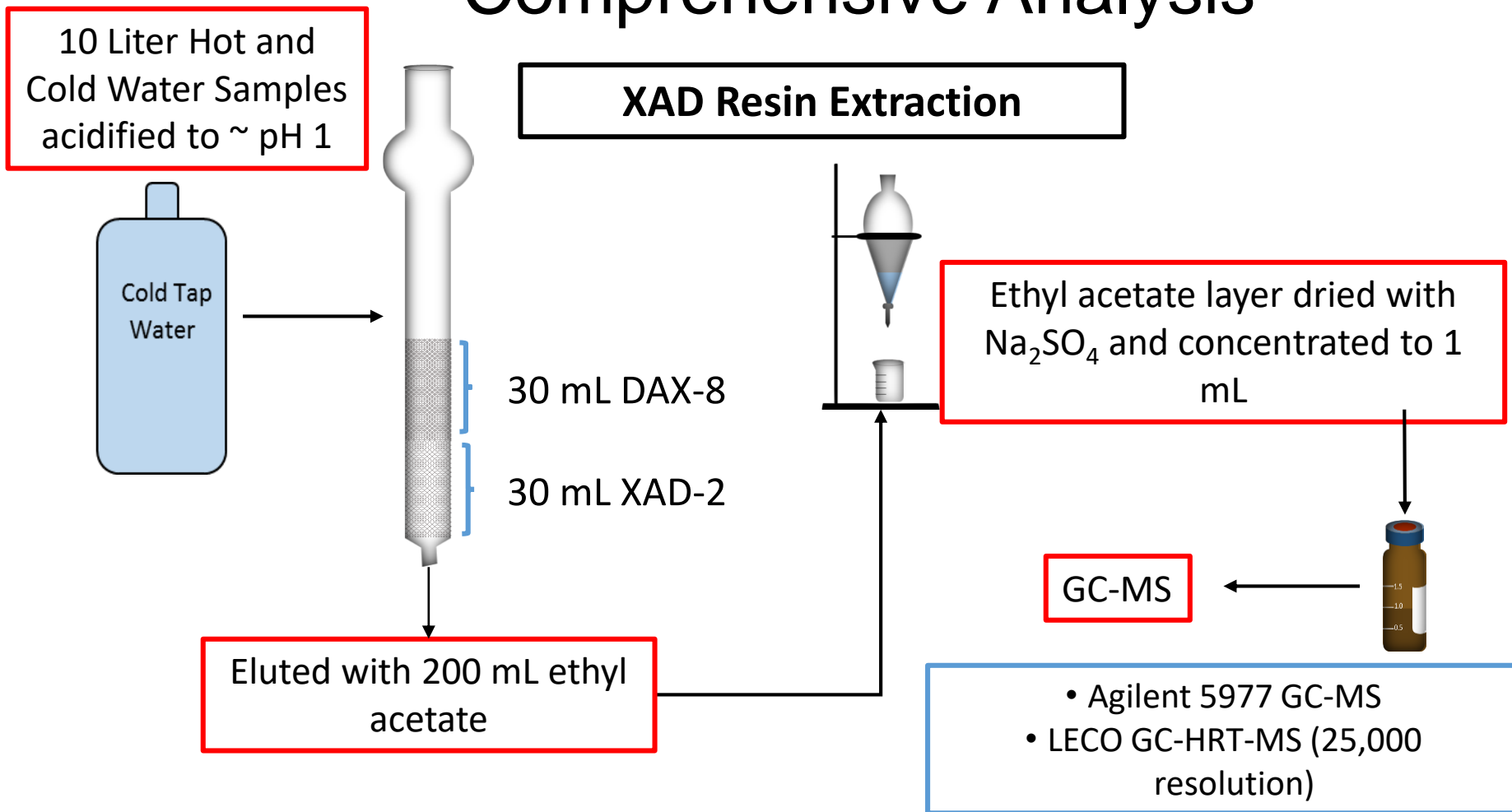
- Compare Flint hot and cold water to water of other cities → Anything unusual?
- **Other cities:**
 - Detroit (uses chlorine and same source water [Lake Huron] as Flint)
 - Grovetown, GA (surface water system using chlorine)
 - Lyons, GA (groundwater system using chlorine)



Quantitative Methods



Comprehensive Analysis



Results Summary

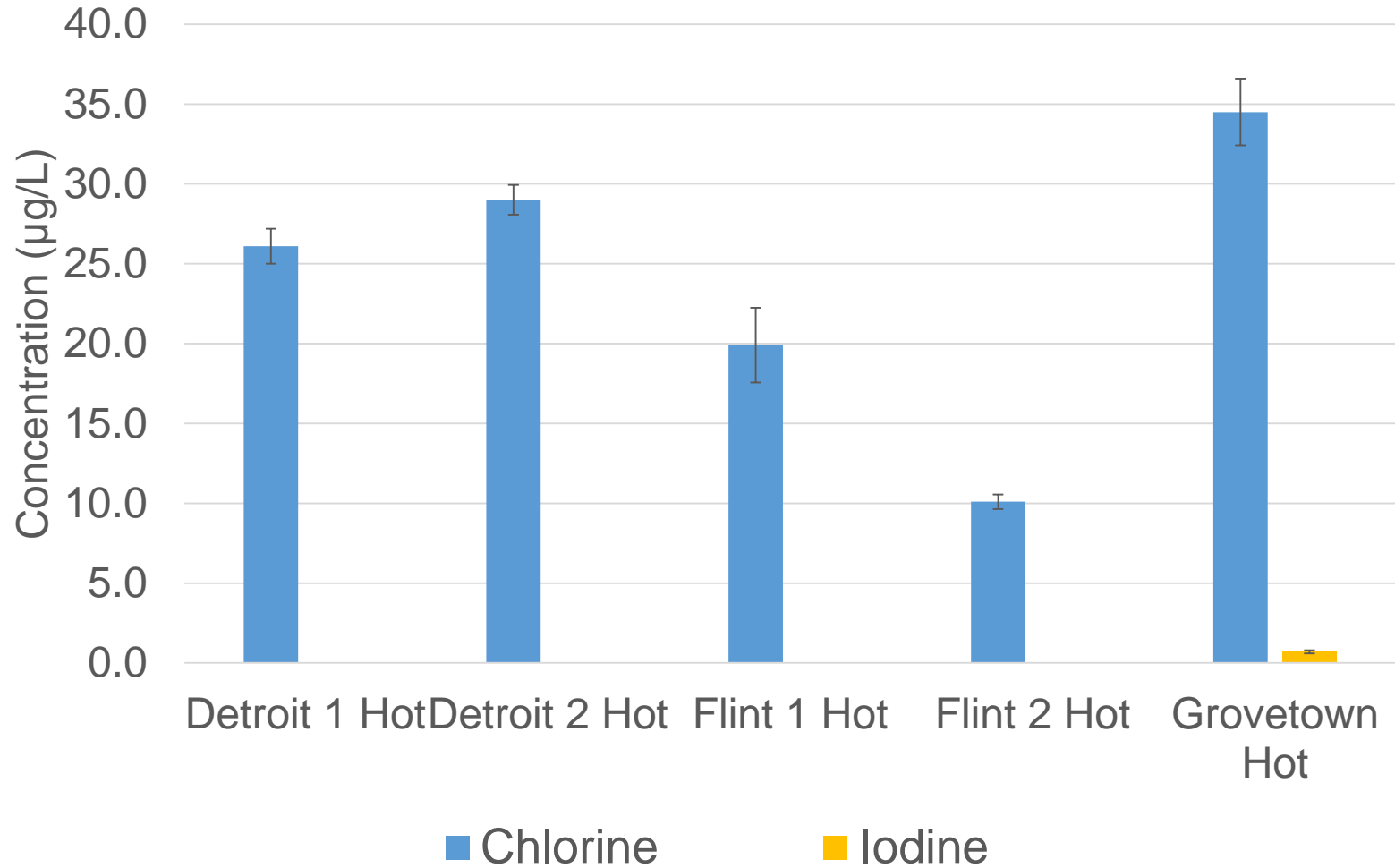
Key: X = detected in XAD extract; NM = not measured; ND = not detected; LOQ = limit of quantification

DBP	LOQ (µg/L)	Detroit 1		Detroit 2	Flint 1		Flint 2	Grovetown		Lyons	
		cold	hot	hot	cold	hot	hot	cold	hot	cold	hot
Haloacetonitriles											
Chloroacetonitrile	0.1	<0.1	<0.1	<0.1	NM	<0.1	<0.1	<0.1	<0.1	ND	ND
Dichloroacetonitrile	0.1	1.5	2.1	1.9	X	0.4	<0.1	3.3	3.6	<0.1	X
Bromochloroacetonitrile	0.1	0.3	0.2	0.2	X	<0.1	X	0.4	0.3	<0.1	<0.1
Dibromoacetonitrile	0.1	<0.1	<0.1	<0.1	X	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Trichloroacetonitrile	0.1	<0.1	ND	<0.1	NM	ND	ND	<0.1	<0.1	ND	ND
Haloaldehydes											
Monochloroacetaldehyde	0.1	<0.1	<0.1	<0.1	NM	<0.1	<0.1	ND	0.3	ND	ND
Dichloroacetaldehyde	0.1	0.4	0.5	0.5	NM	0.5	0.8	0.5	0.5	ND	ND
Bromochloroacetaldehyde	0.1	ND	X	ND	NM	ND	ND	ND	ND	ND	ND
Bromodichloroacetaldehyde	0.1	<0.1	<0.1	<0.1	NM	<0.1	<0.1	0.5	<0.1	ND	ND
Trichloroacetaldehyde	0.1	7.8	18.8	20.3	X	7.1	1.9	18.3	23.0	<0.1	<0.1
Tribromoacetaldehyde	0.1	0.1	0.1	ND	NM	ND	ND	<0.1	ND	ND	ND
Dibromochloroacetaldehyde	0.1	<0.1	ND	ND	NM	ND	ND	<0.1	ND	ND	ND

Most haloacetonitriles were detected at low to trace levels.

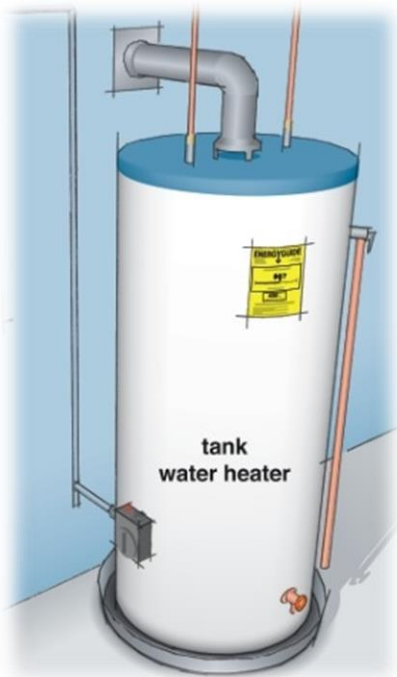
Trichloroacetaldehyde was the only haloaldehyde detected > 1.0 µg/L in Flint waters. This is normal.

DBP Speciation in Unregulated DBPs



Conclusions

Flint appears to have no DBP issues when compared to other cities



= ↑ THMs

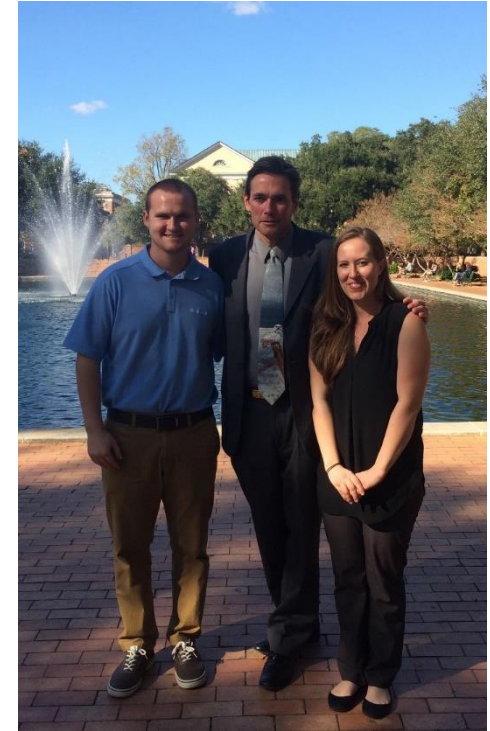
- Increased THM levels from cold to hot water seen in all cases, but below the 80 $\mu\text{g/L}$ regulatory limit.
- Unregulated DBPs detected were found at low to trace levels.
- Comprehensive analyses results showed Detroit and Flint water is very similar in composition.
- Preliminary data shows all iodoacids to be $< 10 \text{ ng/L}$ in Flint and Detroit.

Acknowledgments



Richardson Group

Amy Cuthbertson
Hannah Liberatore
Dr. Susana Kimura-Hara
Meghan Franco



Collaborators

Dr. Marc Edwards, Virginia Tech University



Dennis Walters, Matt Smith, Tracy Hacker, Tonya Williams, Kaylie Mosteller, Carrie Nelson, Claire McClinton, Keri Webber, Tony Palladeno Jr., Leah Palladeno, Jessica Owens

Thank you!

