
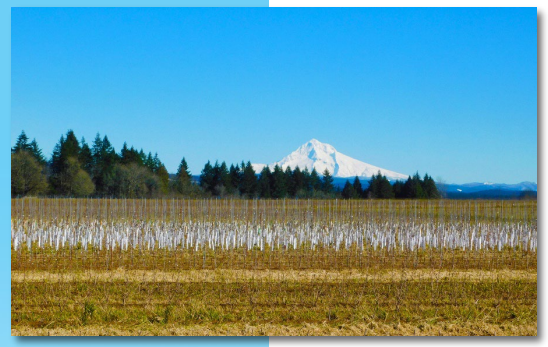
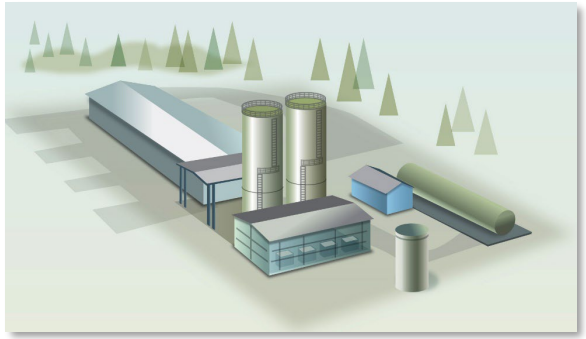


Is my corrosion control treatment change working?

Regulatory, in home, and installation monitoring for implementing Improved Corrosion Control Treatment

Mac Gifford, Water Quality Engineer

PNWS Annual Conference, Kennewick WA

May 5, 2023

PORTLAND WATER BUREAU

FROM FOREST TO FAUCET

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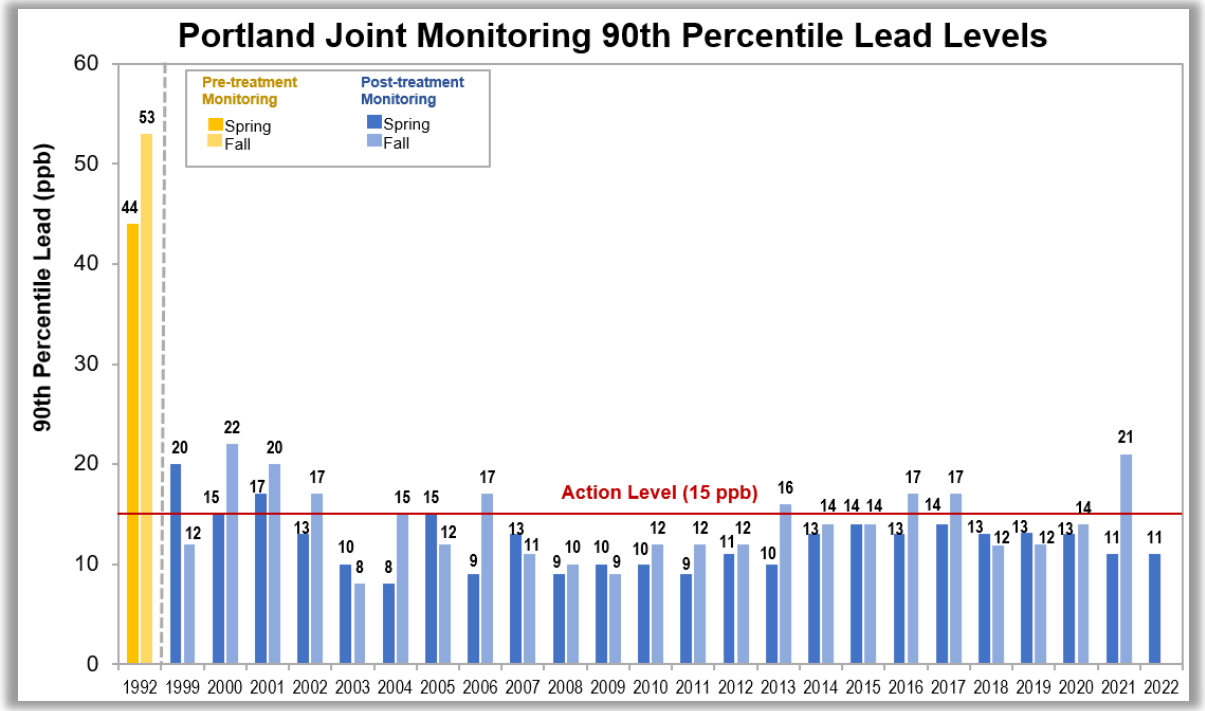
Outline

- Implementation plan
- pH Monitoring programs
- Lead Monitoring programs
- Conclusions

Implementation Plan

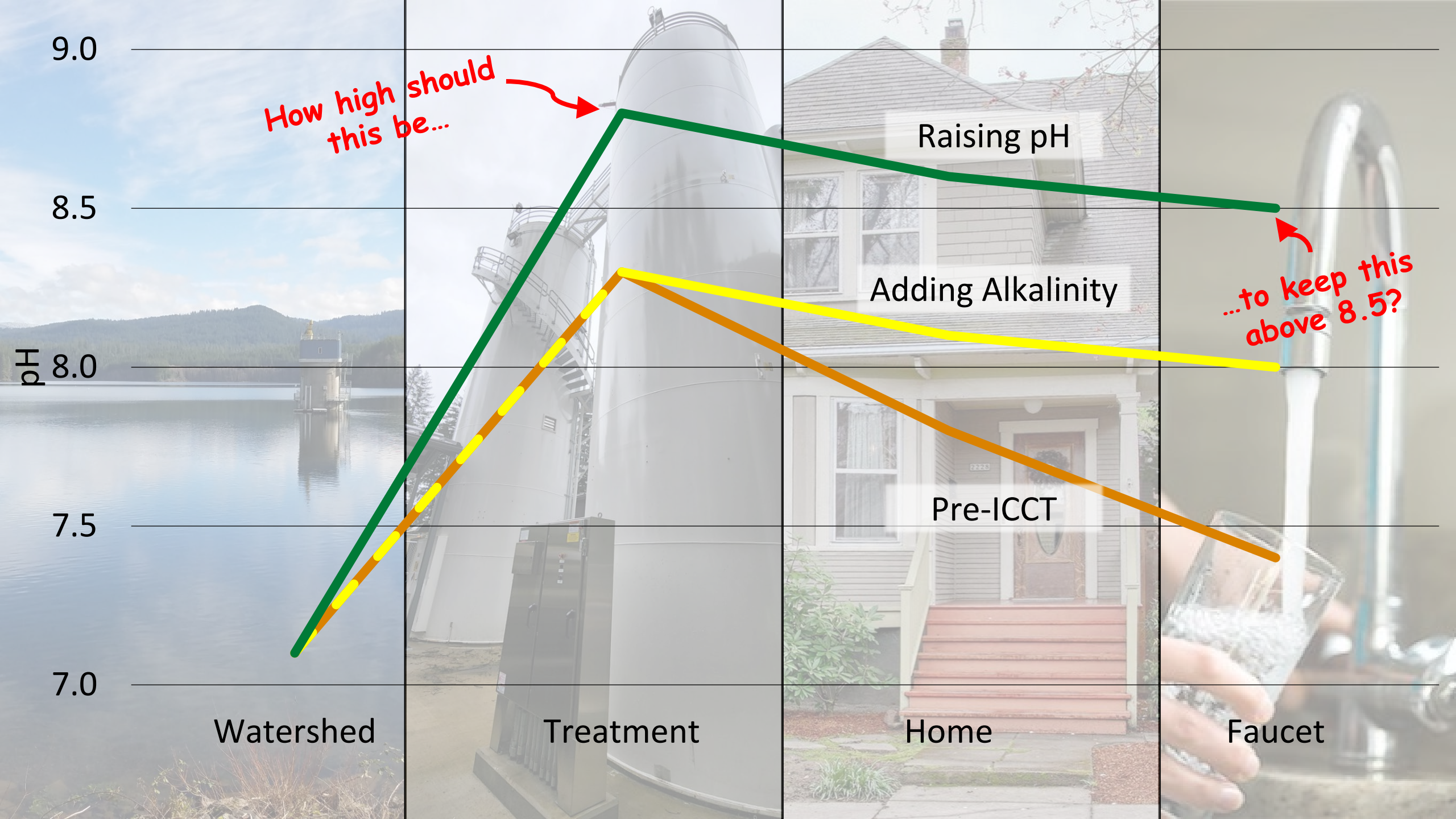
PWB's lead history

- PWB has never had lead pipes or lead service lines. Removed lead pigtails.
- Source of lead is premise plumbing.
- Historically met LCR requirements through the Lead Hazard Reduction Program. Also increased pH using sodium hydroxide.



Improved Corrosion Control Treatment

- Water quality targets:
  - pH of 8.5 through the distribution system
  - Alkalinity of 25 mg/L
- Soda Ash & Carbon Dioxide
- Online April 2022
- Do not modify treatment for secondary groundwater source


9.0
8.5
8.0
7.5
7.0
pH
How high should this be...
Raising pH
Adding Alkalinity
...to keep this above 8.5?
Pre-ICCT
Watershed
Treatment
Home
Faucet

ICCT implementation schedule

April 2022

Baseline
12 months

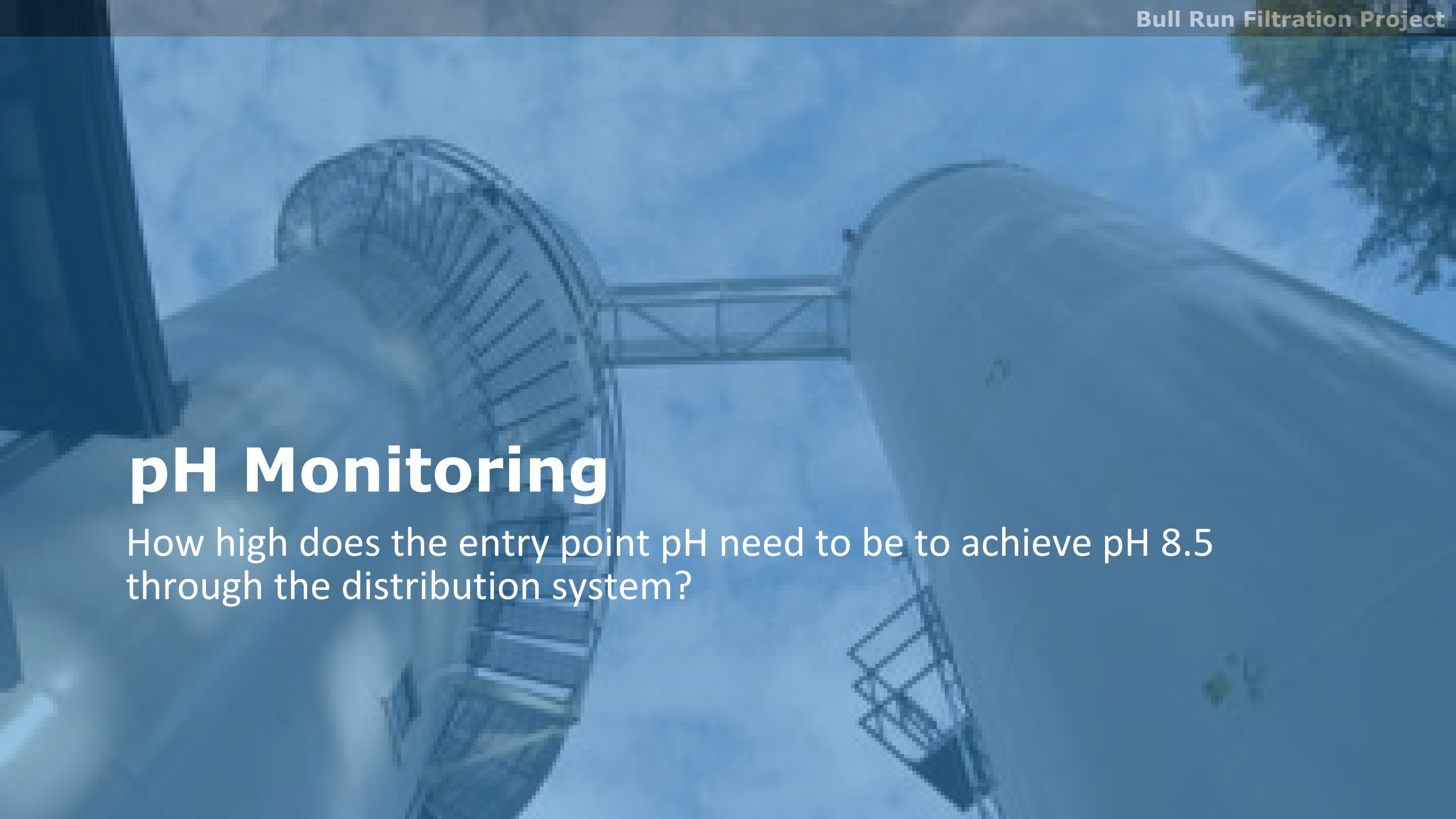
- Develop robust baseline data set

Implementation
~~18-24 months~~ 6 months

- Raise entry point alkalinity to 25 mg/L
- Raise entry point pH until achieve 8.5 through distribution system
- Use 0.2 unit increments
- ~~3-6 months~~ 1 month per step

Validation
12 months

- Monitor effect of improved corrosion control on lead levels
- OHA requires two six-month demonstration periods



pH Monitoring

How high does the entry point pH need to be to achieve pH 8.5 through the distribution system?

pH Monitoring Programs

Lead & Copper Rule Distribution System

- Regulatory pH and alkalinity sampling through the dist. system
- Too infrequent to inform CCT startup operations
- 25 samples every quarter

Total Coliform Rule WQ monitoring

- Include pH with TCR sampling for frequent dist. system sampling
- Not paired with lead results or customer tap information
- 240 samples every month

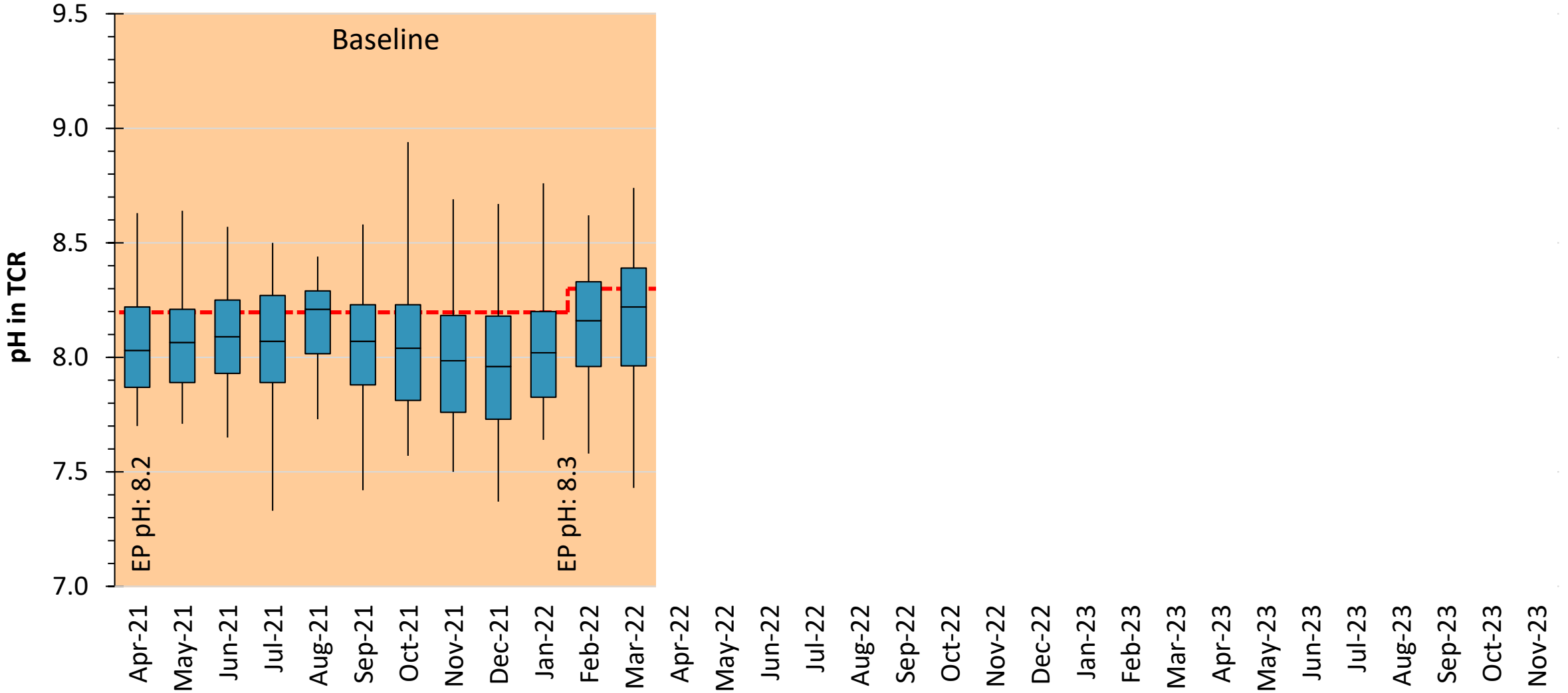
Nitrification Monitoring

- Water quality from most challenging parts of the dist. system
- Seasonal
- 100 samples per month, August through December

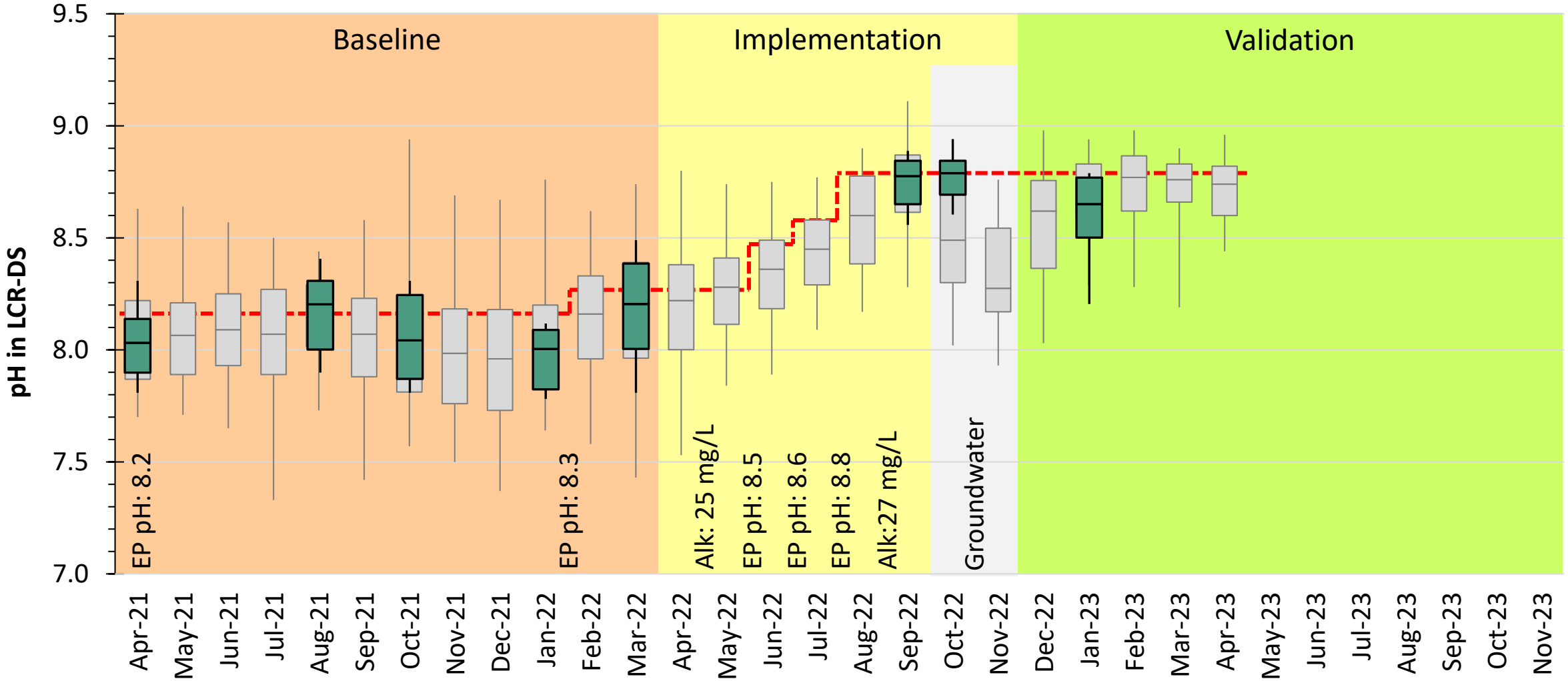
Customer Tap pH Monitoring

- Capture pH at the tap after stagnation
- Small sample size with limited representativeness
- 10-30 samples per month

Controlling entry point pH to achieve DS pH goal



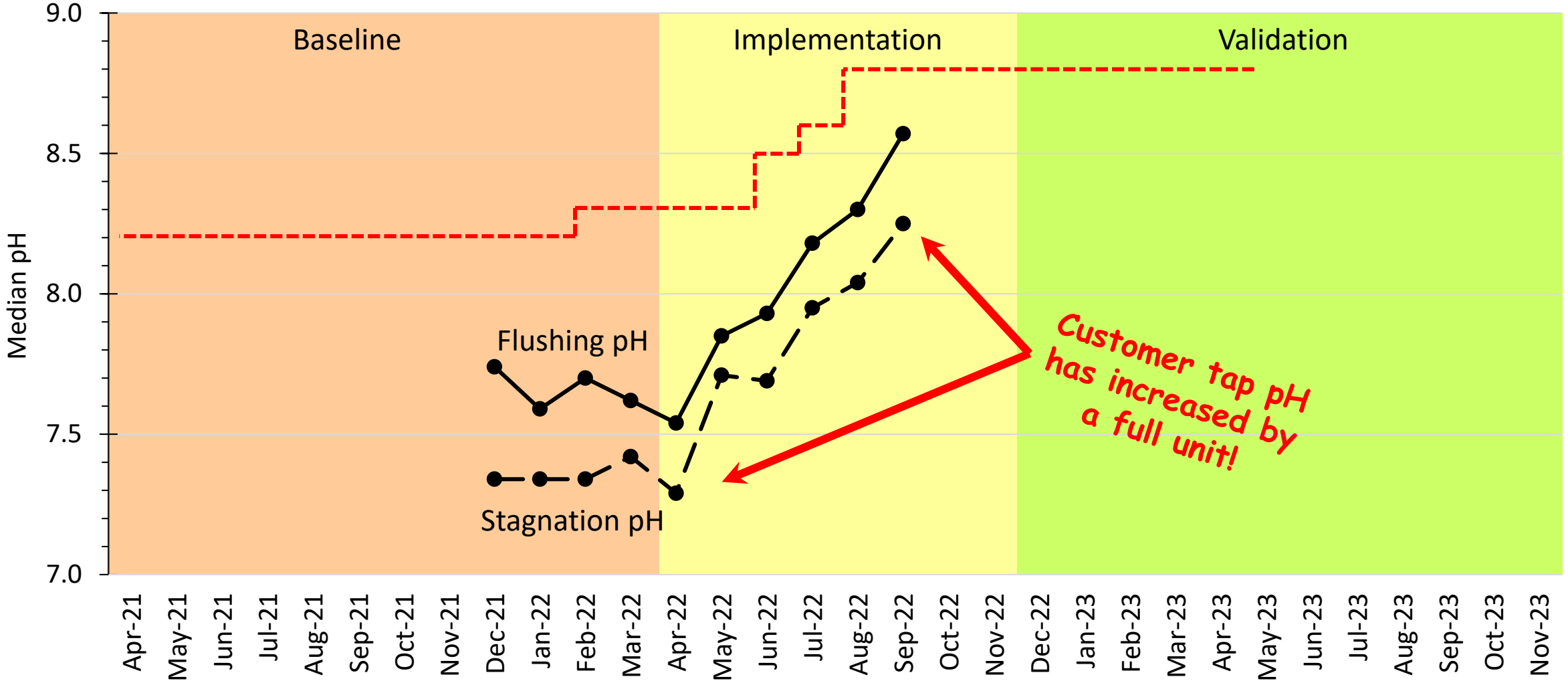
Regulatory LCR-DS monitoring too infrequent to inform startup decisions



pHome Monitoring Program

- Water quality monitoring at customer taps
- Compare pre- and post-stagnation water quality
  - pH, chlorine, temperature
- Employees trained in field equipment
- Homes not necessarily associated with lead exposure or lead levels

pHome Customer Tap pH Monitoring



Lead Monitoring

How will the increased distribution system pH and alkalinity affect lead in water?

Lead Monitoring Programs

Lead & Copper Rule Tier 1 Homes

- Regulatory sampling for lead in homes with known lead exposure
- Too infrequent to inform CCT startup operations
- 100 samples every 6 months

Customer Requested Lead in Water Kits

- Lead in homes with frequent results
- Very low results with inconsistent sampling pool
- 150-3,000 samples every month

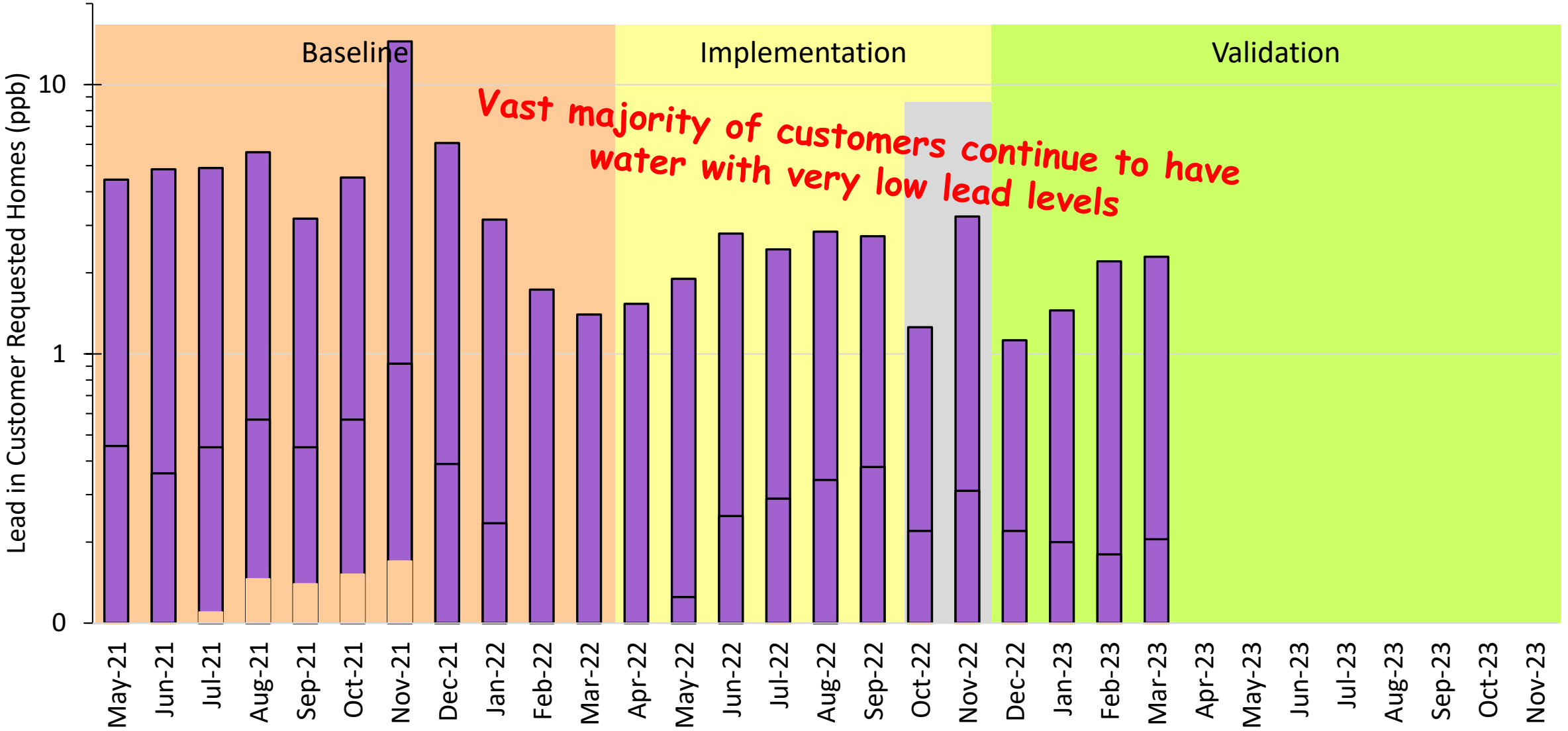
Corrosion Monitoring (PRS) Stations

- Controlled conditions and routine sampling
- Not customer home
- 16 samples every other week

Sentinel Homes

- Repeated, non regulatory, customer lead sampling
- Had to build a baseline data set before CCT change
- 50 samples every month

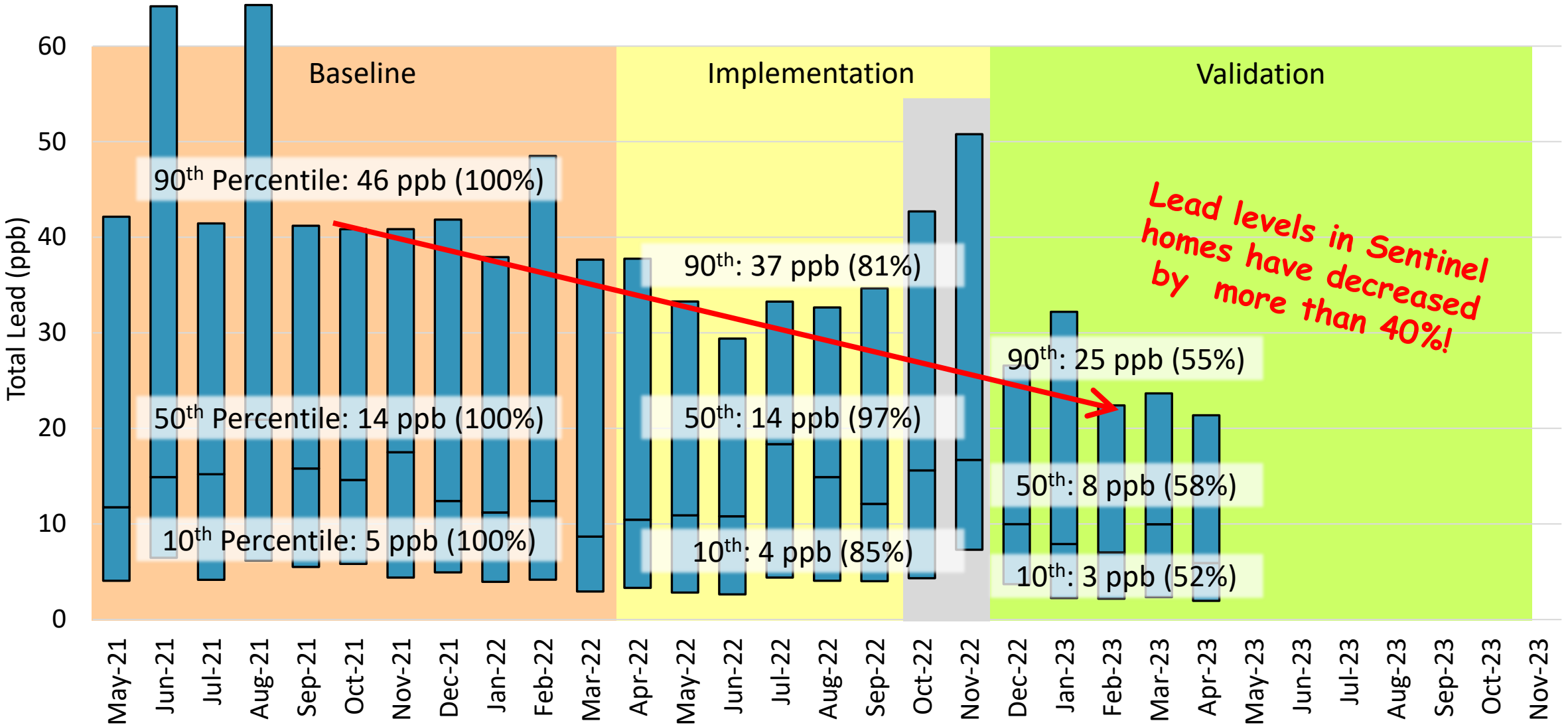
Customer Requested Lead in Water Kits



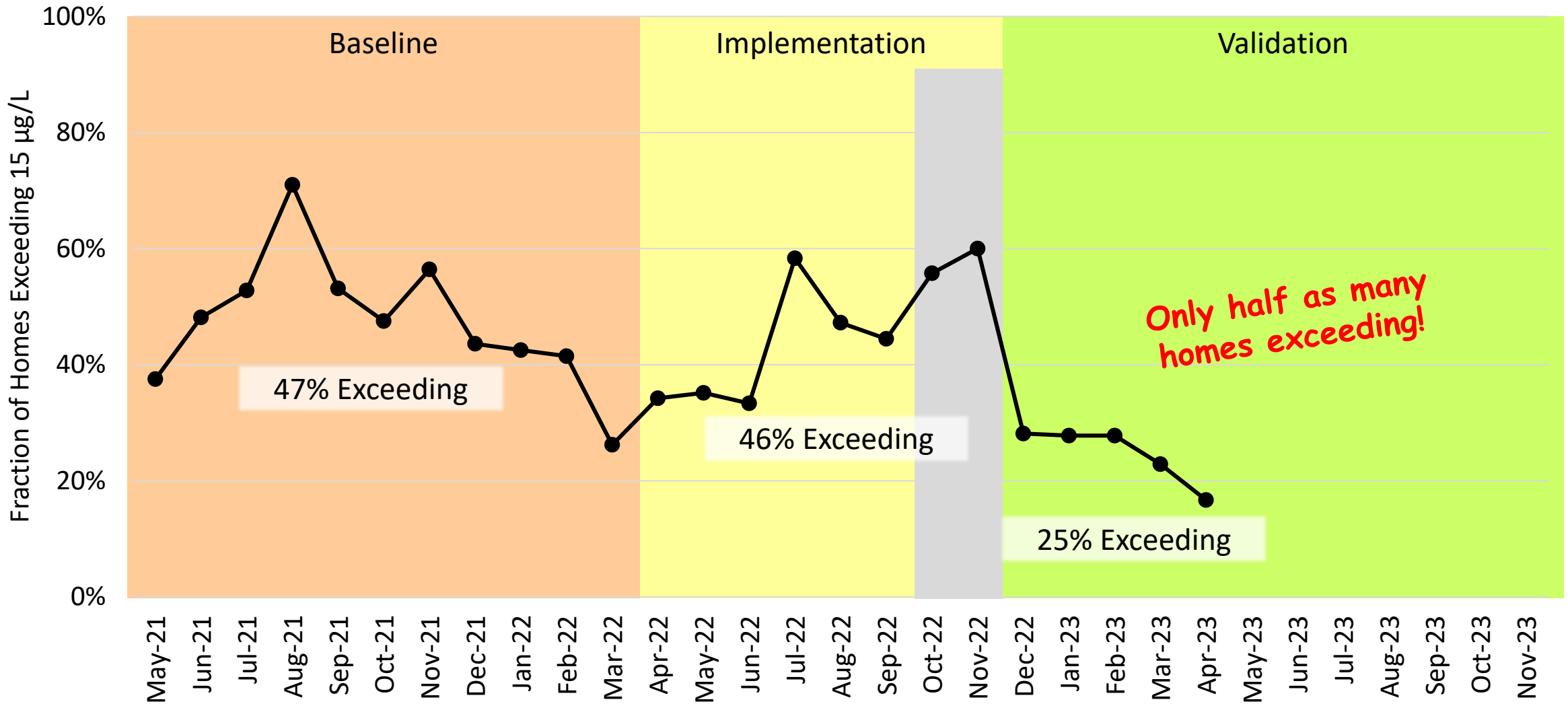
Sentinel Home Lead Monitoring Program

- Monthly in-home customer lead sampling
- 50 participants to start, specifically selected for having high lead results
- Work with regulator to conduct in way that are not regulatory samples

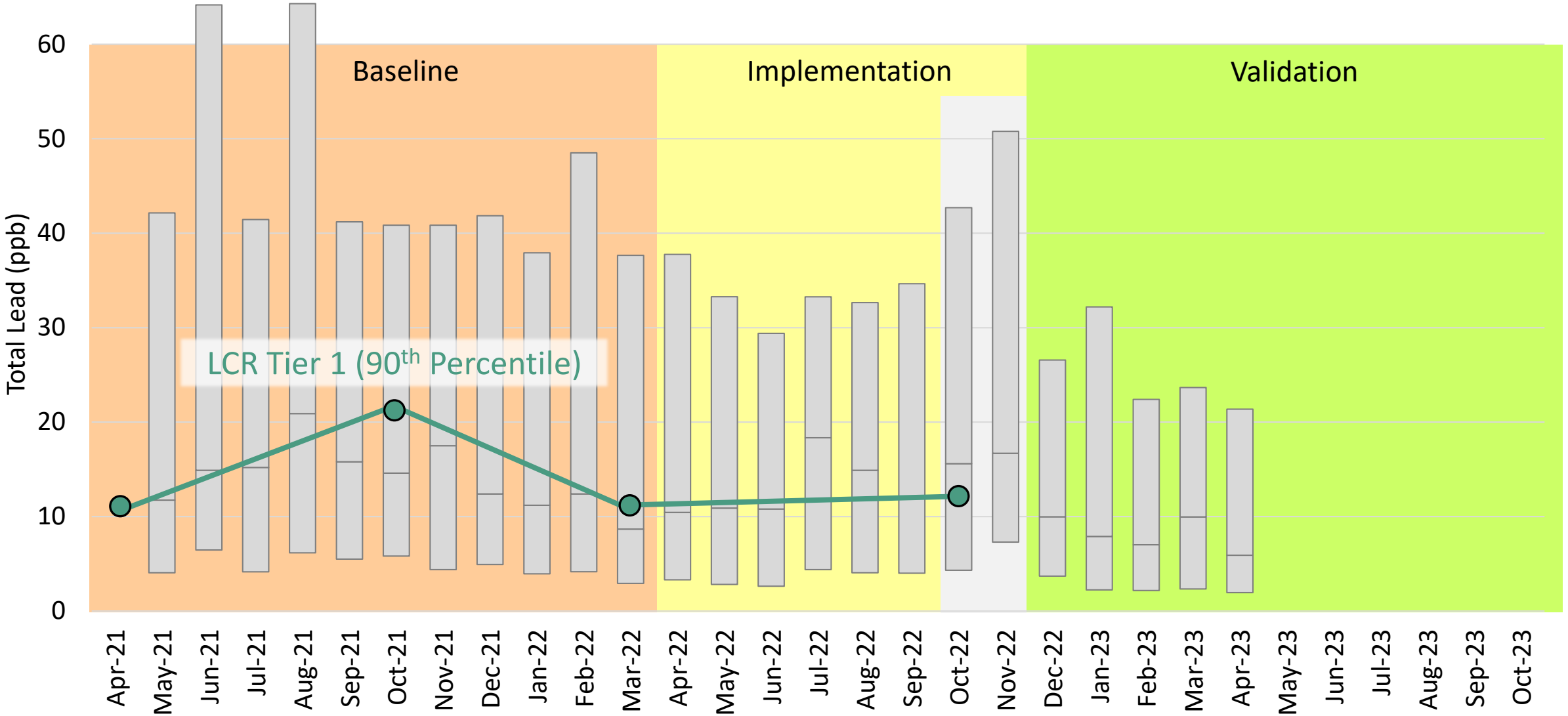
Lead in Sentinel Homes



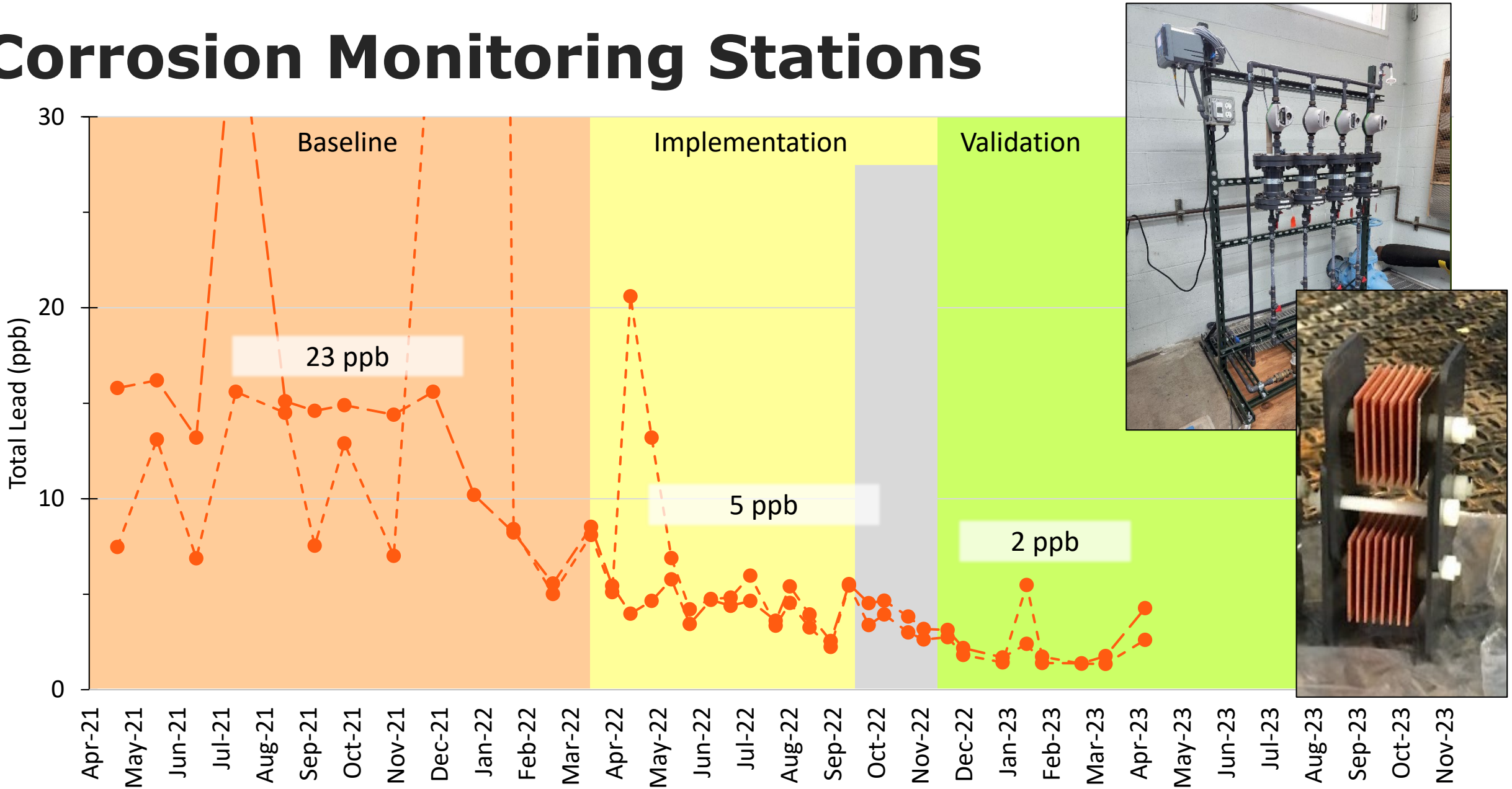
Sentinel Homes Exceeding 15 µg/L



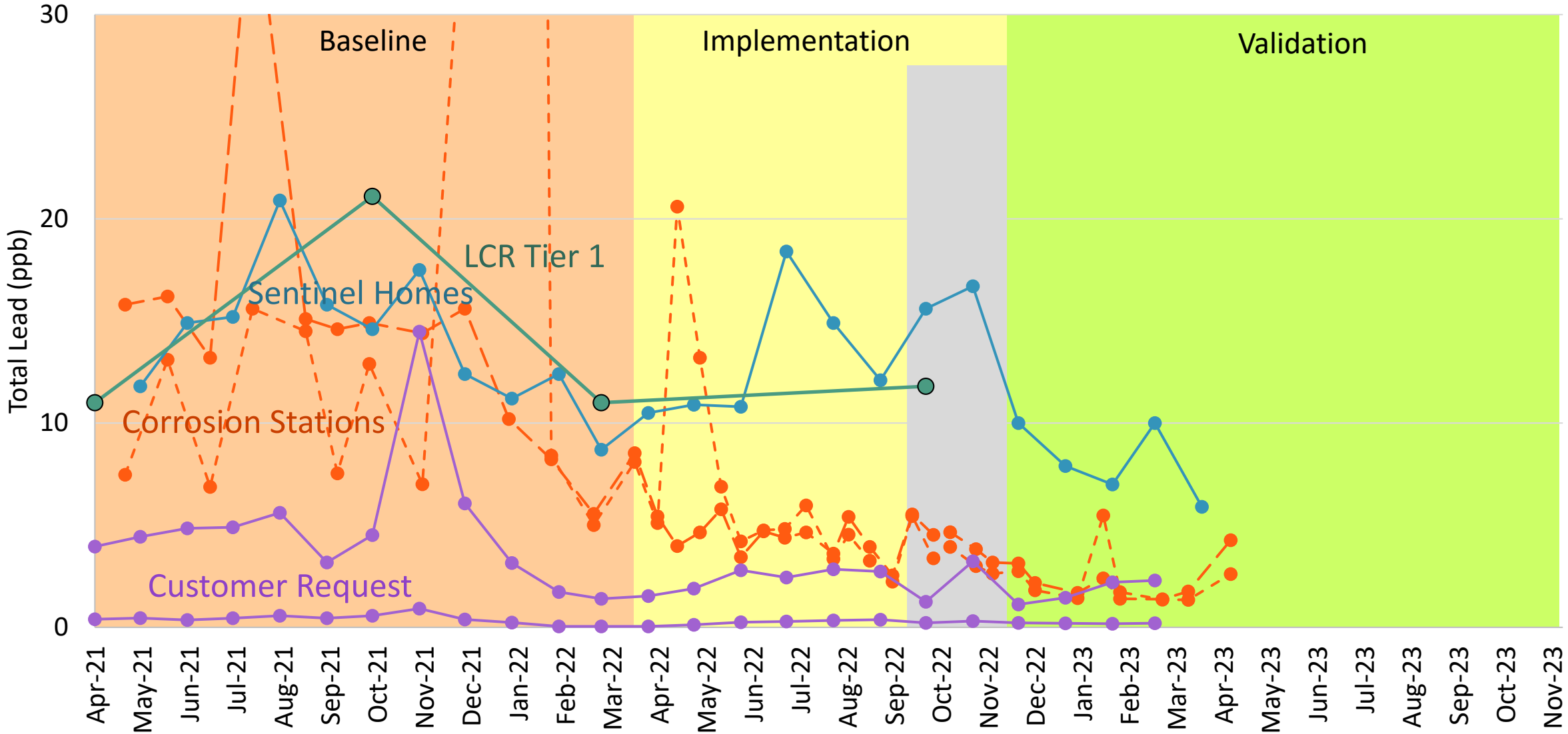
Regulatory monitoring to infrequent for startup



Corrosion Monitoring Stations

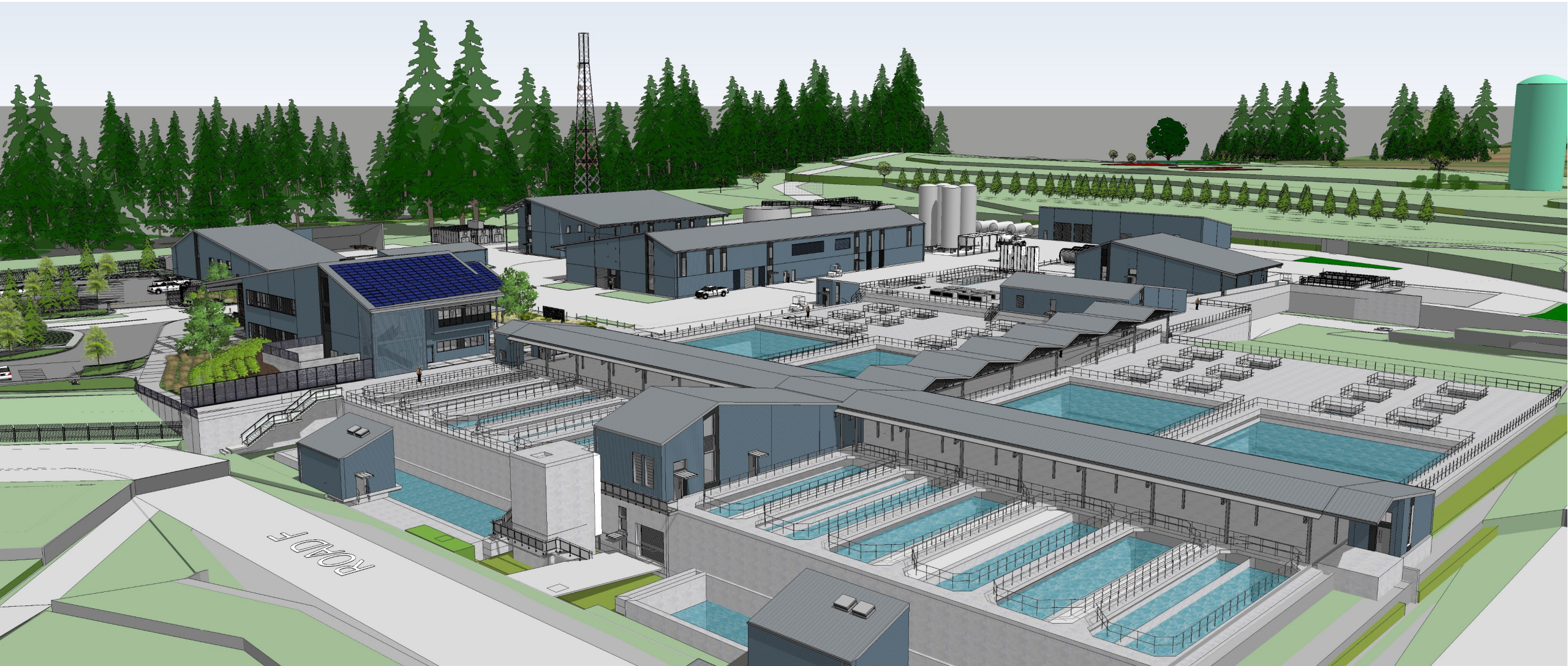


Corrosion Monitoring informs lead behavior

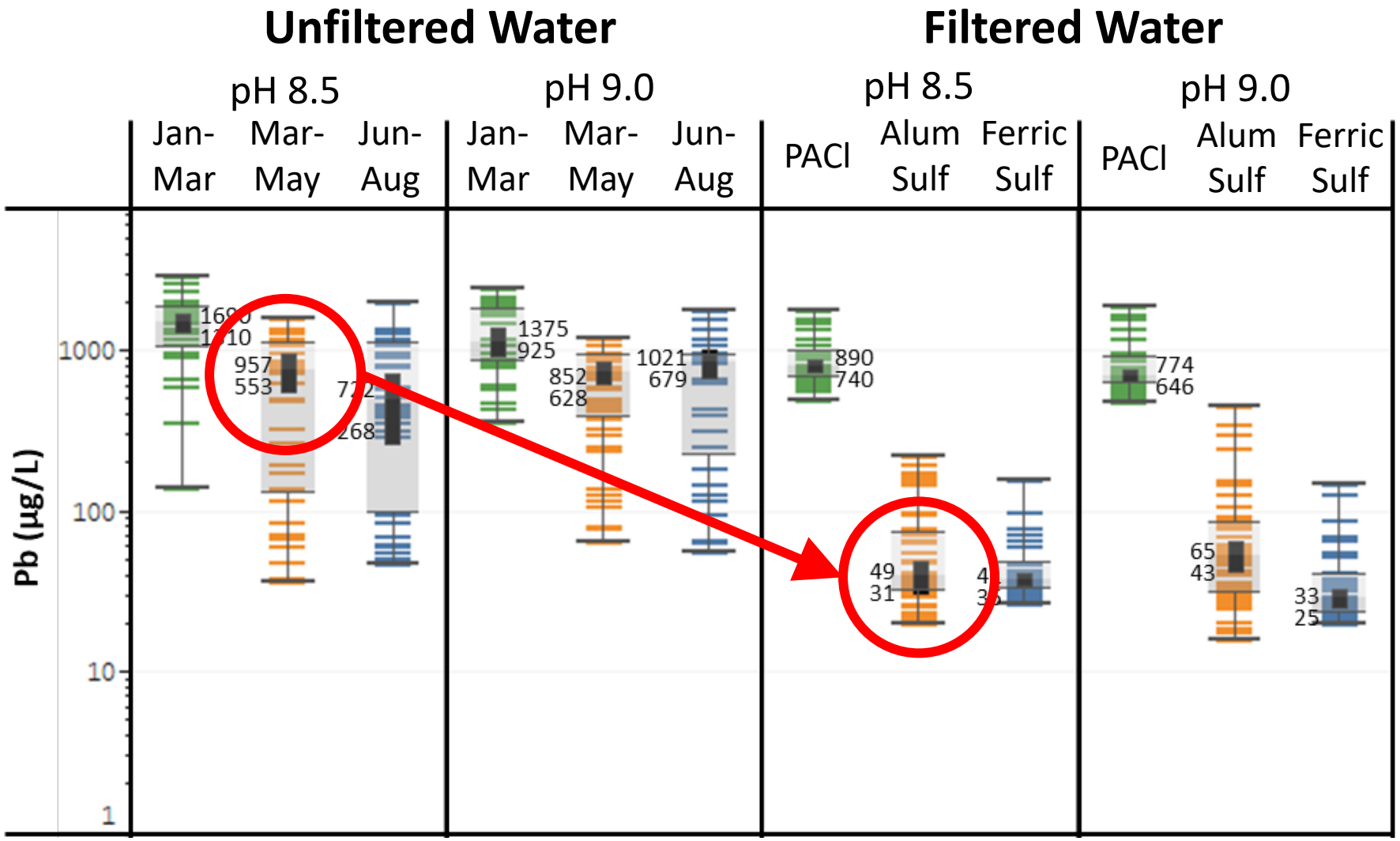


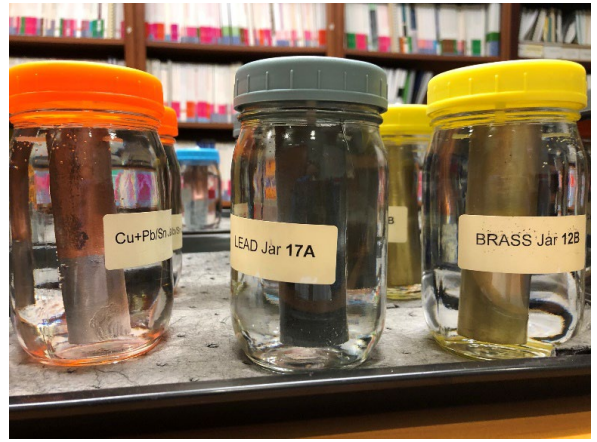
Looking Forward

Filtration coming in 2027



Filtration expected to further reduce lead levels





Take Away Messages

- Continue to develop industry knowledge on corrosion control for copper pipe with lead solder
- Start monitoring programs early. Need a good baseline.
- Implementing a corrosion control treatment change needs feedback faster than regulatory monitoring provides.
- Have patience when watching for changes to lead in water after a corrosion control treatment change.
- Routinely monitor pH through distribution system.
  - Recommend: pH readings with TCR sampling
- Routinely monitor lead at customer taps.
  - Recommend: Sentinel home monitoring

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- Portland.gov/water

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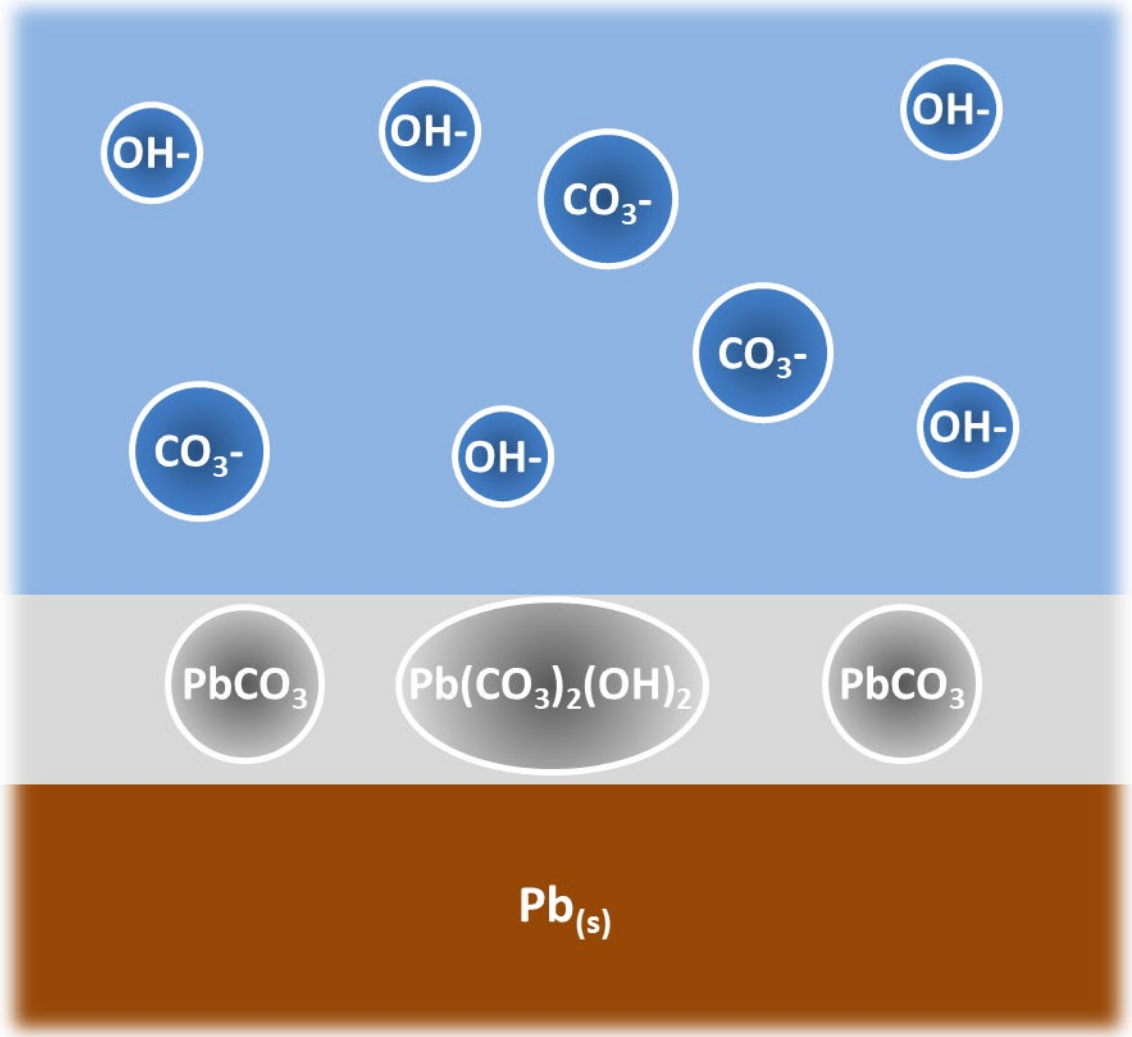
CITY OF PORTLAND, OREGON 1851

For Reference

Effects of corrosion control

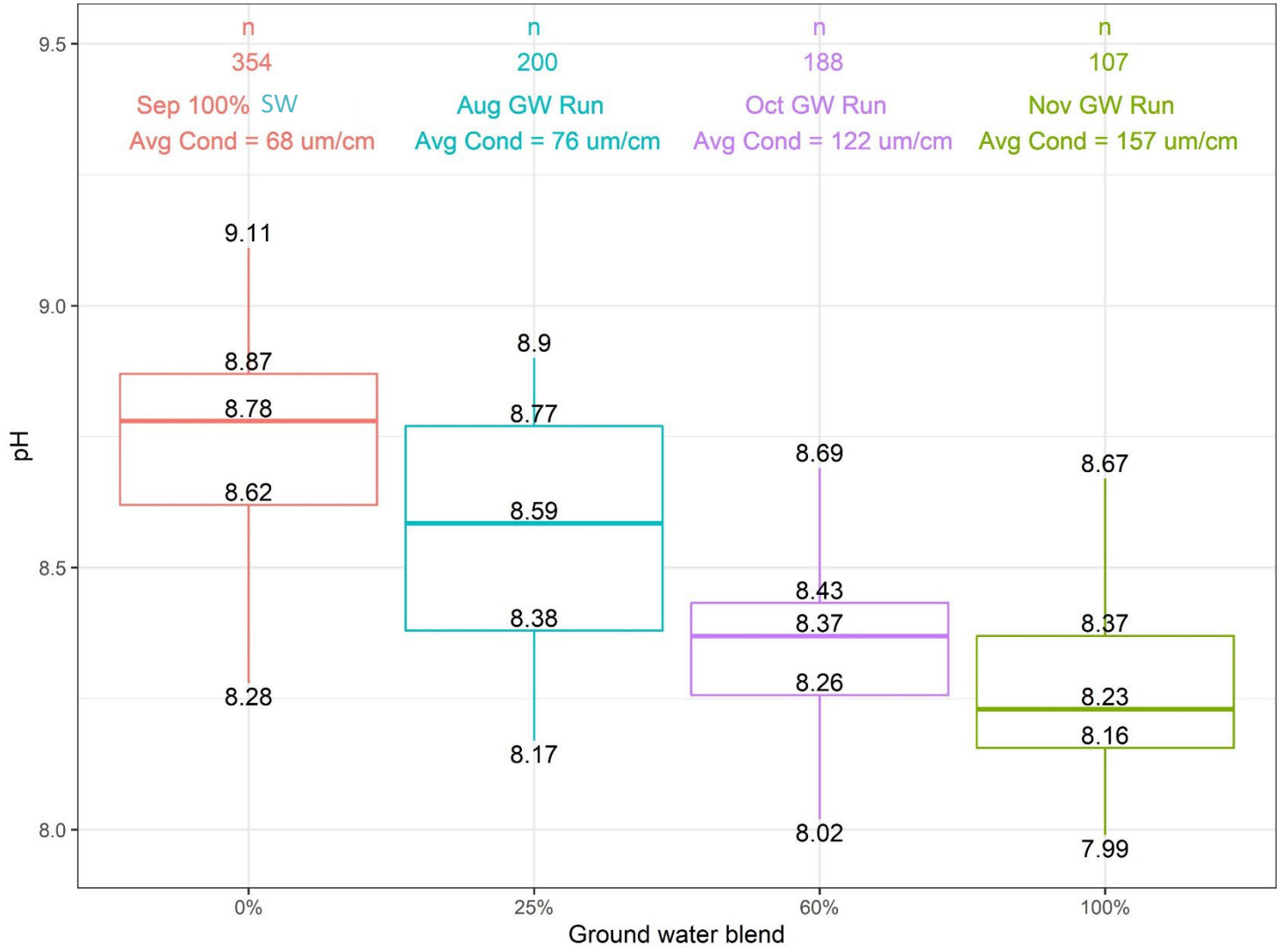


- High pH favors insoluble species of lead.
- Alkalinity creates scale providing protective barrier.
- Alkalinity provides buffering and reduces pH drop from water age.

	pH	Alkalinity
Bull Run	6.6	8 mg/L
Groundwater	7.5 - 8.8	75 - 170 mg/L
Current Target	8.2	N/A
Future Target	8.6	25 mg/L

Groundwater blend comparison of pH in DS

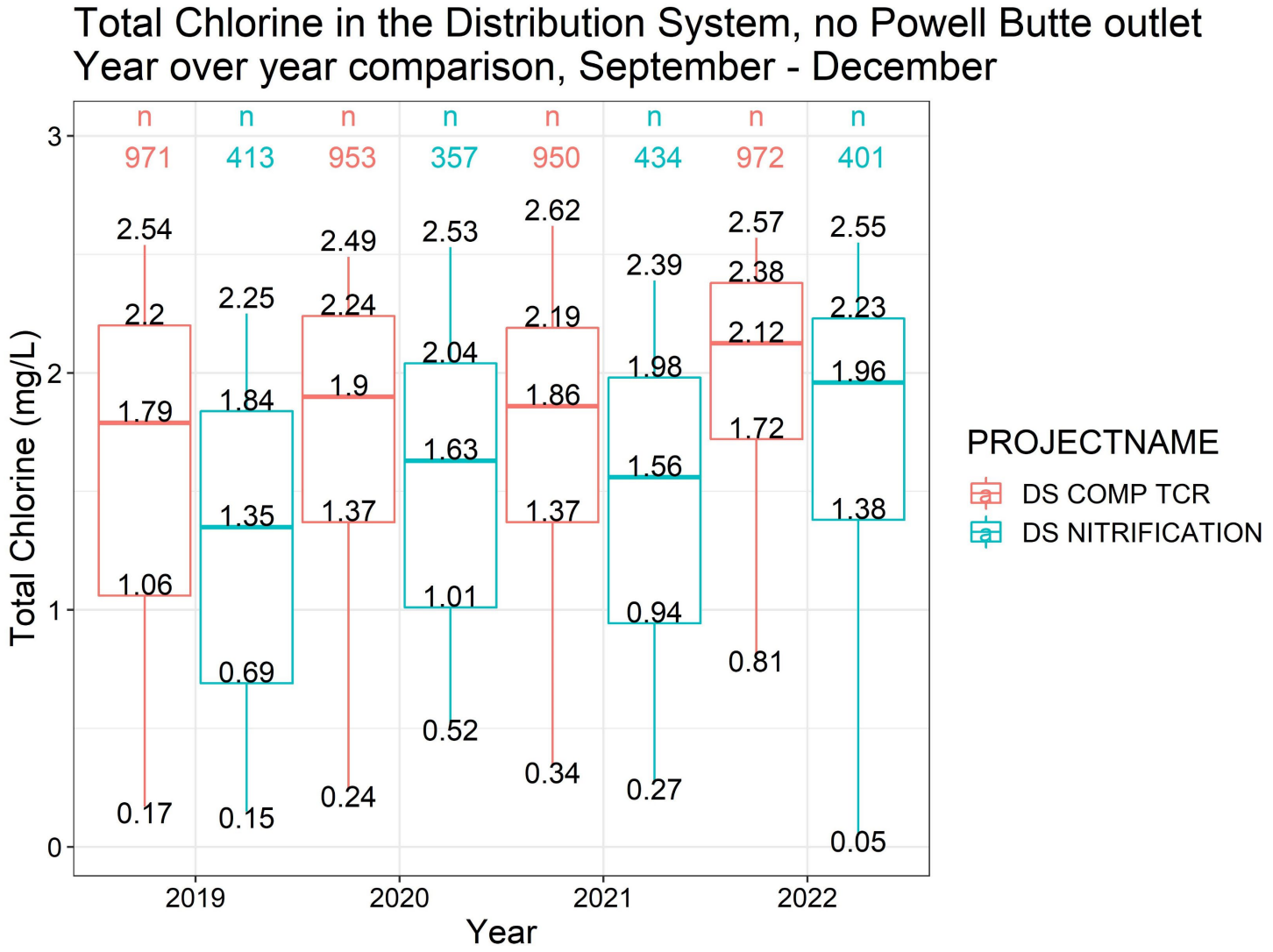
- GW blend dictates the expected pH in the distribution system. This should be considered when setting regulatory DS minimums.



Data updated by PW on 12/02/22 using data available through 11/24/22.

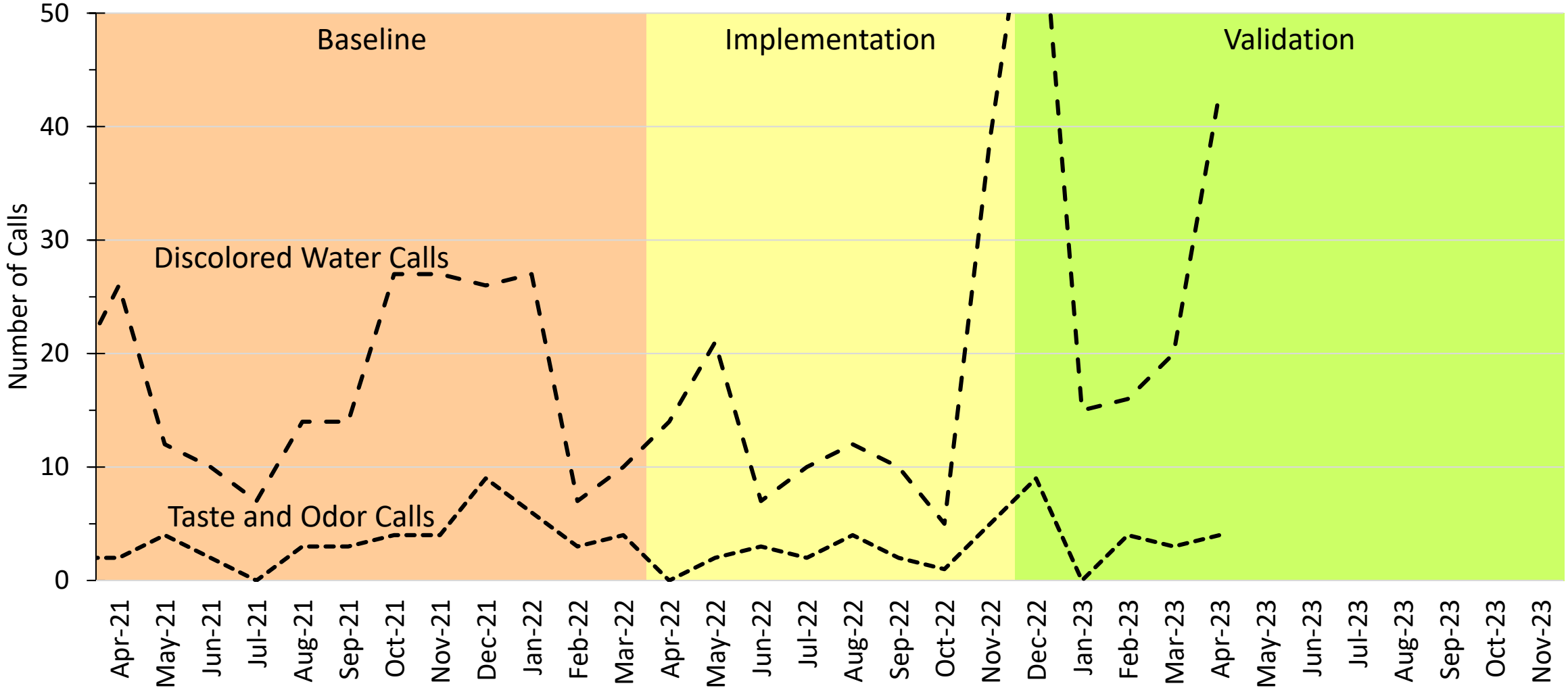
Distribution System Chlorine Monitoring

- Do see improved chlorine residual at both TCR and Nitrification sites. Nitrification sites were only ~0.2 mg/L lower than TCR sites in 2022 compared to 0.3~0.4 mg/L lower in previous years.



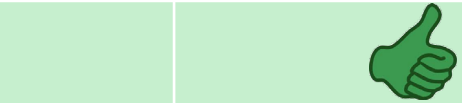
Data updated by PW on 02/27/23 using data available through 02/27/23.

Customer Complaints with Unknown Origin



Lead in Individual Sentinel Homes

Comparing lead monitoring programs

	LCR Tier 1 Homes	Customer Requested Lead Samples	Fixed Monitoring (PRS) Stations	Sentinel Home Lead Monitoring
Robust Historical Data Set				
Taken from Customer Home				
Frequency of Monitoring				
Controlled Usage Patterns				
Consistent Participation of Specific Location