Flint Water Press Conference

August 11, 2016

Virginia Tech
Invent the Future

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

2) A special study of water heater flushing and Legionella testing (led by William Rhoads and Taylor Bradley and funded by the State of Michigan)

3) Second round of water heater disinfection by-product testing (led by Dr. Dave Reckhow, a team at the University of Massachusetts-Amherst and funded by the EPA)

Flint resident sampling: August 2015 - July 2016

Kelsey Pieper, Min Tang,
Anurag Mantha and Marc Edwards

Virginia Tech
Invent the Future

Sampling in July 2016

- Sampling organized by LeeAnne Walters and the Flint citizen science team
- Kits were distributed from 2 Flint churches
  - If requested, team delivered and picked up kits

Sampling protocol

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

6+ hour stagnation → 

1 L
First draw

Flush for 45 seconds → 

500 mL
1 min flush

Flush for 2 minutes → 

125 mL
3 min flush

Sampling protocol

162 homes participated in the 3 sampling efforts

6+ hour stagnation → 

1 L
First draw

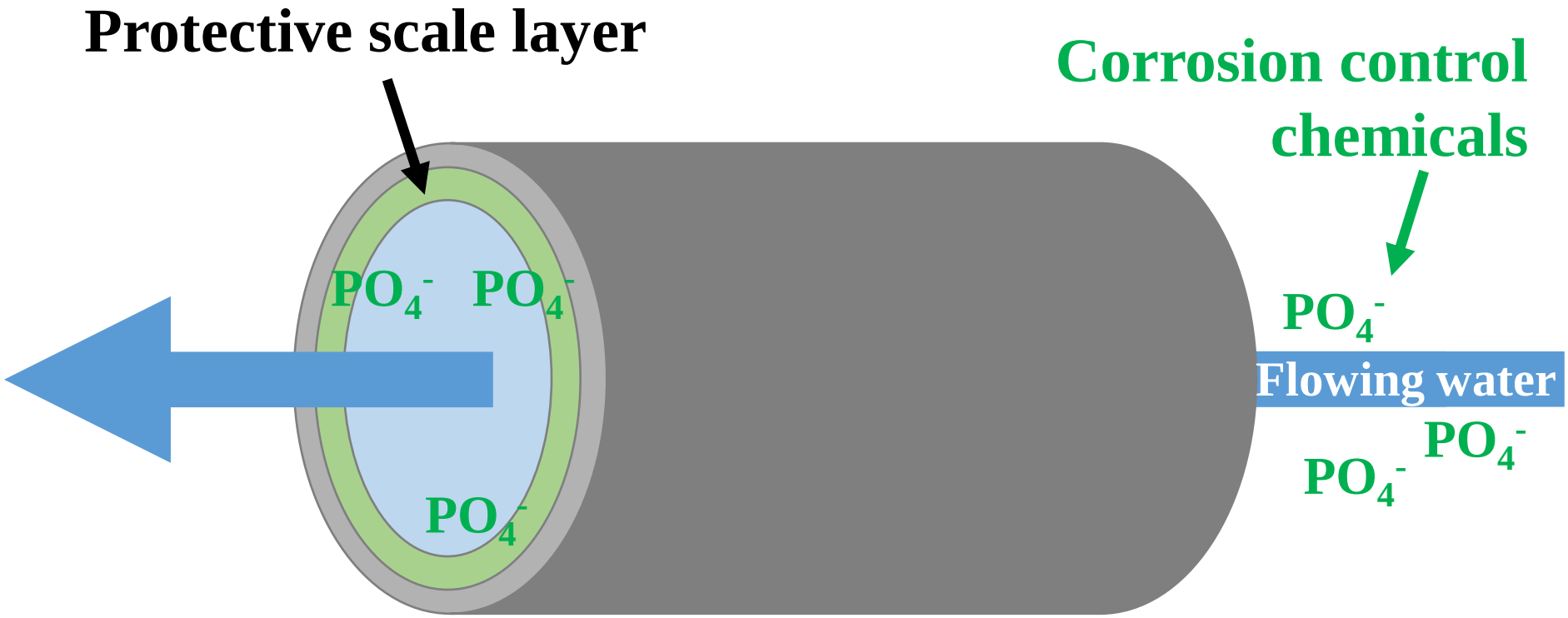
Flush for 45 seconds → 

500 mL
1 min flush

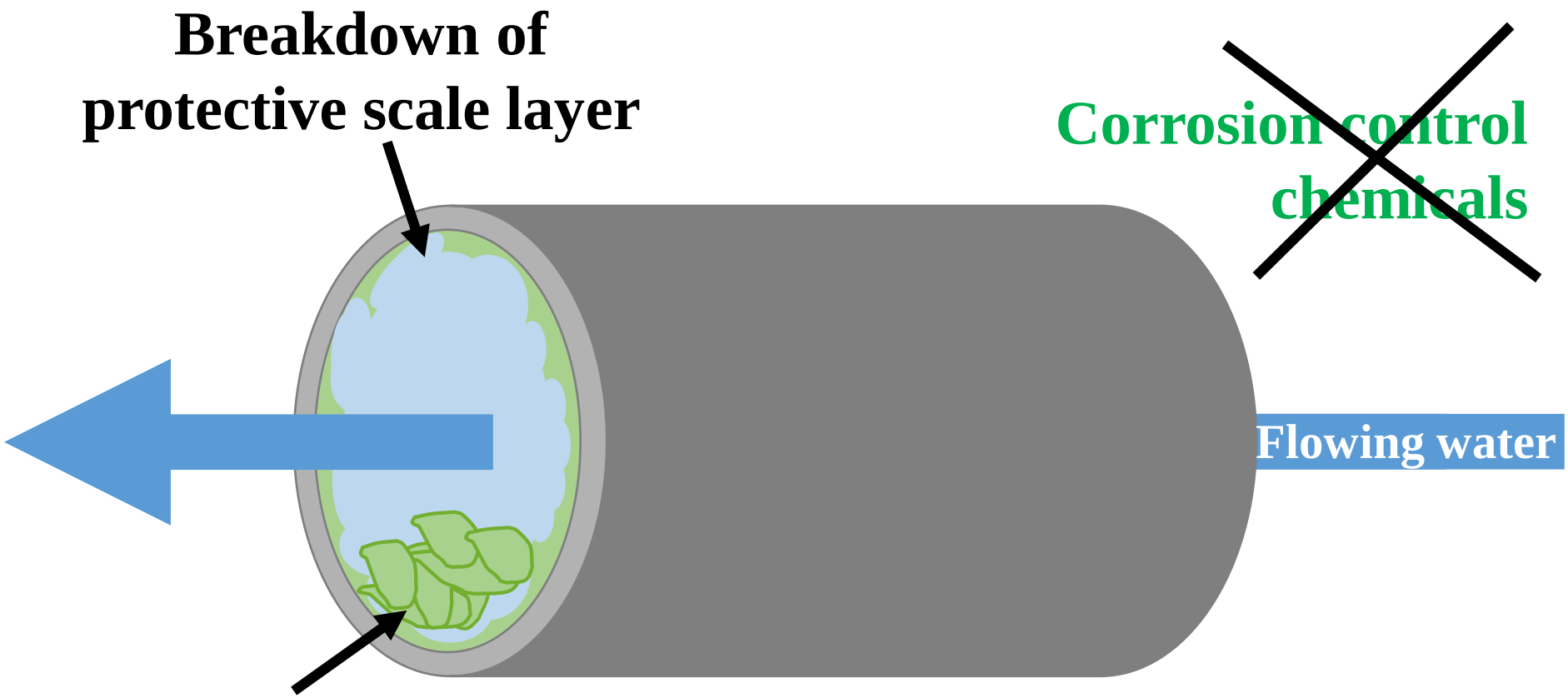
Flush for 2 minutes → 

125 mL
3 min flush

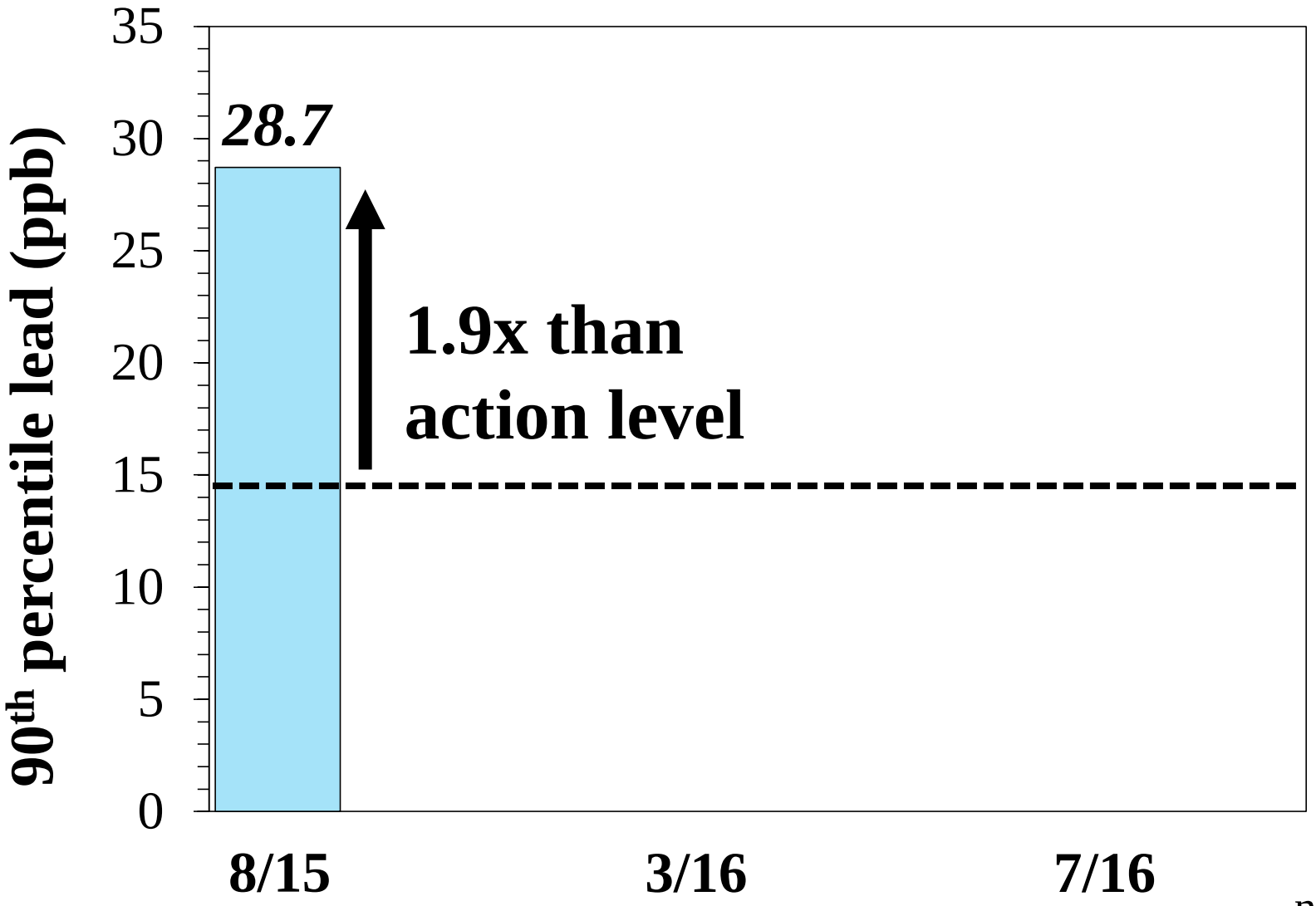
Pre-2014: Formation of scale within the distribution system



Apr. 2014: Water from Flint River disrupted developed scales

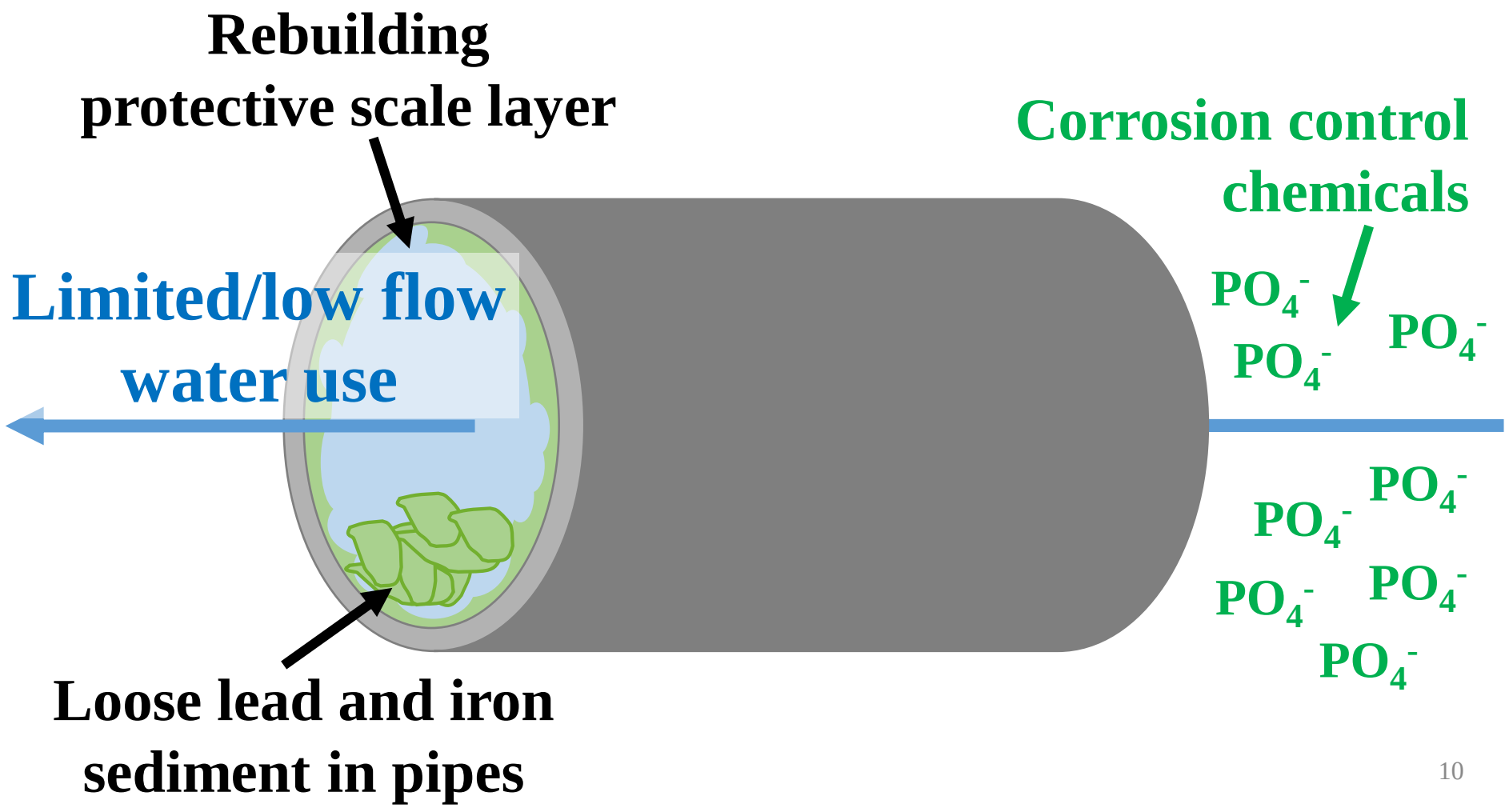


First draw lead in Aug 2015

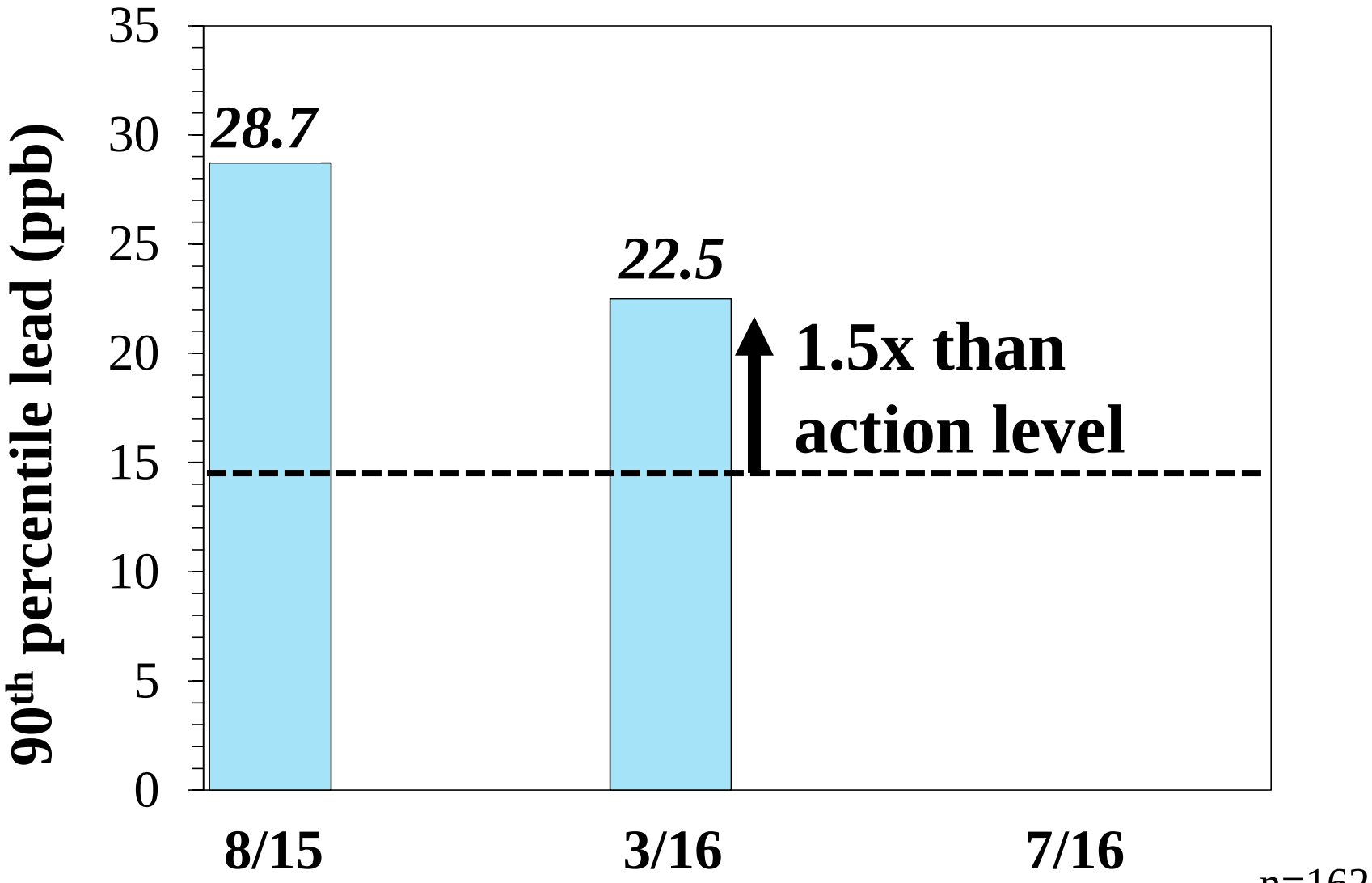


n=162

Nov/Dec. 2015: Detroit water with extra corrosion control chemicals



First draw lead in Mar. 2016



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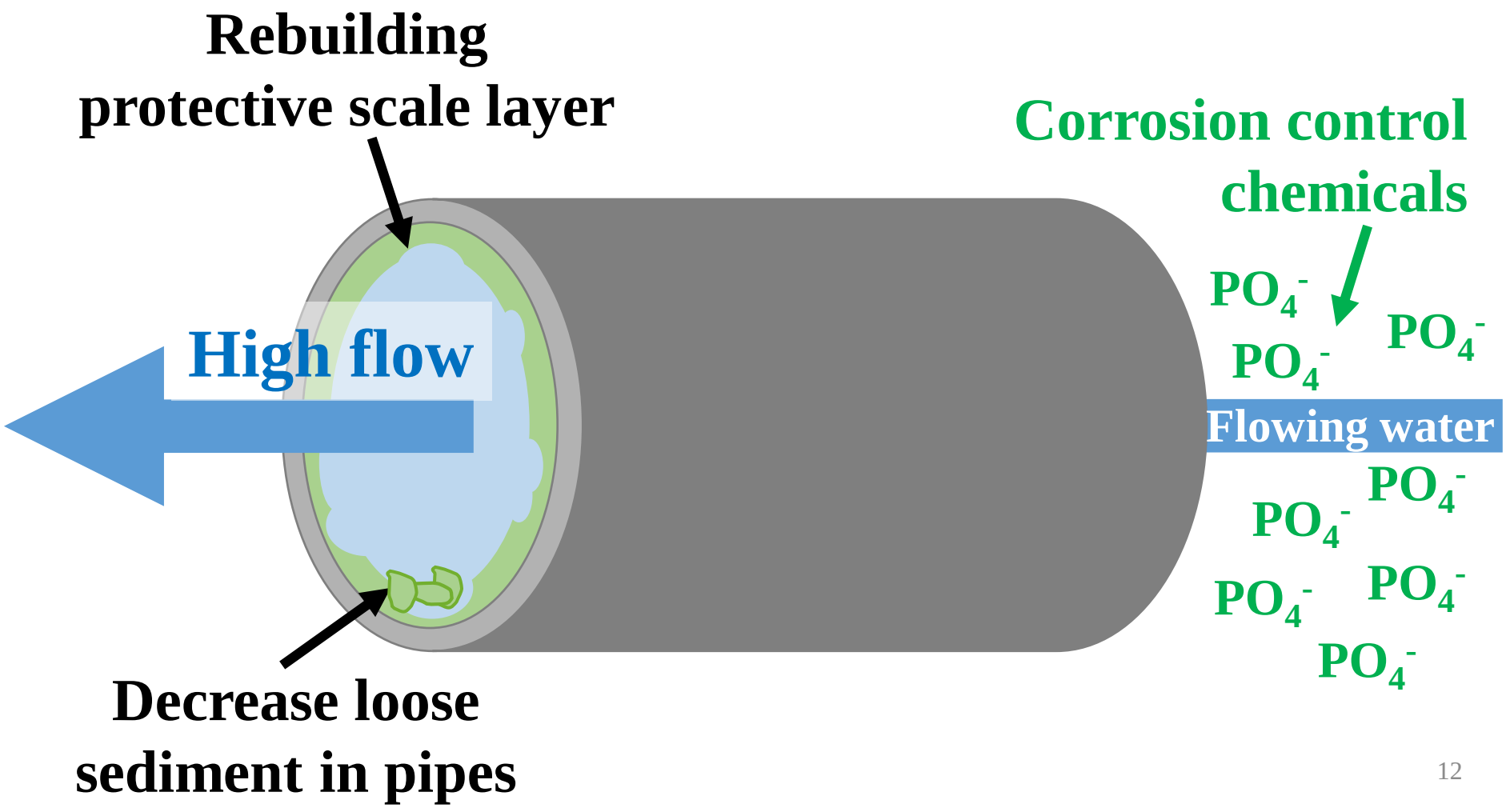
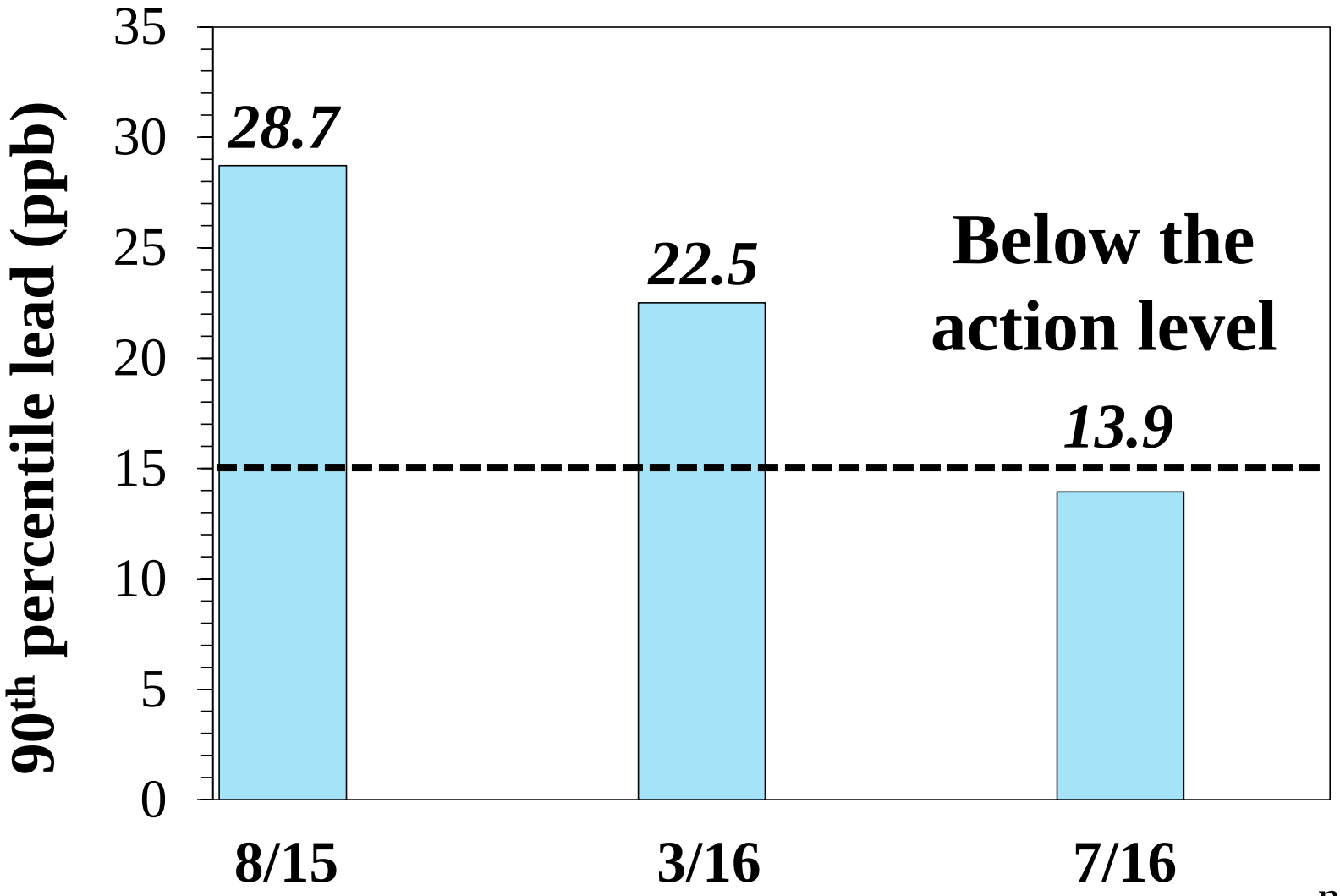
Apr. 2016: EPA encouraged water use through subsidized water bills



First draw lead in Jul. 2016



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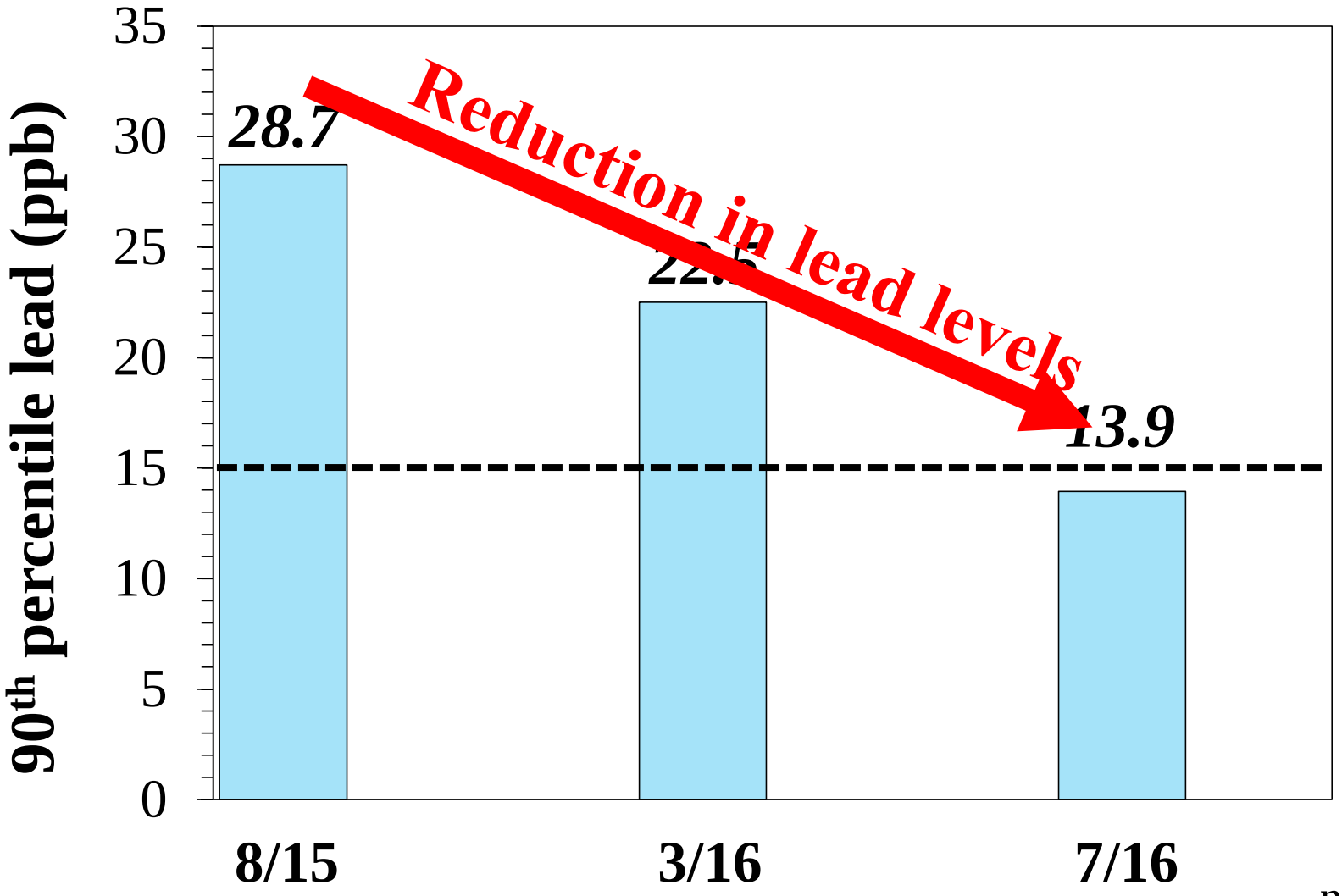
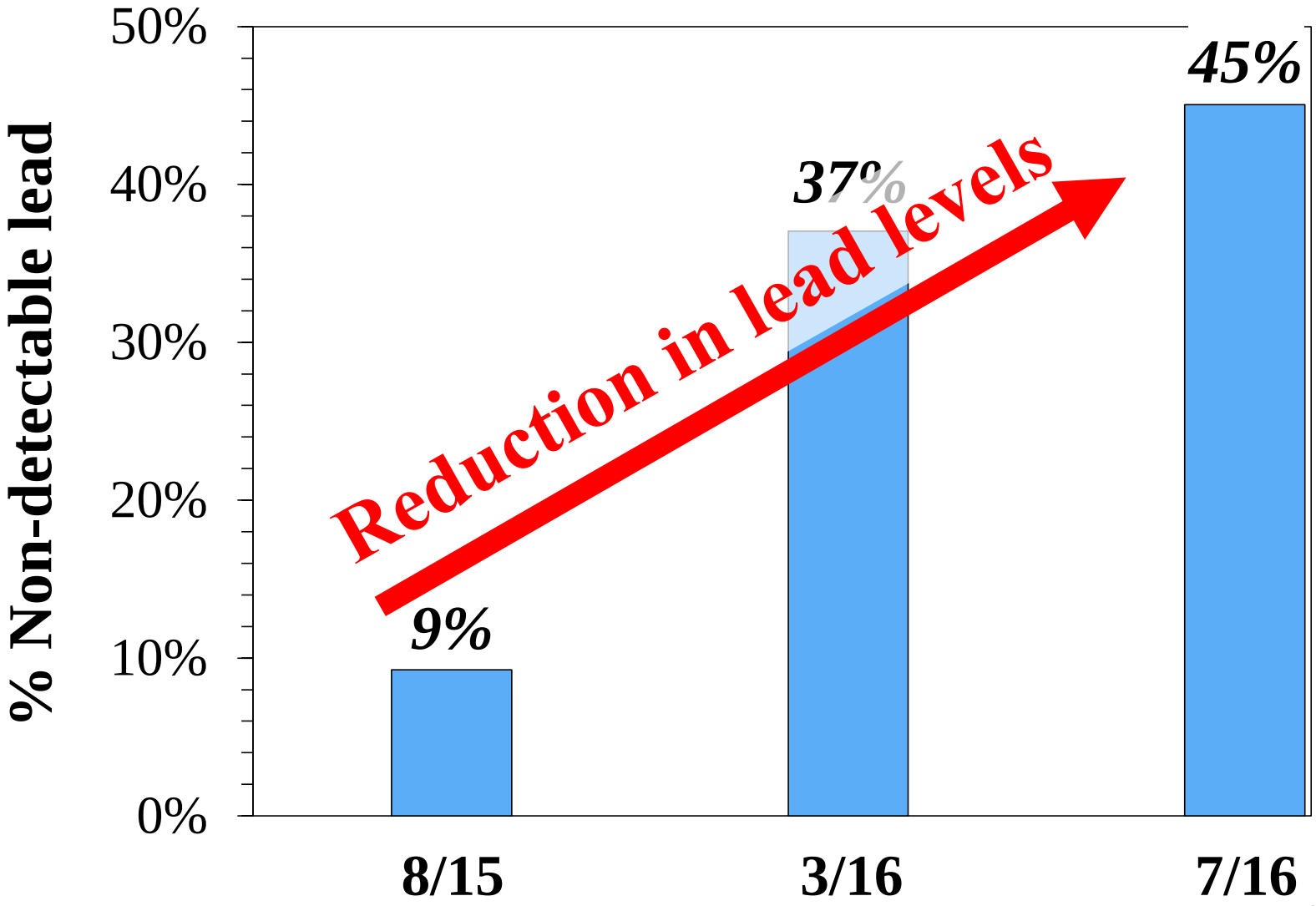
First draw lead in Jul. 2016



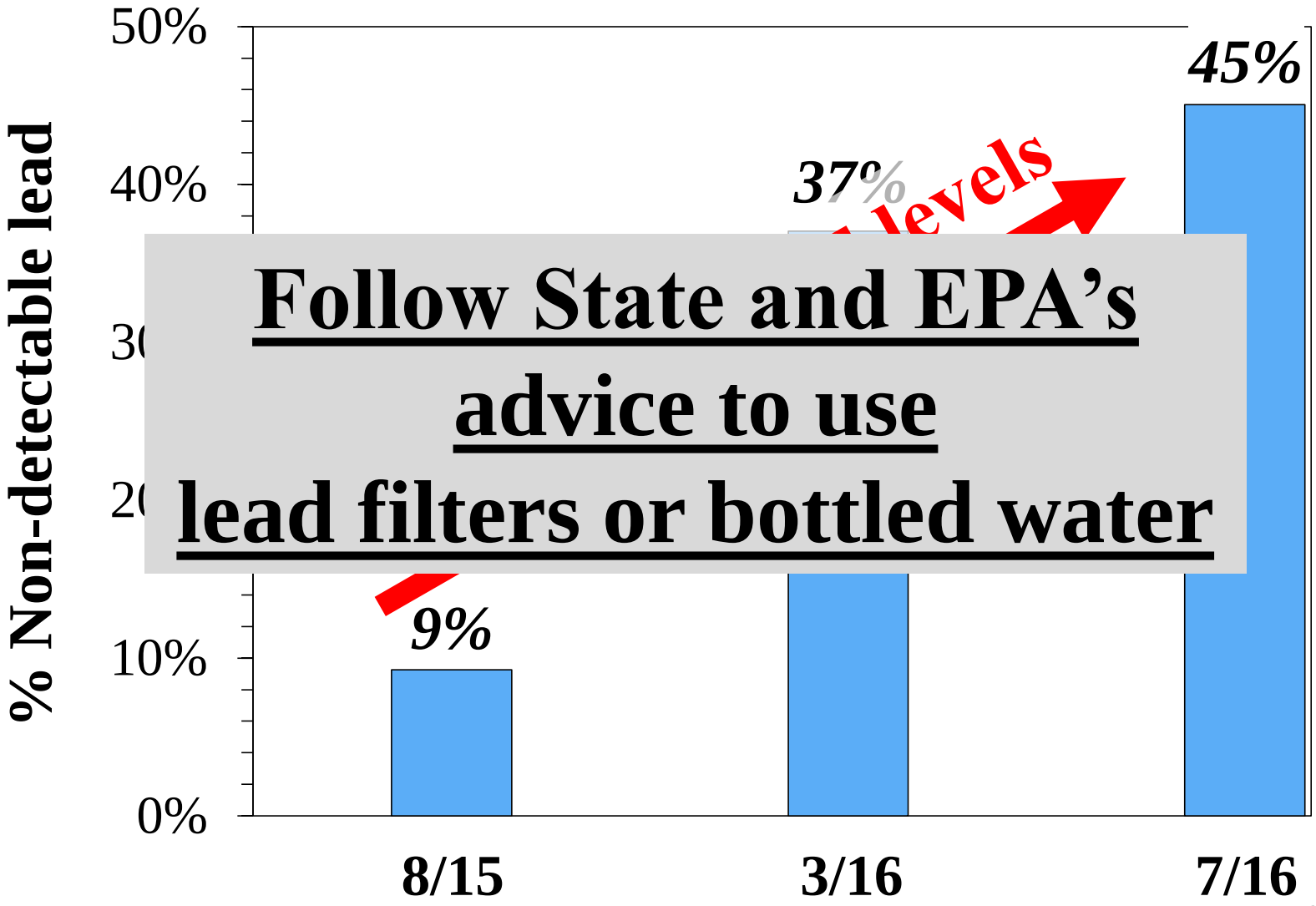
n=162

First draw lead levels



n=162

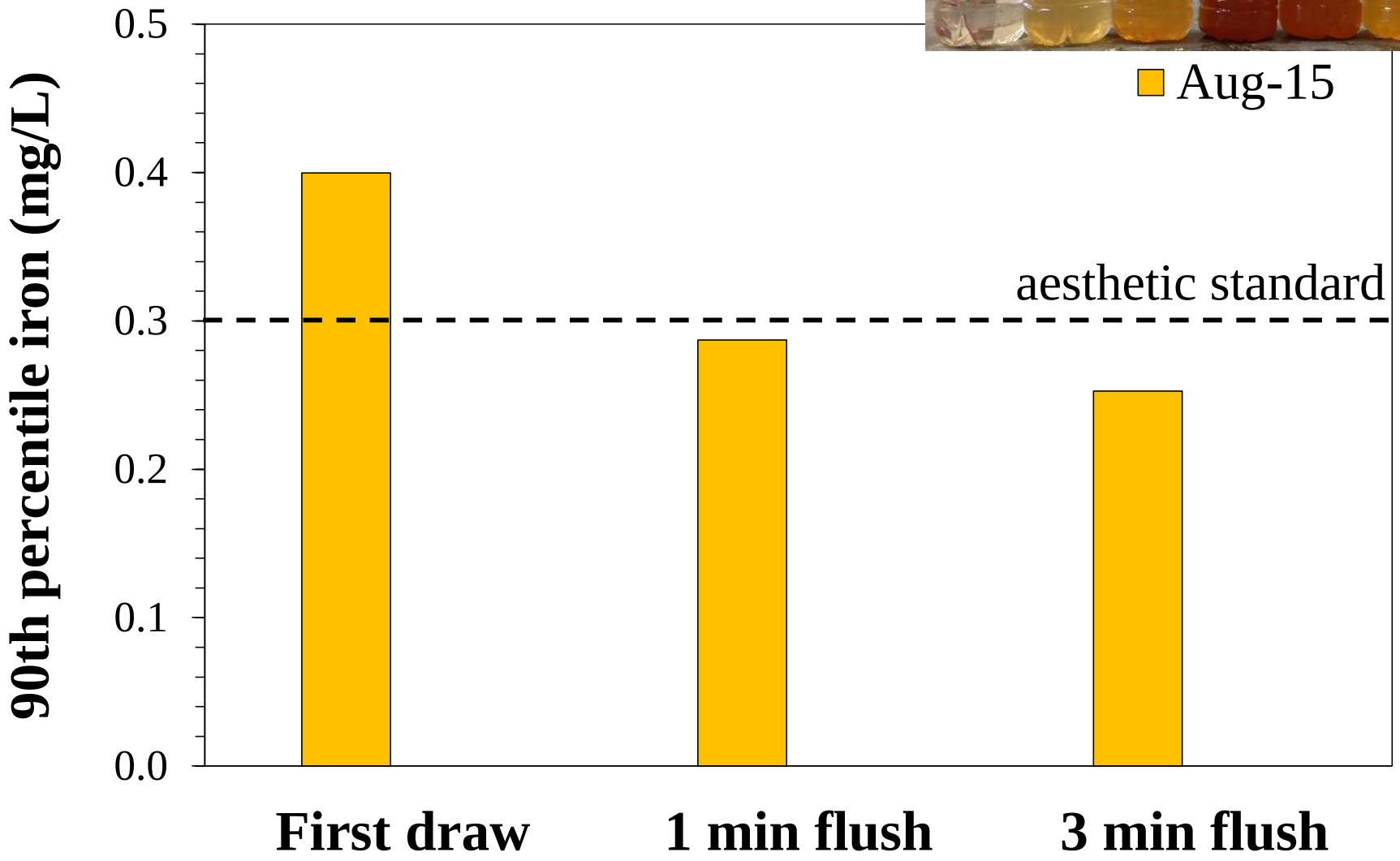
First draw lead levels



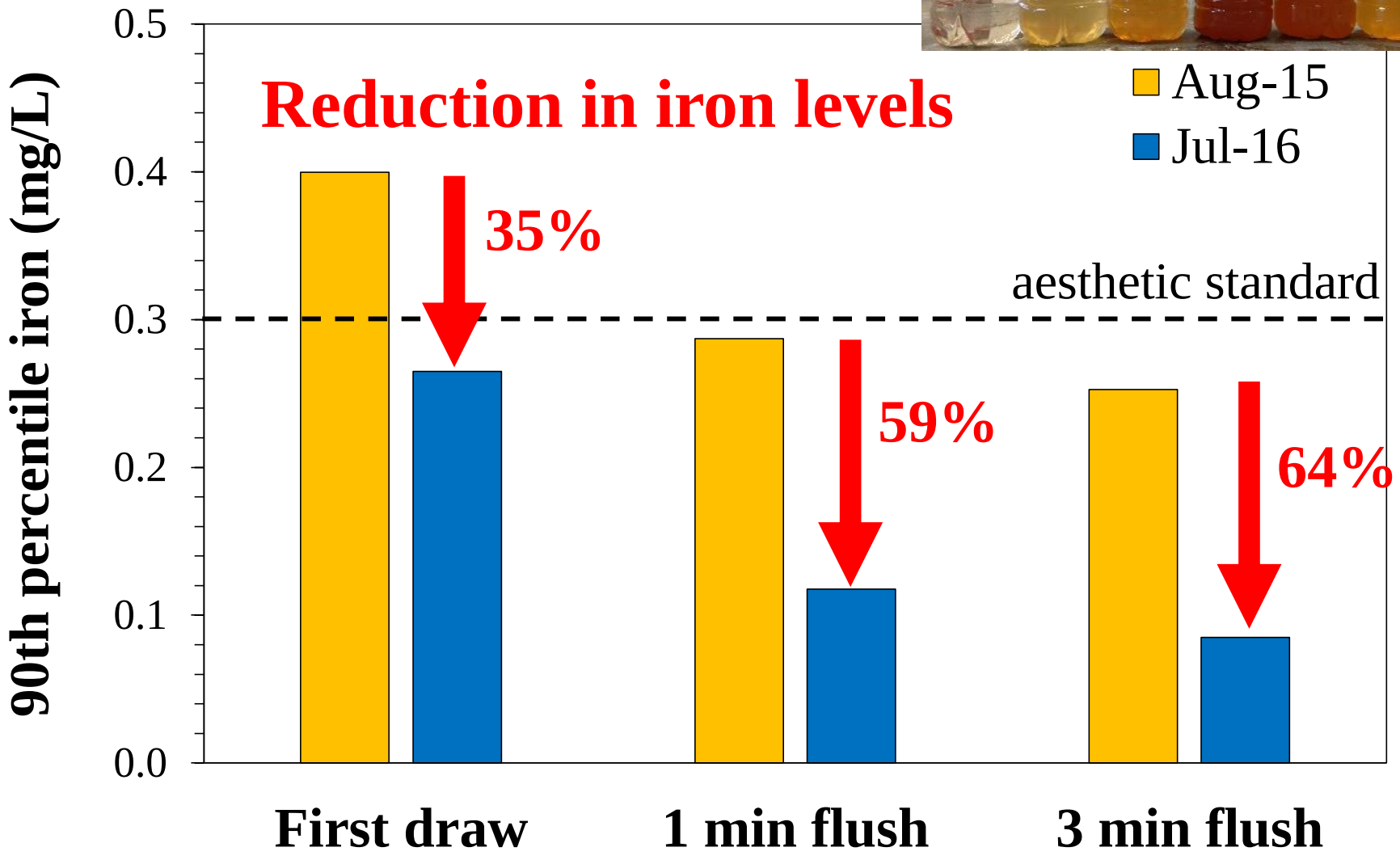
Follow State and EPA's advice to use lead filters or bottled water

n=162

Iron concentrations



Iron concentrations



Conclusions

1. It is now possible that Flint is meeting the lead action level
   - However, this is not an approved LCR sampling pool

2. Lead and iron levels have decreased since August 2015

3. Residents should use lead filters or bottled water until further notice from the State or EPA

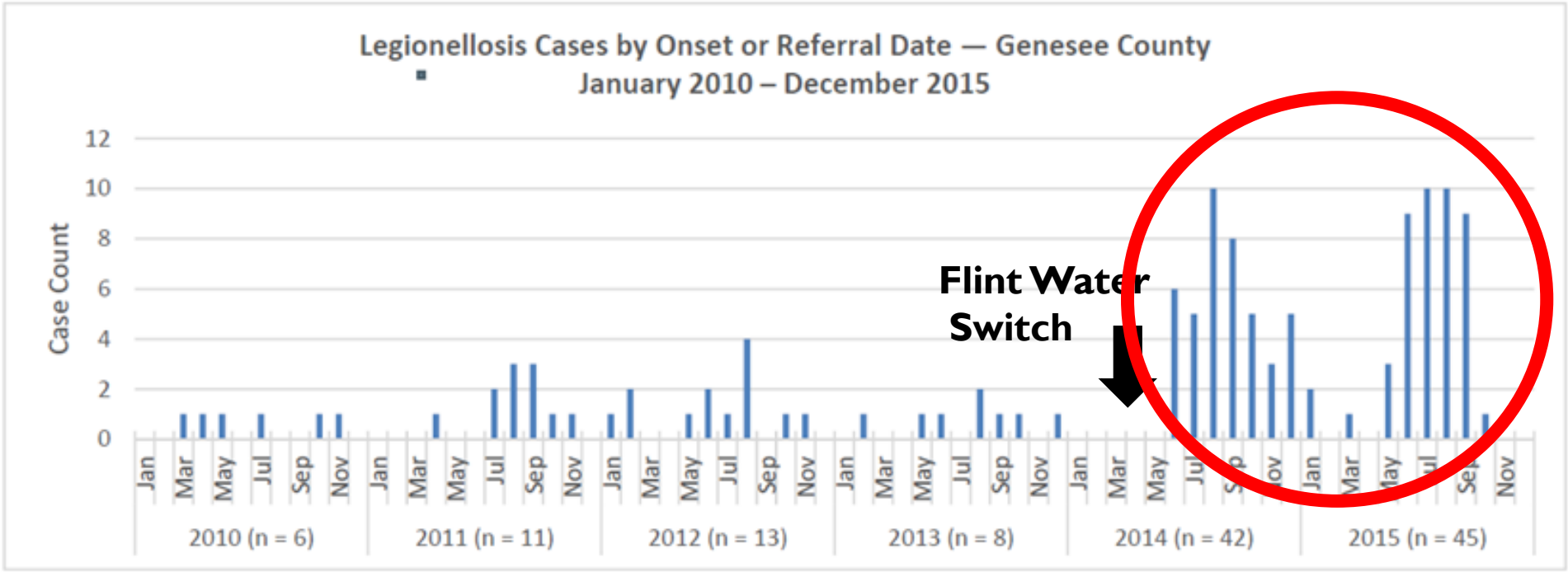
Flint Water Heater Study

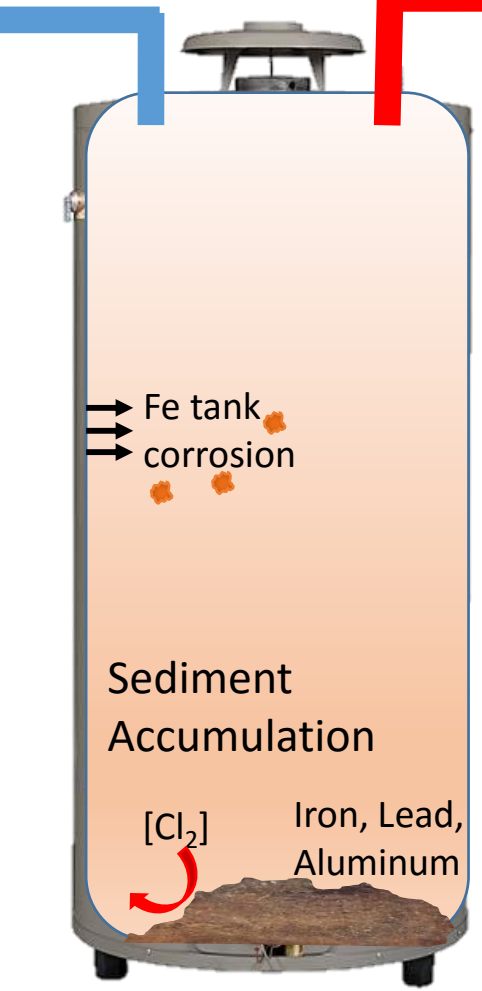
June 20-July 1

Led by: William Rhoads, PhD candidate

Taylor Bradley, MS Candidate

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





Legionella Growth in Water Heaters

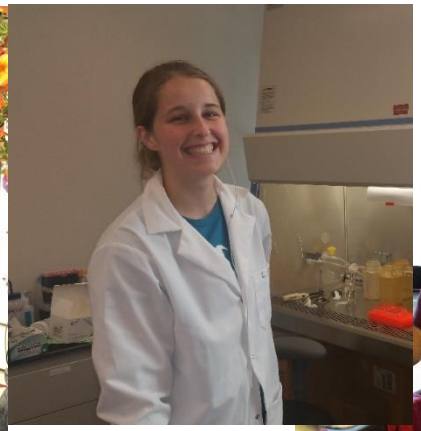
- Sediment accumulation (calcium carbonate, sand, corrosion byproducts)
  - Sediment interferes with chlorine residuals
- Temperature within the tank
  - Gradient
  - Water heater setting

Rapid chlorine decay + Sedimentation + Low Temperatures = Legionella growth?

Goals

- assess the quantity and composition of sediment accumulated in Flint water heaters,
- determine the extent of *Legionella* colonization in Flint water heaters and home plumbing,
- develop and test the effectiveness of a water heater cleaning procedure for removing sediment, and determine if removing sediment improves water quality.

Study Logistics



2 Weeks
30 Homes; 4 electric, 26 gas
2 Teams of 7 Students
3 Community Volunteers
3 Plumbers

Sampling Approach

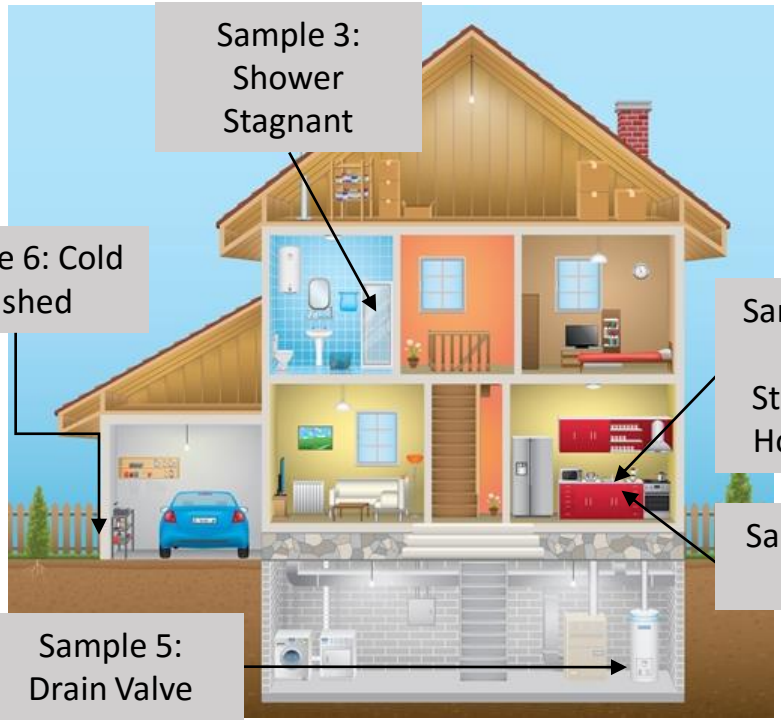


Image: https://www.tn.gov/health/article/buyers

Sampling Approach

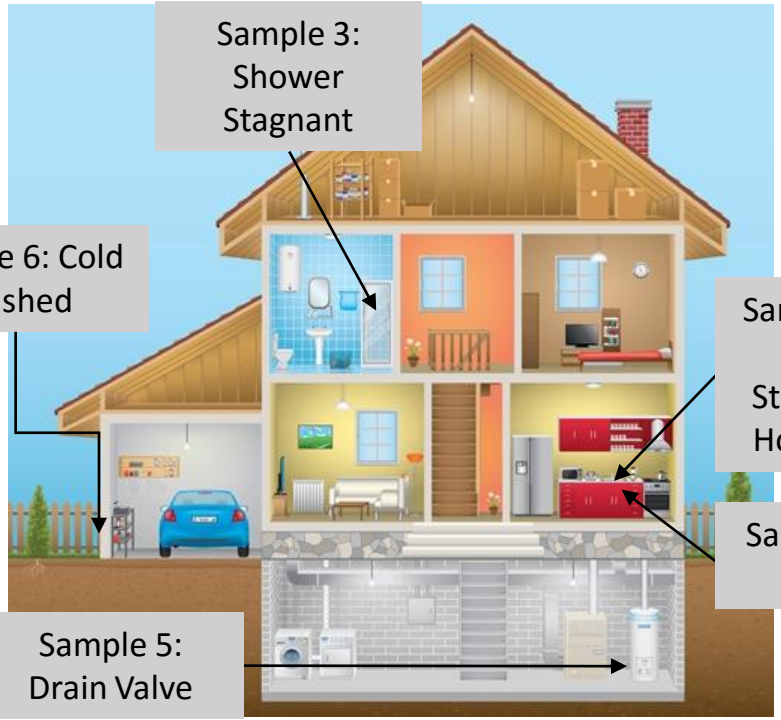
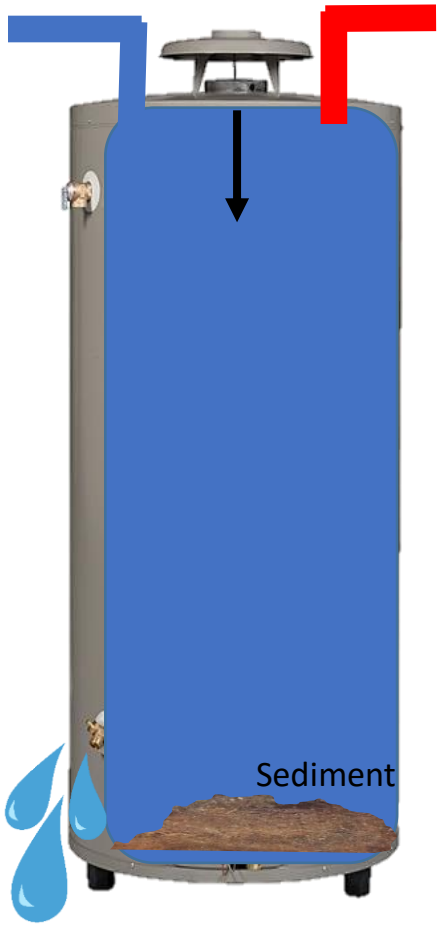


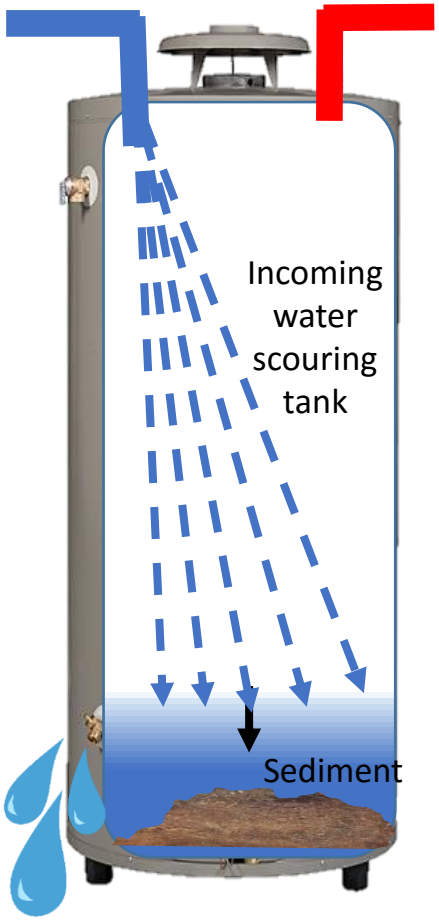
Image: https://www.tn.gov/health/article/buyers

Phase 1



Water is drained from the drain valve under pressure until tank is almost empty

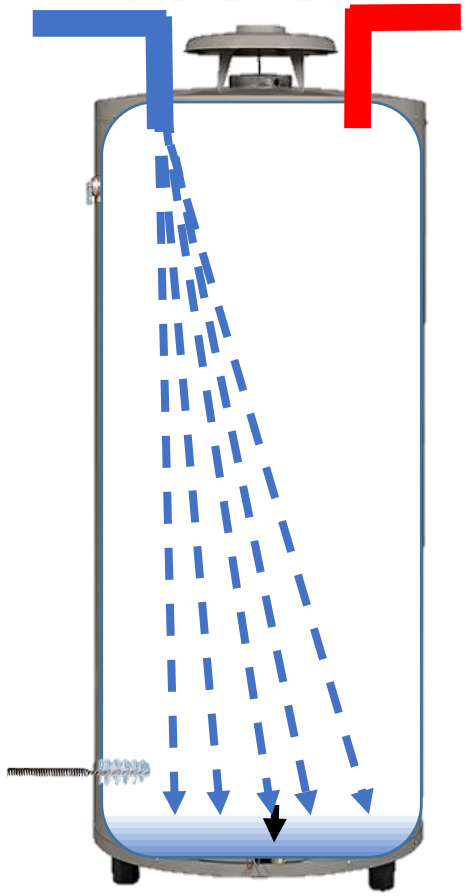
Phase 2



Sediments were scoured with water from the incoming cold water influent dip tube

Phase 3

Drain valve is removed and the interior of tank is brushed to loosen sediments, and remaining sediment is scoured until water runs clear



Hypotheses

1: Flushing water heaters will remove accumulated sediment and lower levels of inorganic contaminant concentrations (i.e., lead, iron, copper) in consumer hot water.

2: Removing accumulated sediment from water heaters will allow chlorine to remain more stable, increasing the level of chlorine residuals in the hot water.

3: While there is very little risk from *Legionella* in residential water heaters, if there is culturable *Legionella,* the levels will improve with flushing

Hypothesis 1:

Flushing water heaters will remove accumulated sediment and lower levels of inorganic contaminant concentrations (i.e., lead, iron, copper) in consumer hot water.

1. Flushing did not change levels of lead, iron, or copper at taps within homes or the water heater drain valve.

Hypothesis 2:

Removing accumulated sediment from water heaters will allow chlorine to remain more stable, increasing the level of chlorine residuals in the hot water.

- Median chlorine in cold flushed samples was 0.6 mg/L as Cl_2 both before and after flushing

1. Flushing did not change chlorine in any sample location
2. Chlorine levels in distributions system water were generally high

Hypothesis 3:

There is very low colonization of *Legionella* in residential water heaters

If there is culturable *Legionella*, the levels will improve with flushing

Legionnaires' disease and Pontiac Fever

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

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

Previous *Legionella* Field Surveys

Alary and Joly, 1991 – (Background colonization)

- 10 of 105 isolates (9.5%) were *L. pneumophila* serogroup 1

Schwake et al., 2016 – our previous samplings in Flint, MI (High colonization)

- 46 of 65 samples (70%) were *L. pneumohpila*
- 15 of 65 samples (23%) were *L. pneumophila* serogroup 1
- 10 of 65 sample (15%) were *L. pneumophila* serogroup 1 and MAb2 positive

Legionella culturing results of this study

Before Flushing…

- 1 of 32 houses (3%) [or 3 of 192 samples (1.6%)] were positive for *L. pneumophila*
  - None were serogroup 1 or MAb2 positive

After Flushing…

- 2 of 30 houses (7%) [or 4 of 180 samples (2.2%)] were positive for *L. pneumophila*
  - Those positive for *L. pneumophila* were also serogroup 1 and MAb2 positive

Hypothesis 3:

There is very low colonization of *Legionella* in residential water heaters

If there is culturable *Legionella*, the levels will improve with flushing

1. *Legionella* colonization rates in Flint homes were very low
2. Flushing did not eliminate or reduce the incidence of *Legionella*

Conclusions

- One-time flushing of water heater drain valves did not significantly reduce inorganic contaminants in home plumbing
- Flushing did not improve chlorine levels in water heaters or stagnant samples in home plumbing
- Chlorine levels reaching homes were relatively high
- *Legionella* colonization rates were very low
- Flushing did not remove culturable *Legionella* from the one home that was positive before flushing

Recommendations

- A one-time, short-term cleaning program to improve the water quality in residential home plumbing is not recommended for *Legionella* control or reducing inorganic contaminants

Acknowledgements

- Flint Water Study Team
- MDEQ
- Orchard Children Services
- Flint Residents

Flint DBPs

Dave Reckhow
University of Massachusetts
Amherst, MA

Research Funded by EPA. These comments have not been reviewed by EPA nor do they necessarily reflect the views of the EPA.

KEY POINTS (5-31-2016 Press Conference)

- CHLOROFORM, THMs and OTHER DBPs ARE EXPECTED IN THE WATER OF EVERY CITY USING CHLORINE
- IF WE DID NOT USE CHLORINE, VERY HIGH LEVELS OF WATERBORNE DISEASE AND DEATHS WOULD OCCUR, INCLUDING LEGIONAIRRES DISEASE
- ALL AVAILABLE DATA SHOW REASONABLE AND EXPECTED LEVELS OF CHLOROFORM, TTHMs and OTHER DBPs IN FLINT SINCE RETURNING to DETROIT WATER
- NOTHING UNUSUAL DETECTED BY EPA OR UMASS, EVEN FROM FLINT WATER HEATERS

New Sampling By UMass

Members of the UMass Flint DBP Team:
Dr. Dave Reckhow (Team Lead)
Dr. Joe Goodwill (DBP sampling, THMs, Iodo-THMs and other volatiles)
Yanjun Jiang (Iodo-THMs and other volatiles)
Xuyen Mai (DBP sampling)
Xian “Max” Ma (DBP sampling, Haloacetamides)
Ran Zhao (Haloacetamides and HAAs)
Soon-Mi Kim (Haloacids)
Yun “Rosa” Yu (N-halo-haloacetamides)
Aarthi Mohan (Halobenzoquinones)
Pranav Mashankar (Aldehydes)
Sherrie Webb-Yagodzinski (Sampling preparation)

Project Report #2

TESTING OF HOMES IN FLINT MICHIGAN TO ASSESS DISINFECTION BYPRODUCTS IN HOT AND COLD WATER

Report on Samples Collected May 31, 2016

2 more samples from buildings always on Detroit water.
2 more samples from Flint homes.
Both hot and cold water tested.

Table 1 Summary of Analyses and Procedures

DBP Group[1]	Method#	Method Type	Instruments	Precision
THMs, HANs, HKs, CP	UMA01	LLE/GC/ECD	Agilent 6890 GC	Varies, but typically ± 10%
Iodo-THMs and other volatiles	UMA06	LLE/GC/ECD	Agilent 6890 GC	Varies, but typically ± 10%
Total Organic Chlorine (TOCl)	UMA03	Ads/Combustion /IC	Mitsubishi TOX-Metrohm IC	typically ± 15%
Total Organic Bromine (TOBr) & Iodine (TOI)	UMA18	Ads/Combustion /ICPMS	Euroglass TOX/ Varian Elan 9000 DRC ICP/MS	typically ± 15%
Haloacetic Acids	UMA02	LLC/deriv./GC/ECD	Agilent 6890 GC	Varies, but typically ± 15%
Haloacids	UMA10	Isotope dilution LC/MS/MS	Acquity/Quattro Premier triple quadrupole LC/MS	Varies, but typically ± 20%
Haloacetamides (HAMs)	UMA11	SPE/GC/MS/MS	Varian 2200 Ion Trap GC/MS	Varies, but typically ± 15%
N-Cl-HAMs	UMA13	SPE/LC/MS/MS	Acquity/Xevo G2-XS QTof	typically ± 20%
Oxyhalides	UMA21 UMA25	LC/MS/MS	Acquity/Quattro Premier triple quadrupole LC/MS	Varies, but typically ± 10%
Halobenzoquinones (HBQs)	UMA15	LC/MS/MS	Alliance/Quattro Micro triple quadrupole LC/MS	typically ± 15%
Aldehydes	UMA04	Deriv./LLE/GC/ECD	Agilent 6890 GC	typically ± 10%

SECTION D: GENERAL CONCLUSIONS

The following conclusions are based on the suite of DBPs that were measured by UMass from samples collected on May 31, 2016.

The two cold water samples collected from Flint homes were typical of what exists around the US especially when comparing systems that use free chlorine as a residual disinfectant. Some DBPs were near or even below the national average, and some were slightly above average. In general, the two Flint samples had DBP concentrations that were comparable to that of the control community (Grand Blanc).

Samples collected from the hot water taps showed changes, with some DBPs decreasing in concentration and some increasing. The changes that were noted are typical of what we've seen from other systems or from what we expect based on the known thermal stability of the particular DBP compounds.

In summary, we didn't see anything unusual or alarming in the Flint water samples from these two locations.

Thank you!

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