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CONTAMINANTS OF CONCERN:
Managing Lead and Manganese
WEBINAR SERIES
May 26th, 2020 | 1:00 – 2:30p.m (Mountain)
Strategies for Understanding and Managing Risk from Lead
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Webinar Moderator

Michelle DeHaan

Water Quality & Treatment Manager

Park City Municipal Corporation

Michelle De Haan has 28-years of experience as a drinking water quality and treatment specialist, over the last 9-years as Park City Utah's Water Quality & Treatment Manager. She was an AWWA Planning Committee Member for the 2020 International Symposium on Inorganics, is a Past AWWA Trustee of Water Science & Research Division, is a past AWWA Chair of Inorganic Contaminant Committee, and was the 2018 AWWA Water Science and Research Division Emerald Erlenmeyer Awardee.

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Panel of Experts

Sandra Kutzing
Principal Engineer
CDM Smith

Carol Rego
Water Supply and Treatment Specialist
CDM Smith

Sophie Manley
Sanitary Engineer III
City of Chicago Department of Water Management

Kiran Udayakumar
Water Quality Engineer
Arcadis

John Tobiason
Professor and Department Head of Civil and Environmental Engineering
University of Massachusetts at Amherst

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Agenda

I. **Factors that Influence the Effectiveness of POU Filters to Remove Lead**
Sandra Kutzing, CDM Smith, Carol Rego, CDM Smith

II. **Managing Millions of Data Points – Administering Chicago's Free Lead Testing Program**
Sophie Manley, City of Chicago Water, Kiran Udayakumar, Arcadis

III. **Assessment of Lead in Childcare and School Drinking Water**
John Tobiason, University of Massachusetts Amherst

Time Permitting – Q&A

Enter your **question** into the **question pane** at the lower right-hand side of the screen.

Please specify to whom you are addressing the question.

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Factors that Influence the Effectiveness of POU Filters to Remove Lead

Carol A. Rego, P.E.
Sandra L. Kutzing, P.E.

May 26, 2020

CDM Smith

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Overview

- Newark's Corrosion Control Background
- POU Filter Study
  - Why Test the Filters?
  - Full Program Roll-out
  - Study Results
  - Conclusions and Recommendations

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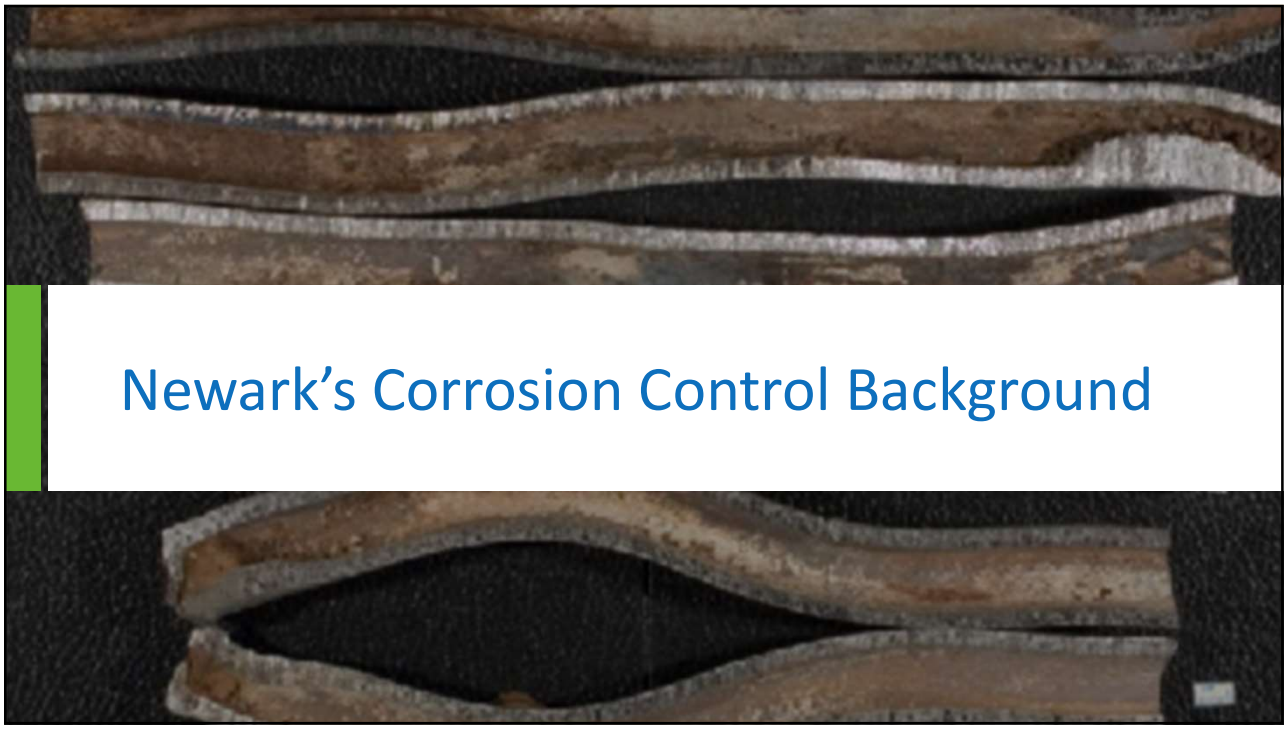

Newark's Corrosion Control Background

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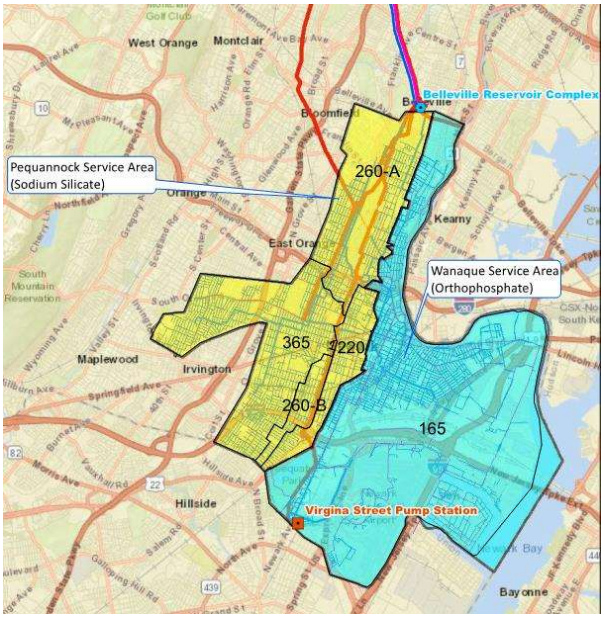
City of Newark, NJ

- 300,000 customers
- 60 million gallons per day
- Approximately 20,000 LSLs
- Two supplies with different corrosion control treatment (CCT)
  - Pequannock: sodium silicate (now zinc orthophosphate)
  - Wanaque: zinc orthophosphate



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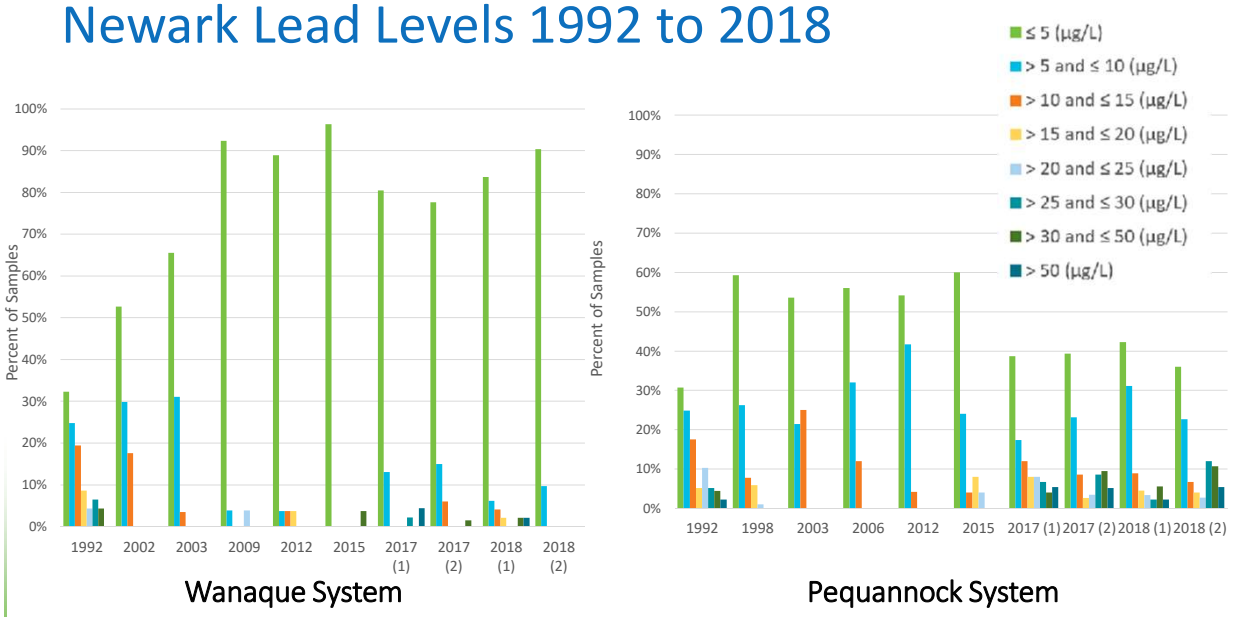
Newark Lead Levels 1992 to 2018



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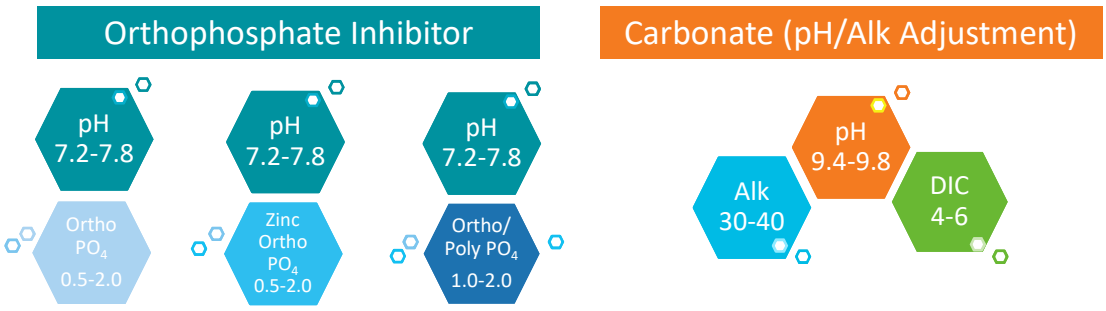
Typical Conditions for <15 ppb Lead Action Level in Northeast Waters



- Newark meeting Lead Action Level with pH 7.0-7.2, sodium silicate
  - Highly suspicious of potential for tetravalent lead (plattnerite, PbO_2) scale
  - But... chlorine residual not excessively high

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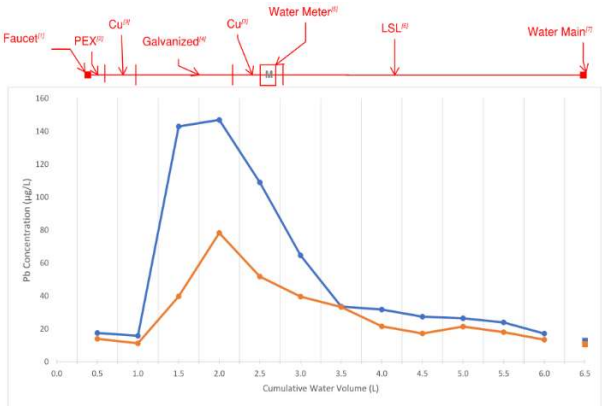
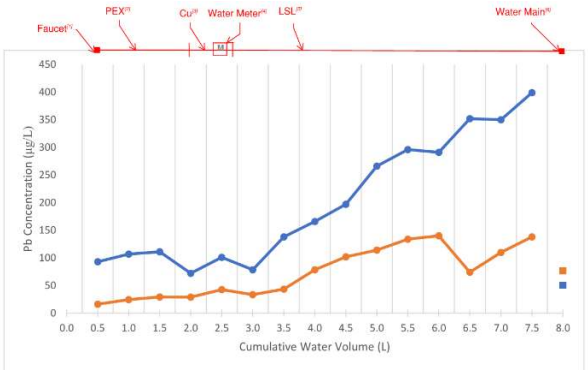
Sequential Sampling



Home No. 1



Home No. 2

Total Lead (µg/L)
Soluble Lead (µg/L)
Flush - Total Lead (µg/L)
Flush - Soluble Lead (µg/L)

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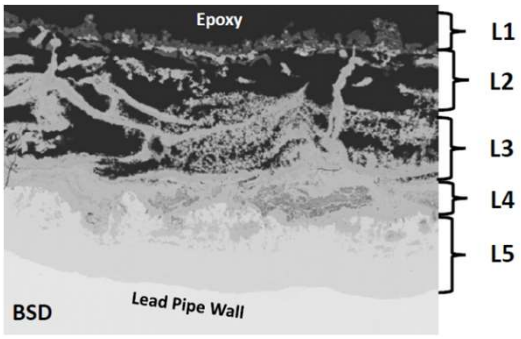
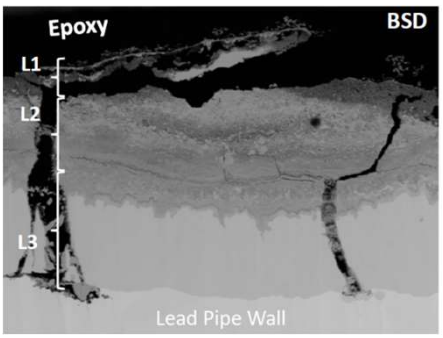
Scale Minerology

- Pipes did not contain any crystalline Si-Pb compounds
- Plattnerite (PbO_2) predominant in scale minerology
- Pb(II) carbonates growing up through plattnerite
- Plattnerite not being maintained:
  - Uppermost layer not very robust
  - Porous and easily detachable, therefore not providing a very resilient barrier to lead release





Courtesy EPA Office of Research & Development

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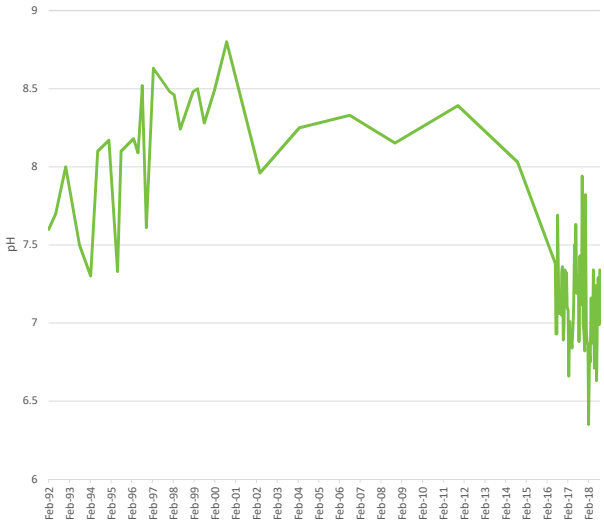
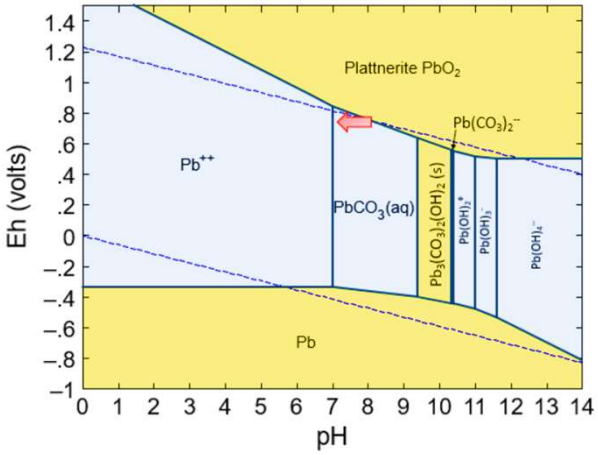
So…. Why/How?





Potential-pH Diagram
DIC = 8.5 mg C/L

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Public Health Aspects

- pH decreased (above 8 to 7.1 on average) for DBP simultaneous compliance (but silica maintained)
- Plattnerite protective scale not maintained at lower pH
- Multiple factors provided evidence of an urgent concern:
  - Theoretical chemistry
  - Sequential sampling
  - Scale minerology
- **Decision** → *immediate* POU filter distribution to Pequannock service area customers with LSLs and lead solder

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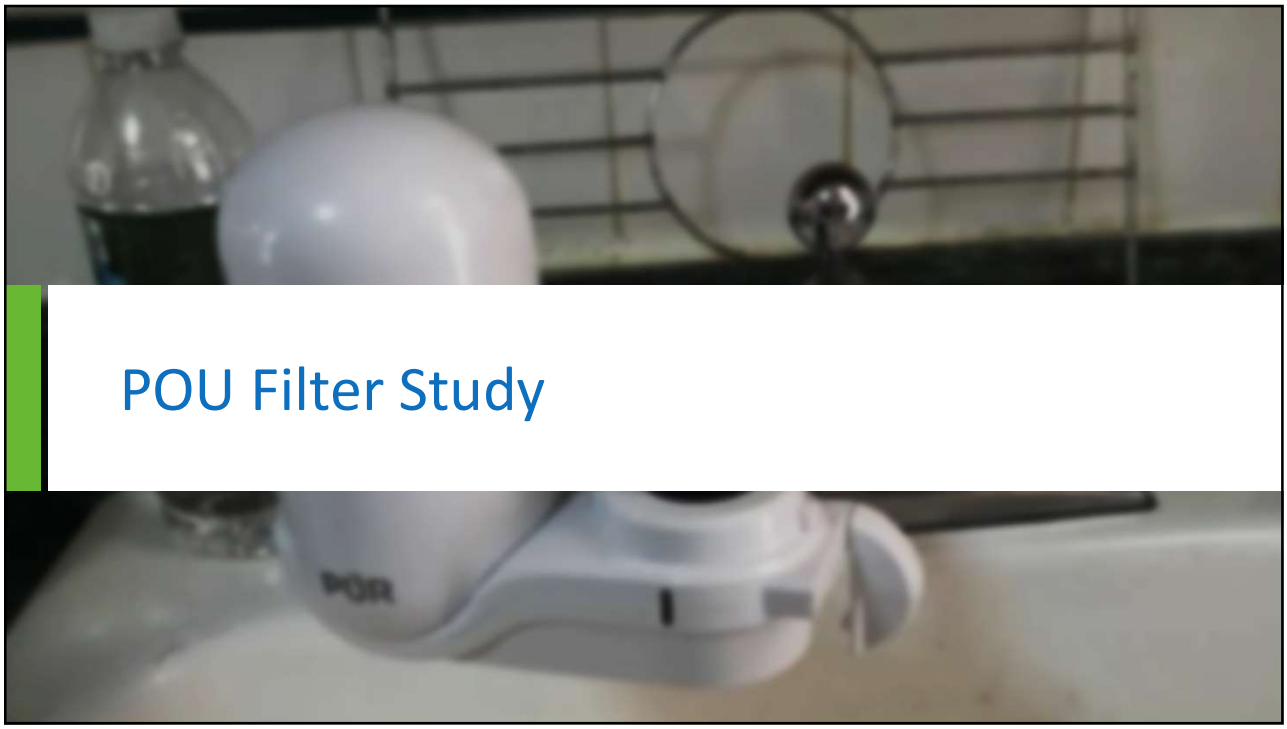

POU Filter Study

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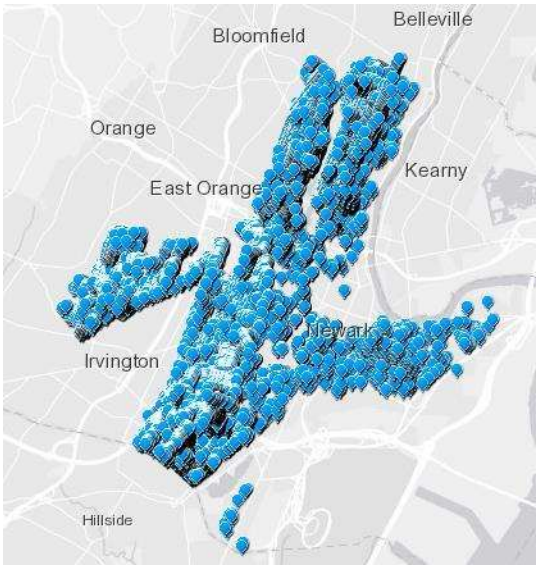
Newark's Point-of-Use (POU) Filter Distribution

- Over 40,000 filters
- Over 35,000 packages of filter cartridges
- Distributed to homes:
  - In Pequannock with LSLs or lead solder
  - Anywhere in the City that test over 15 ppb



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The Customer Expectation...

The Certification...

Reduce lead levels to 10 ppb or less*

Certification changed to **5 ppb in December 2019*

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POU Filter Certifications

- NSF/ANSI Standard 42 for Class 1 particulates (0.5 to < 1 µm)
- NSF/ANSI Standard 53 for reduction of soluble and particulate lead
- Specific test water is used–2 specific conditions
- 150 ppb of lead in the influent challenge water
- Reduce lead to 10 ppb (now 5 ppb as of December 2019)

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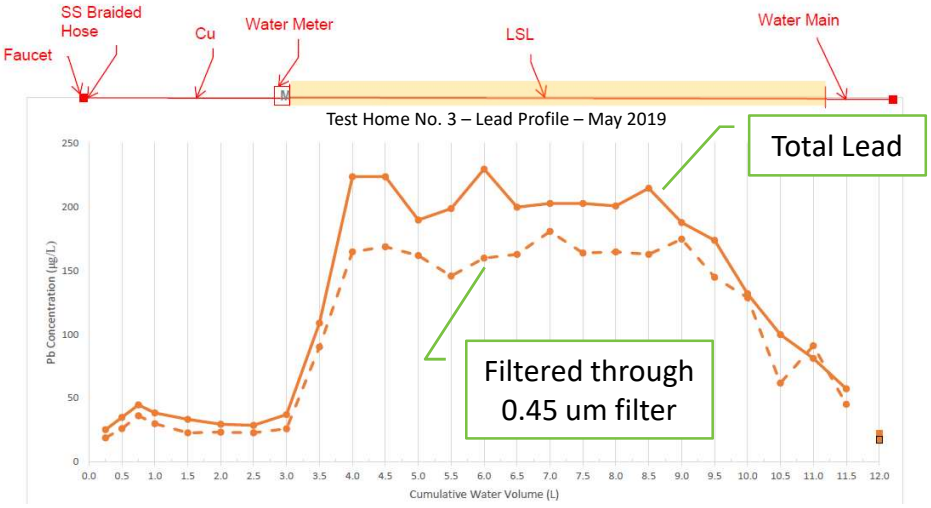
Why Test the Filters?



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Initial Filter Testing Parameters

- Three (3) initial POU filters tested in July and August 2019 under extreme conditions
  - 6+ hours of stagnation
  - Targeted water sitting in lead service line
  - Also tested first draw and after a 10 minute flush
  - 500 mL samples collected—both unfiltered and filtered

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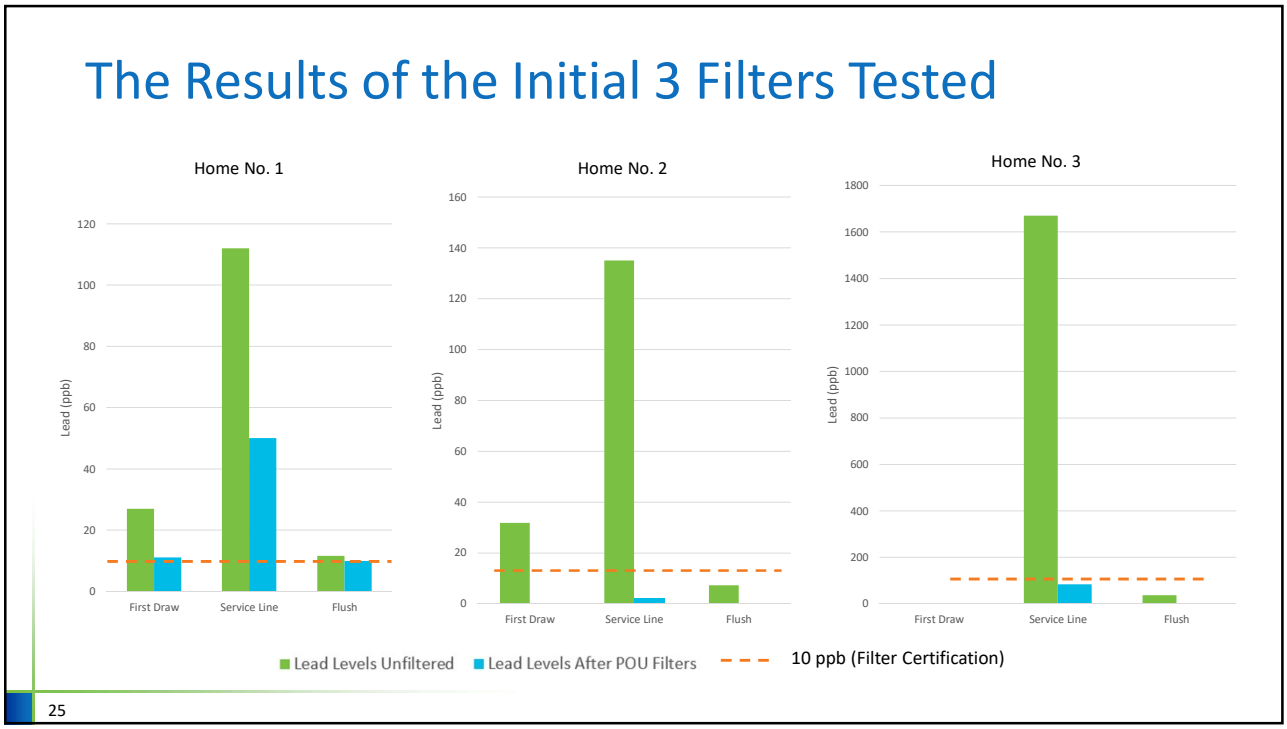
The Results of the Initial 3 Filters Tested
Home No. 1
Home No. 2
Home No. 3
Lead (ppb)
First Draw
Service Line
Flush
Lead Levels Unfiltered
Lead Levels After POU Filters
10 ppb (Filter Certification)
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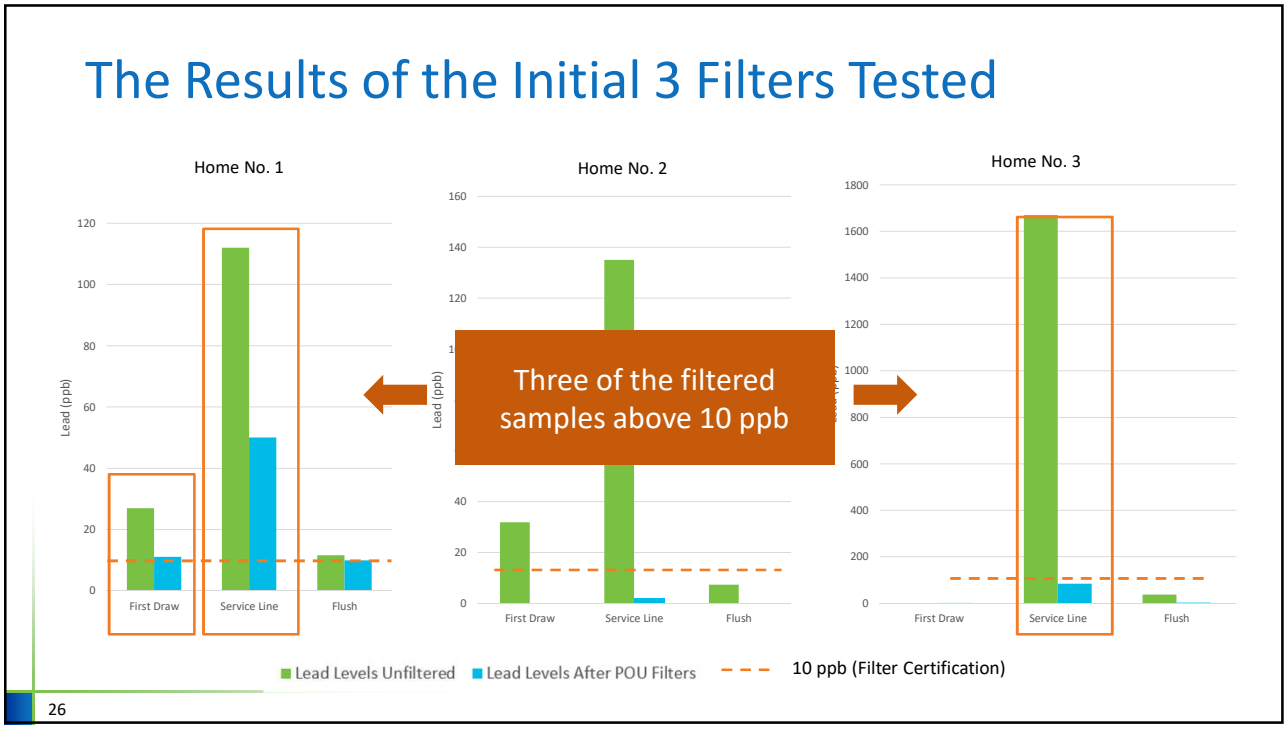
The Results of the Initial 3 Filters Tested
Home No. 1
Home No. 2
Home No. 3
Lead (ppb)
First Draw
Service Line
Flush
Three of the filtered samples above 10 ppb
Lead Levels Unfiltered
Lead Levels After POU Filters
10 ppb (Filter Certification)
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Filter Study Roll Out

- Protocol developed with Newark, EPA and DEP
  - Random sampling of first draw, service line, flushed
  - Filters properly installed and maintained
- 20-25 samplers each day for 4 weeks
- 3 labs–Newark, DOH, EPA
- Custom survey app to collect data
- Daily coordination meetings
- Transparency–data posted to SharePoint

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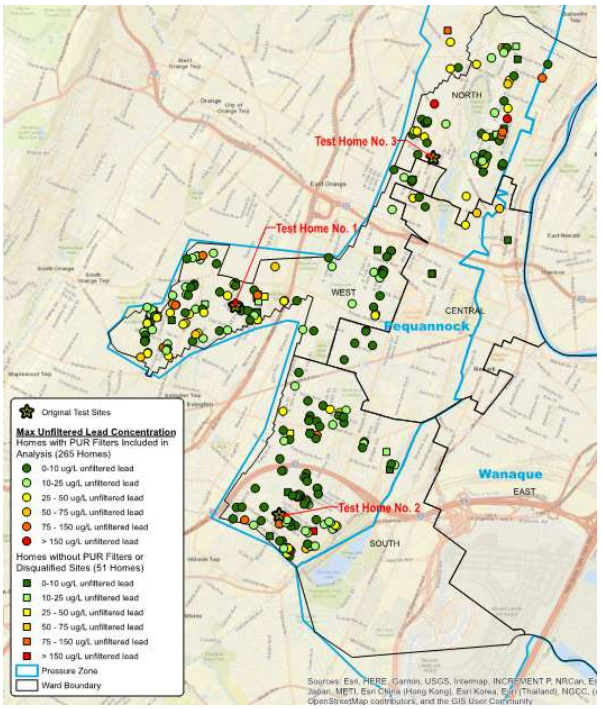
Filter Study Overview

- 1,573 samples collected
- 337 sampling events
- 316 homes
- 265 PUR filters tested (type distributed by City)

All collected in 4 weeks



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Evaluation of Impacts on Filters

- Proper installation and use of filters
- Unfiltered lead levels – first draw, service line, flushed
- Service line material
- Flushing
- Filter type–faucet, pitcher
- Premise plumbing material
- Recent plumbing changes or construction
- Time since water last used in house and at faucet
- Last time cartridge was replaced
- Filter manufacturer and model
- Cartridge model
- Common filter uses
- Cold and/or hot water usage through filter
- Filter flow rate
- Length of service line

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Evaluation of Impacts on Filters

- **Proper installation and use of filters**
- **Unfiltered lead levels – first draw, service line, flushed**
- **Service line material**
- **Flushing**
- **Filter type – faucet, pitcher**
- Premise plumbing material
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- Filter flow rate
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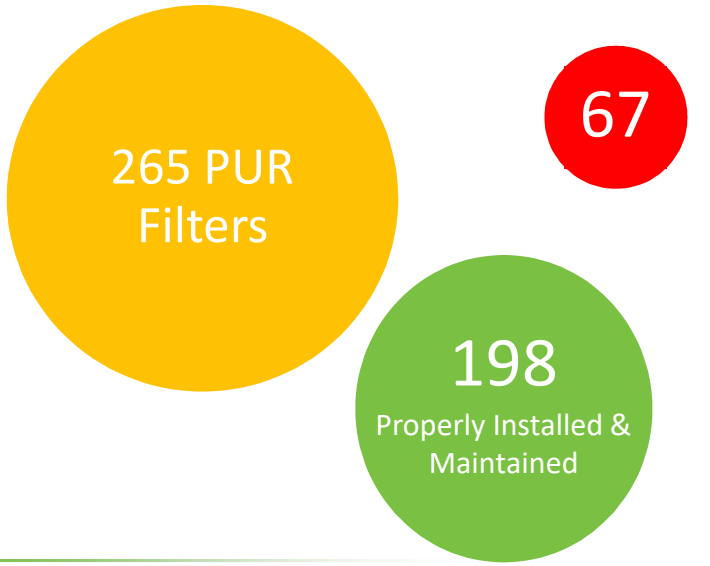
Proper Installation and Use of Filters



67 Filters Removed from Analysis

- Red indicator lights
- Incorrect cartridge
- Use of hot water
- Improperly installed
- Combination of above

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Influence of Proper Installation and Use on Filters

Scenario	No. Filters	% All Filtered Samples Below 10 ppb	% All Filtered Samples Below 5 ppb
All Filters (Provided by Newark)	265	96.6%	90.6%
Filters Properly Installed & Maintained	198	97.5%	91.5%

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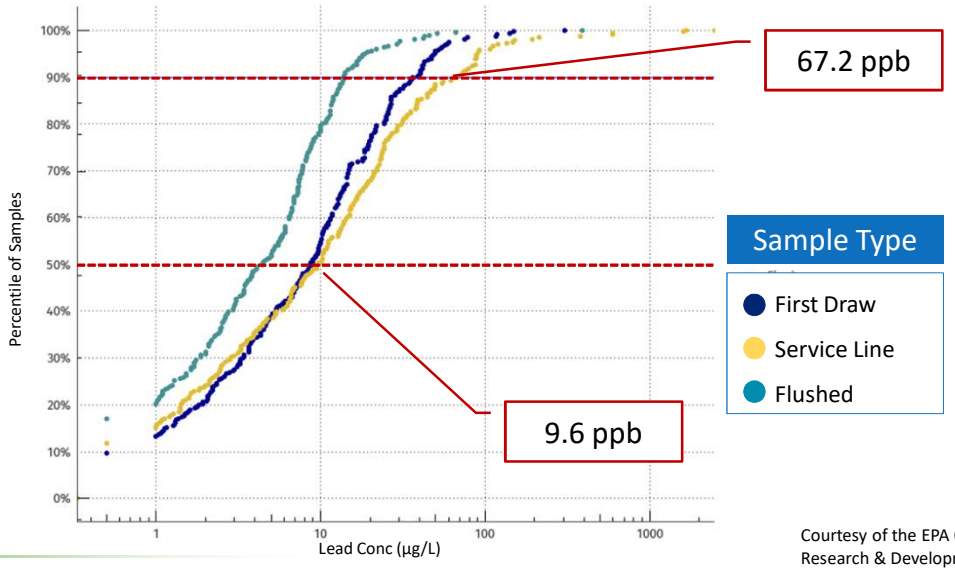
Unfiltered Lead Levels – All Service Line Materials



Courtesy of the EPA Office of Research & Development

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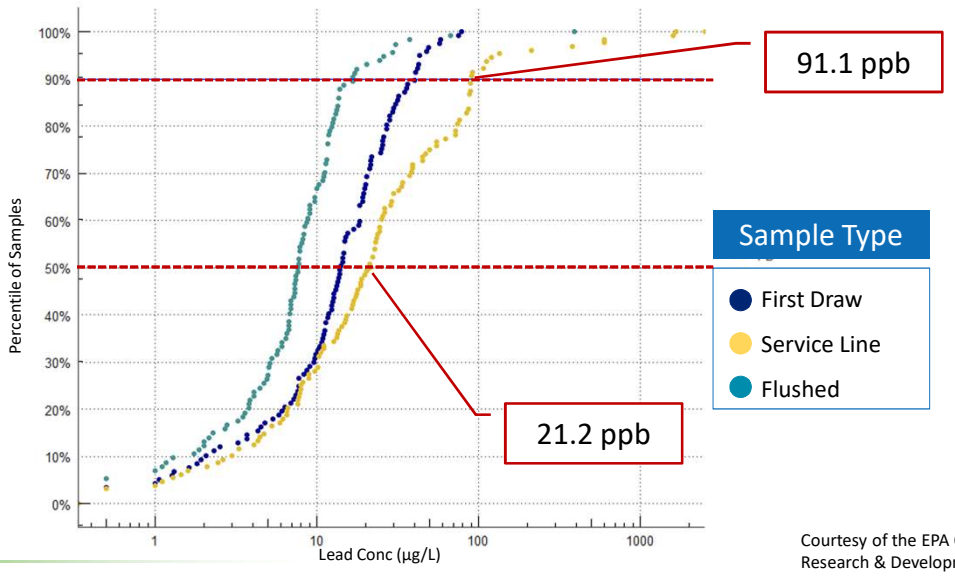
Unfiltered Lead Levels – LSLs Only



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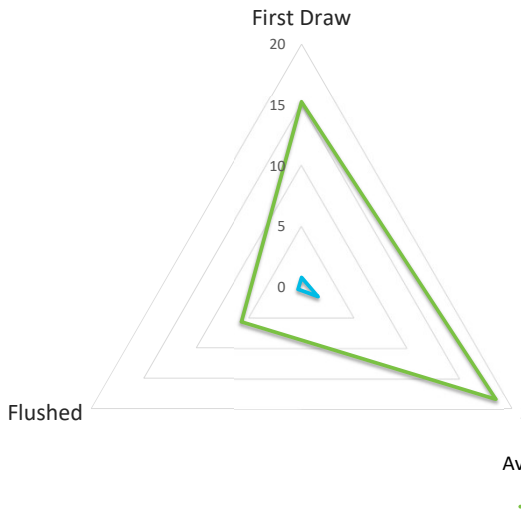
Influence of Unfiltered Lead Levels on Filters



Sample Type	% Reduction *
First Draw	95%
Service Line	91%
Flushed	94%

** % reduction for entire data set – not paired by location*

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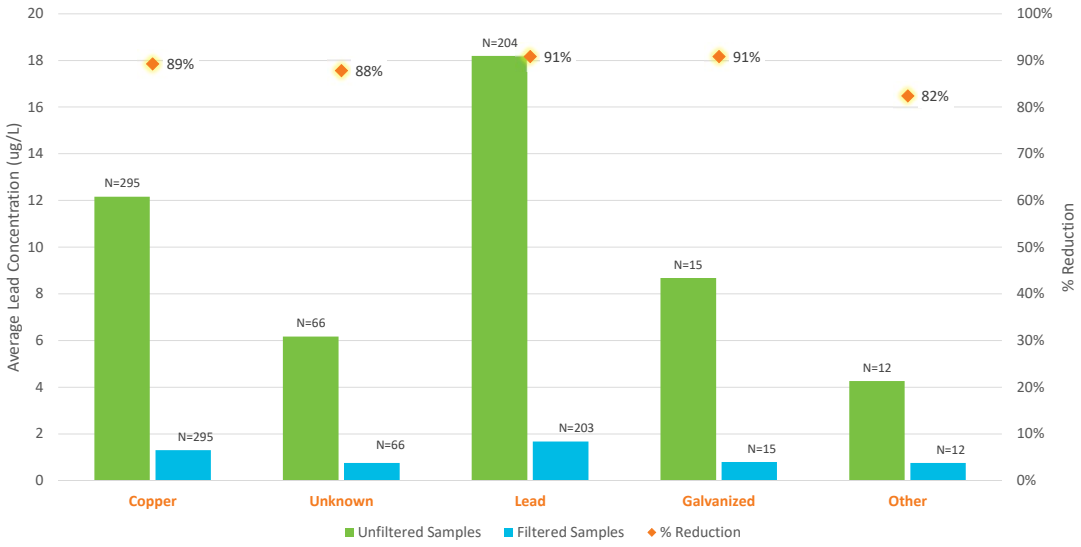
Influence on Service Line Material on Filters



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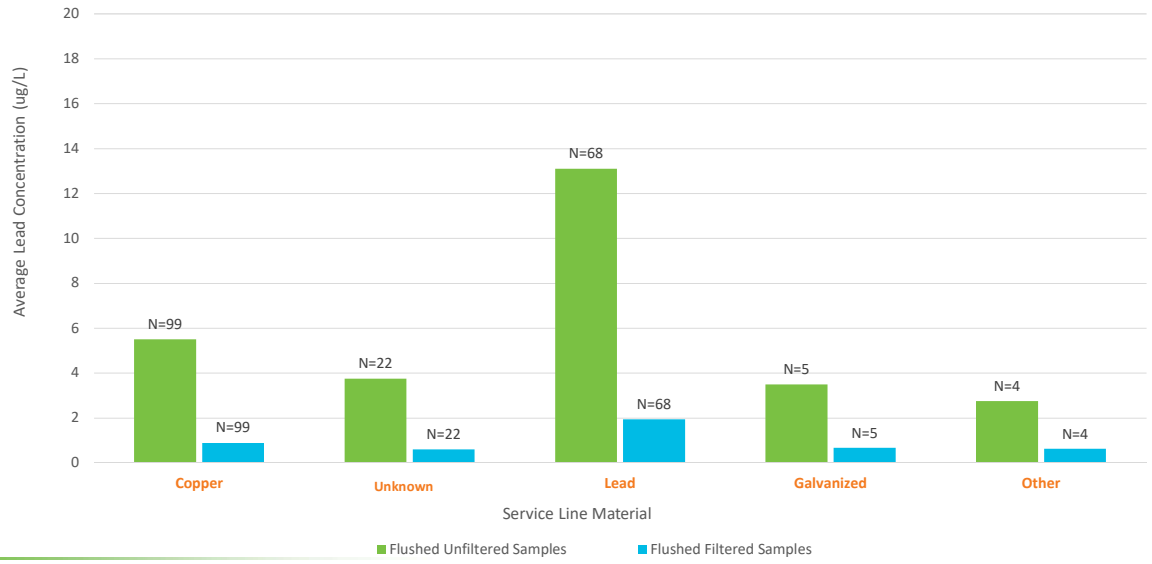
Influence of Flushing on Filters (5 min flush)



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Filter Types – Faucet and Pitcher

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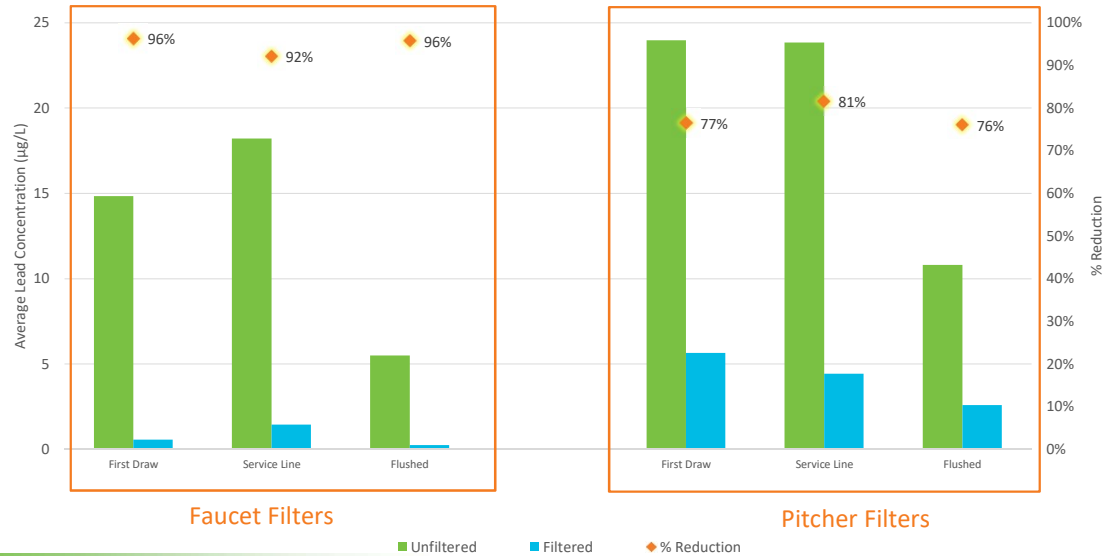
Influence on Filter Type – Faucet vs. Pitcher



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Combined Influence – Unfiltered Lead Levels and Faucet Filters

Unfiltered Lead Levels	No. Faucet Samples	% Filtered Samples 10 ppb or Below	% Filtered Samples 5 ppb or Below
<= 10 ppb*	379	100%	100%
> 10 and <= 150 ppb*	182	98.9%	92.9%
> 150 ppb	3	0%	0%
Overall	564	99.1%	97.2%

**NSF Certification Test Parameters*

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Combined Influence – Unfiltered Lead Levels and Pitcher Filters

Unfiltered Lead Levels	No. Pitcher Samples	% Filtered Samples 10 ppb or Below	% Filtered Samples 5 ppb or Below
<= 10 ppb*	11	100%	90.9%
> 10 and <= 150 ppb*	16	87.5%	68.8%
> 150 ppb	0	N/A	N/A
Overall	27	92.6%	77.8%

**NSF Certification Test Parameters*

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Summary – Filter Effectiveness

Samples	No. Filters Properly Installed and Maintained	% All Filtered Samples Below 10 ppb
Stagnated and Flushed Samples	198	~~97.5%~~
5 Minute Flushed Samples	198	**99.5%**

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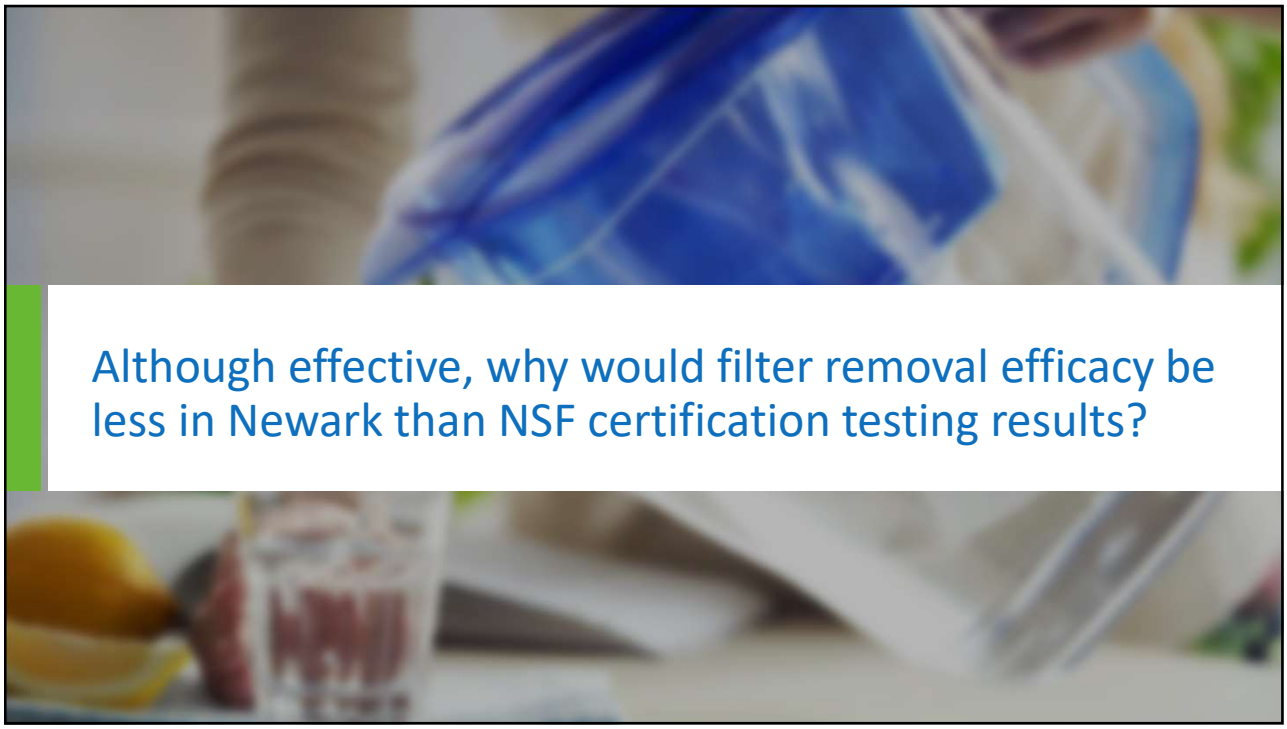

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Water Quality Differences: NSF Test Water and Newark Water

Parameter	NSF Test Water No. 1	NSF Test Water No. 2	Newark Water
pH	6.5	8.5	7.2 – 7.7
Alkalinity (as CaCO3)	10 – 30 mg/L	100 mg/L	29 mg/L
Corrosion Control Treatment	Carbonate chemistry	Carbonate chemistry	**Zinc orthophosphate**
Lead Levels	150 ppb Assumed all soluble lead	150 ppb Particulate lead = 30% max Fine particulates **(0.1 to 1.2 µm)** = 20% of particulate	Varies

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Orthophosphate Impact on Filters

- EPA ORD conducted sampling in August 2019
  - Metals, pH, alkalinity, and total inorganic carbon
  - Pb particle size fractionation of service line treated (through POU filter) samples
    - 0.2 µm syringe filters
    - 0.01 µm ultrafilter
  - Nanoparticles (< 0.01 µm) found passing through POU filters in 3 of 4 homes
  - Analysis found elemental lead, phosphorus and chlorine (consistent with pyromorphite)

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Key Takeaways

- Filters ***do*** remove lead in Newark
- Filters are ***not certified*** to remove 99% of lead under the NSF 53 certification
- Filters are certified to remove lead to 10 ppb (changed to 5 ppb) under ***specific carbonate water quality conditions***
- Orthophosphate can produce nano-size lead particles that are challenging for the filters to remove—especially pitcher filters
- Flushing prior to filtering reduces lead levels

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Study Recommendations

- Continue to provide access to filters and cartridges
- Emphasize flushing prior to using filters to reduce lead levels in the unfiltered water
- Use faucet filters where possible
- Public education on flushing and proper install and use of filters
- Continue with parallel efforts to reduce lead levels in the distribution system

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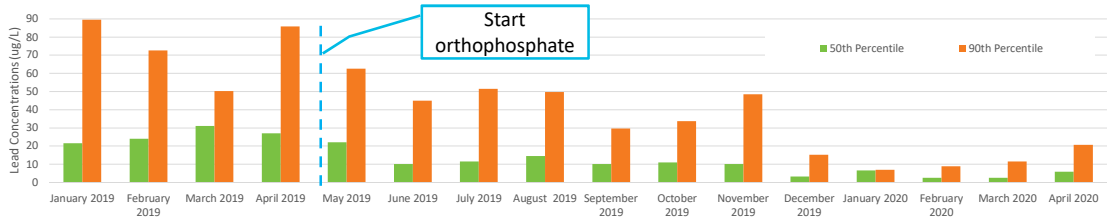
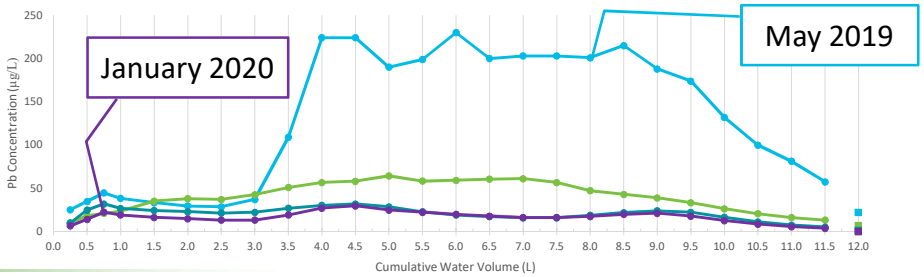
Newark is seeing improvements in CCT





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Newark knows the only permanent solution is to remove the lead

Newark's Lead Service Line Replacement Program Replaces 10,000 Lines in 13 Months

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Thank You!

- City of Newark, NJ
- US Environmental Protection Agency
  - Office of Research & Development
  - Region 2
  - Office of Water
- New Jersey Department of Environmental Protection
- New Jersey Department of Health

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Contact us!

Link to Newark's Filter Study Report:
https://www.newarkleadserviceline.com/2019filterstudy

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Water Partnership with CDM Smith

Find more insights through water partnership at cdmsmith.com/water and @CDMSmith

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MANAGING MILLIONS OF DATA POINTS

Administering Chicago's Free Lead Testing Program

Sophie Frances Manley, Sanitary Engineer III
City of Chicago Department of Water Management

Kiran Udayakumar, Water Quality Engineer
Arcadis

Department of Water Management • City of Chicago

ARCADIS Design & Consultancy for natural and built assets

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City of Chicago
Department of Water Management

- Responsibilities
  - Drinking water treatment
  - Water distribution system maintenance
  - Combined sewer system maintenance
  - Stormwater management
- Serve over 5 million people
  - Residents of the City & 125 suburbs
- Infrastructure
  - 4,311 miles of water main
  - 4,600 miles of sewer main

Jardine Water Purification Plant

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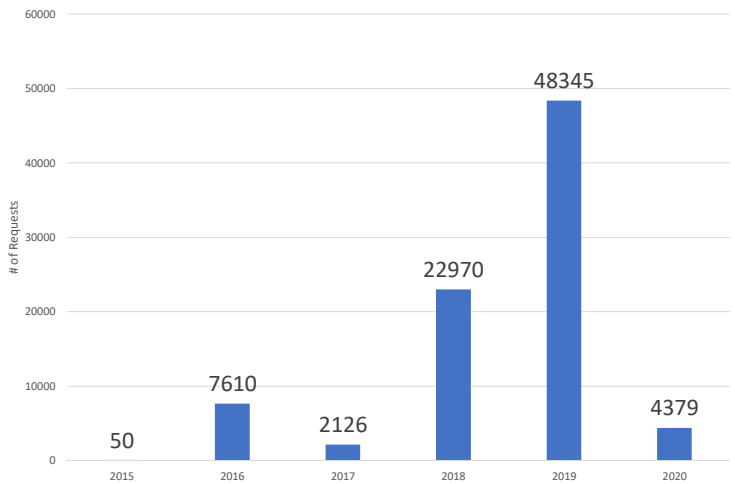
History of Lead Testing

- Free lead testing for Chicago residents since at least 1986
- Change in program in 2016 due to spike in requests
- Customer initiated program through CHI311



Lead Testing Requests per Year since 2015

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Current Program

Lead Test Kit

- Voluntary program for Chicago residents
- Two Options:
  1. **Lead Test Kit**
     - A test kit is mailed to the resident
     - ~89% of requests
  2. **Lead Test Visit**
     - A DWM representative goes to the resident's home to complete the kit for them
     - ~11% of requests

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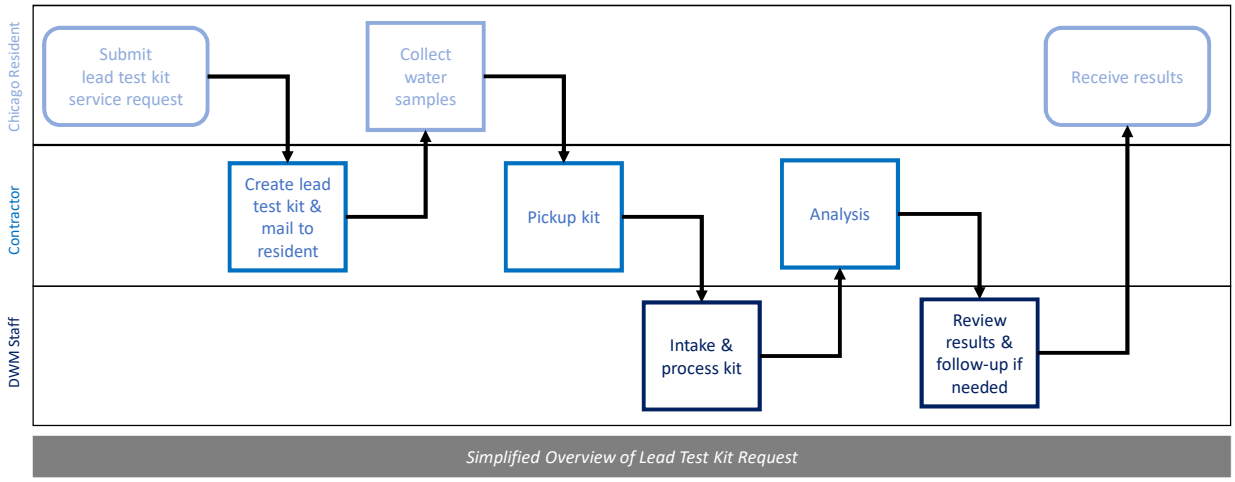
Life Cycle of a Service Request



Simplified Overview of Lead Test Kit Request

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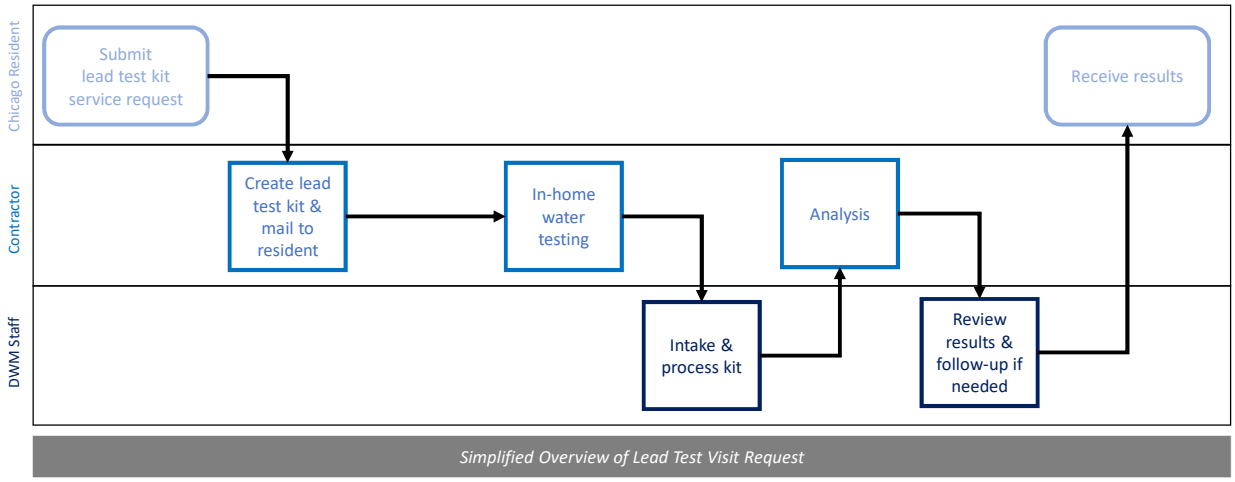
Life Cycle of a Service Request



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Follow-Up Investigation

Sanitary Engineer performs a detailed sampling profile of the plumbing

Includes ten 1L samples collected in a row, followed by samples at 3 and 5 minutes (when necessary, also 7, 10, and 15 minute samples)

Plumbing Inspector & Electrician look for sources of lead

Plumbing Inspector looks at service line, plumbing materials & connections

Electrician evaluates plumbing for excess current & voltage

Sanitary Engineer reviews data collected & writes letter to resident

Reviews lead results, inspection reports & water usage data to create customized recommendations for flushing time and home repairs

Letter is sent to resident & service request is closed out

If resident performs recommended mitigation, we encourage them to call back for another follow-up profile sampling

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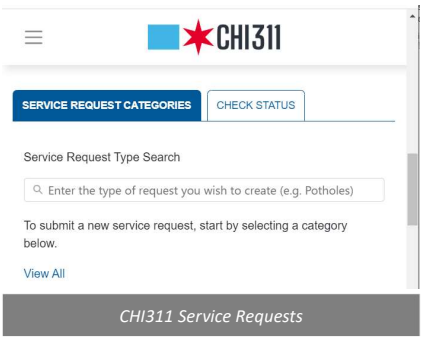
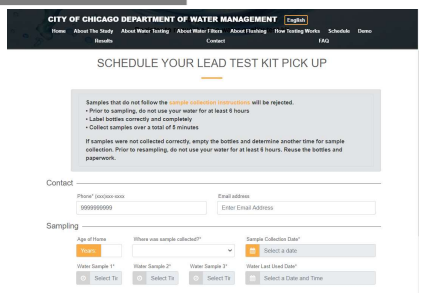
Data Collection

1. **CHI311** non-emergency services ticketing system
   - Based on Salesforce Customer Relationship Platform (CRM)
2. Integrated to localized data management solution **InforEAM**
3. Customized **Water Quality Website** for resident data collection and scheduling
4. Customized **Geographic Information System (GIS) Applications** for field data collection
5. Result data from **Laboratory** after analysis



CHI311 Service Requests



ChicagoWaterQuality.org

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How many data points are collected?

Millions of data points!

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Reporting Needs

Program Stakeholders

Chicago resident
Engineers and researchers
Utility management
Elected officials
Regulators

What do they want to know?

Lead test results
Program fulfillment
Results over time
Trends
Proof of contact

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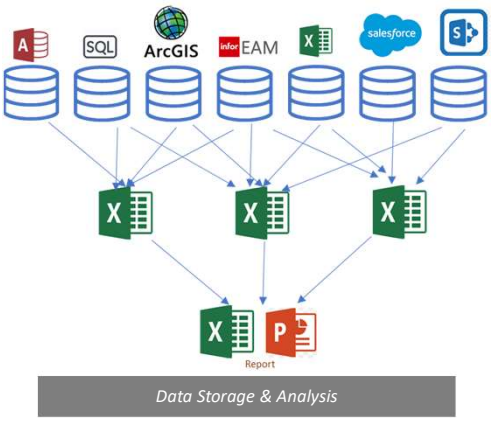
Data Storage & Analysis

- Current data point numbers and storage locations
  - Over 85,000 individual requests
  - Over 90 data fields
  - Over 7 different data storage locations
- Variety of unique analysis methods and reports
- Drilling through data and identifying trends with large data
- Data interpretation and analysis was tedious and time consuming with increasing requests.
- Recent implementation: *Dashboards*



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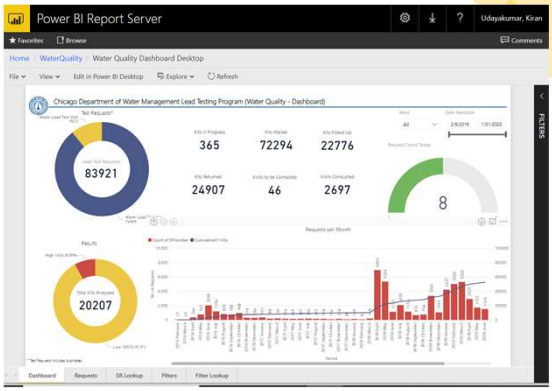
Business Intelligence Dashboard Solution

- Large datasets
- Access multiple data sources
- Real time data updates and analysis
- Drill through data
- Mobile access
- Notifications



Example Dashboard

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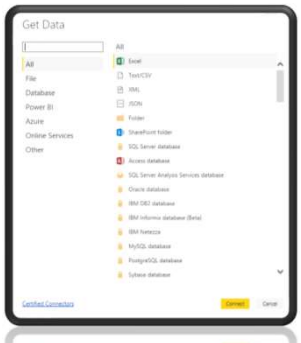
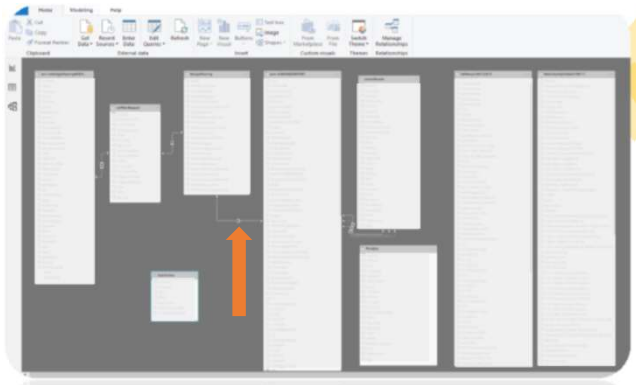
Large Datasets & Multiple Data Sources





...and many more!

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Drill through Data

Filter selection panels | **Filter selection through other visuals** | **Extract filtered data into reports**

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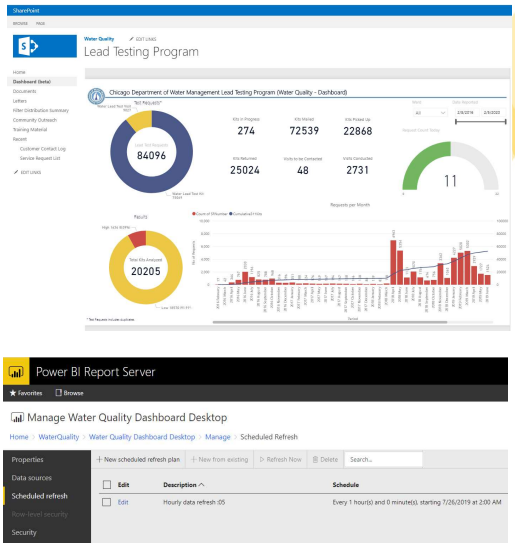
Dashboard Sharing and Real-Time Updates

- Embedded on collaborative platforms
- User access privileges
- Data drilling and exporting access
- Schedule refresh rate
- Updates mobile and desktop
- Unique Mobile application
- Mobile Notification



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Dashboard Sharing and Real-Time Updates

- Real time data analysis and notification to required personnel
- Streamlined Data Distribution
- Dashboard showed a 360 view of the program
- Improved workflows and productivity
- Identified regions of concern
- Easily access multiple data sources at same platform

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Implementation and Security

- On premise Implementation
- Multi-tier enterprise architecture
- Private network
- Access to legacy data sources and flat files
- Single Sign on
- Active Directory Authentication

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Key Takeaways

1. When creating or expanding lead testing programs, keep in mind future reporting needs to help determine what data needs to be collected
2. Data management can get tedious over the course of the program
3. Digital dashboards can be a helpful solution and aid in making real-time, data-driven decisions

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Thank you!

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Assessment of Lead in Childcare and School Drinking Water

John E. Tobiason, PhD, PE, BCEE
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Professor, Dept. of Civil & Environmental Engineering
University of Massachusetts at Amherst

AWWA Webinar
Managing Risk from Lead Service Lines
26 May 2020

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Science: Lead (Pb) Health Concerns

- **Long known that:**
  - **Pb is a neurotoxin, accumulates in tissues/bones, teeth.**
  - **Pb can cause cardiovascular diseases, brain damage, carcinogenic properties, lead poisoning.**
  - **Vulnerable populations are pregnant women, developing fetuses, infants and children.**
- **The US CDC lowered the "level of concern" for children's blood lead level (BLL) from 10 µg/dL to 5 µg/dL in 2012. Medical treatment is recommended at levels > 45 µg/dL**
- ***Frequent statements by public health officials that there is no safe level of lead exposure for children***

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Policy: Pb Sources & Human Exposure

- **Advantages of using lead in materials/products took precedence over health/exposure concerns**
  - **Why? Insufficient knowledge/data? Economics?**
- **Human exposure to lead: mostly due to lead paint, contaminated soil/dust. US society took action!**
  - **Lead paint was banned in 1978.**
  - **Leaded gasoline phased out in mid 1970's**
- **Pb exposure from consumed drinking water**
  - **Decisions to use Pb containing materials to convey water from the water main to consumers**
  - **Relative contribution increasing as other sources decrease**

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Plumbing: Pb Sources for DW

- **Plumbing components**
  - **Old small diameter water mains**
  - **Lead service lines (LSLs), lead goosenecks, copper piping**
  - **Building plumbing: brass fixtures, solder (before 1986) containing lead, copper & galvanized iron piping**

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Typical ~ 3/4 inch lead service line removed from ground, coiled (material is flexible!)

Piece of large ~ 2 inch inside diameter lead service line (courtesy Steve Price, Denver Water)

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Policy: Regulating Pb in Plumbing Materials-USA

- 1986 SDWA prohibited use of pipes, solder or flux that were not "lead free"; at that time, "lead free" defined as < 0.2 % for solder and flux, and < 8% for pipes (by weight)
- 1996 SDWA required plumbing fittings and fixtures to be in compliance with voluntary lead leaching standards
- 2011 Reduction of Lead in Drinking Water Act (RLDWA) re-defined "lead free" to be weighted average across wetted surface of < 0.25% lead by weight, but eliminated compliance with voluntary lead leaching standard
  - Prohibited introduction of products that are not lead free
  - Exemptions for variety of products not usually used to provide drinking water
  - NSF/ANSI 372 standard as of Jan 2014

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Science: Pb from materials into water

- Zero valent solid Pb (and Cu) metals in *plumbing* materials get oxidized (corroded)
  - Corrosion products include dissolved and particulate (solid) forms of the metals; these can enter drinking water
- How much and how fast? Complex!
  - Redox reactions, equilibrium reactions, solid phases, electrochemistry, microbiology, etc…….
- Extensive research on various critical factors:
  - pH, inorganic carbon, phosphate, other inorganic anions, oxidants, temperature……
  - dissimilar metal connections…
  - hydraulics: velocity, stagnation….
- Chemistry & operation can limit, but not eliminate, Pb transfer to water from Pb containing materials

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Policy: What level of Pb in Water is OK?

- US EPA Maximum Contaminant Level Goal (MCLG) of zero for drinking water (due to cancer endpoint)
- Prior to 1991 US EPA Lead and Copper Rule (LCR), lead (Pb) regulated at 50 ppb at entry to distribution system
- 1991 US EPA LCR set an "Action Level" (AL) of 0.015 mg/L
  - If more than 10% of tap water samples from homes > AL, public water supplier must take "action" (education, service line removal, optimal corrosion control).
- World Health Organization: guideline value of 0.010 mg/L
- Health Canada maximum acceptable concentration (MAC) for total lead at the tap:
  - March 2019, set at 0.005 mg/L (was 0.010 mg/L)
- American Academy of Pediatrics (2016)
  - Lead not greater than 1 ppb (0.001 mg/L)

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Policy: Pb/Cu in School tap water

- US EPA 1988 Lead Contamination Control Act (LCCA)
  - US EPA established a voluntary program aimed at decreasing the lead (and copper) concentrations in school drinking water
  - Applies to K-12 schools and early education and care (EEC) programs
  - Provided a list of banned water coolers due to lead materials
  - Provided guidance on how and where to collect water samples
- US EPA "3Ts" guidance manual provides many details on fixture sampling and follow-up actions.
  - Original 3Ts: training, testing, *telling*
  - New revised 3Ts Guidance Oct 2018
  - October 2018: training, testing, *taking action*

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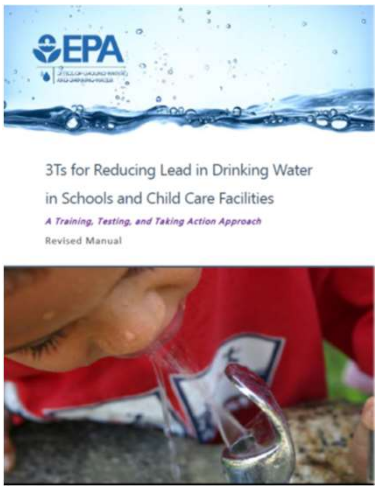

Oct 2018 Revised 3Ts:

- "no safe level of lead for children"
- "..reduce their lead levels to the lowest possible concentrations."
- No longer refer to an "action level" for lead (was 20 ppb) for school drinking water
- Indicates that there may be a state or local "remediation trigger level" to refer to
- Thus, states must decide and give guidance
- May 2019: MassDEP issued guidance to schools/EECFs for Pb < 1 ppb

https://www.epa.gov/sites/production/files/2018-09/documents/final_revised_3ts_manual_508.pdf

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MassDEP/UMass Assistance Program

- Late April 2016: Governor Baker administration announces the "Massachusetts Assistance Program for Lead in School Drinking Water" to fund implementation of LCCA based sampling of taps at K-12 public schools and EECs in Massachusetts
  - $2.75 M from the Massachusetts Clean Water Trust
  - $0.97 M from USEPA WIIN Act Funding to states
  - Implemented by MassDEP and UMass Amherst
  - Extensive involvement of MWRA
  - Supported by MassDPH, MassDESE, MassDEEC, PWSs
  - Phase 1: 5/2016 – 3/2017; Phase 2: 8/2017-06/2020
  - Phase 3: Extended Assistance Program 1/20 – 6/21
- DEP funds UMass Amherst to implement Program
  - Technically competent, 3rd party, PIs to manage project
  - Much easier for UMass to hire hourly, non-benefited, staff
- UMass Project Managers and Technical Assistance Providers worked closely with DEP staff to develop & implement program

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Program Components

- Existing DEP LCCA Program
- Forms and information materials (on DEP Website)
- Application by school system
- Informational Meeting w/ Community
- Sample Plan/Fixture Map
- Web-Based Lead and Copper Management Tool
- Sampling
- Laboratory Analyses
- Reporting of Lab Results to DEP and Schools
- Follow-up Steps

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Summary of MassDEP Phase 1&2 Program (2016-2018)

- Sampled ~ 985 school building in 190 municipalities
- Range of 1 to 76 buildings per school system
- Average of 39 sample locations (1 – 234 range) per building
- Average of 69 samples per building
  - 250 mL primary (first draw) after 8-18 hrs stagnation, all locations
  - 250 mL flush sample after 30 seconds flushing (most locations)
- ~70,000 samples collected (~63,000 analyzed by commercial labs), cost of $1.8 M (lead and copper for all samples)
- **Final report on Phase 1 Assistance Program issued 2 May 2017**

  http://www.mass.gov/eea/agencies/massdep/water/drinking/testing-assistance-for-lead-in-school-drinking-water.html
- **Phase 2 & overall reports: 2020**

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MassDEP EAP (2020-2021) & SWIG

- **MassDEP awarded $0.96 M USEPA WIIN Act Funding**
  - **Focus on children < 6 years of age**
  - **Sampling and analysis for lead only (not copper)**
  - **Accepted first round of applications early 2020.**
  - **65 facilities accepted into program; 58 public & private group childcare facilities, 7 schools**
  - **Sampling & analysis on hold due to COVID-19**
- **SWIG: New MA Clean Water Trust funded program**
  - **School Water Improvement Grants**
  - **$3000/fixture grants for purchasing and installing point-of-use filtered water bottle filling stations**
  - **Replacement of fixtures that showed > 1 ppb lead in testing conducted in accordance with MassDEP/UMass Assictance Program (LCCA Program)**
  - **Accepted applications online early 2020, Round 1 awards announce 4/29/2020. 32 school districts, 225 fixtures, $675,000**
  - **UMass technical assistance on assessing applicant eligibility, appropriate fixtures to replace (hallway bubblers (fountains) mostly).**

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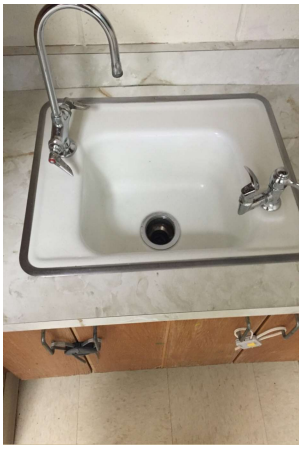
What to Sample (From DEP UMass Sampling Training Document)

P-P-F

Paired drinking water bubblers and some classroom sinks share a main water pipe that splits to provide water to two or three fixtures.

A primary (P) sample is taken from all fixtures (each fixture has its own location code) but only one flush (F) sample is taken.



P-P-F

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What to Sample (continued)

Kitchen Kettle (Cold only) | **Ice Machine** | **Food Preparation Sink**

These have one main water line. The sequence for sampling is P-F

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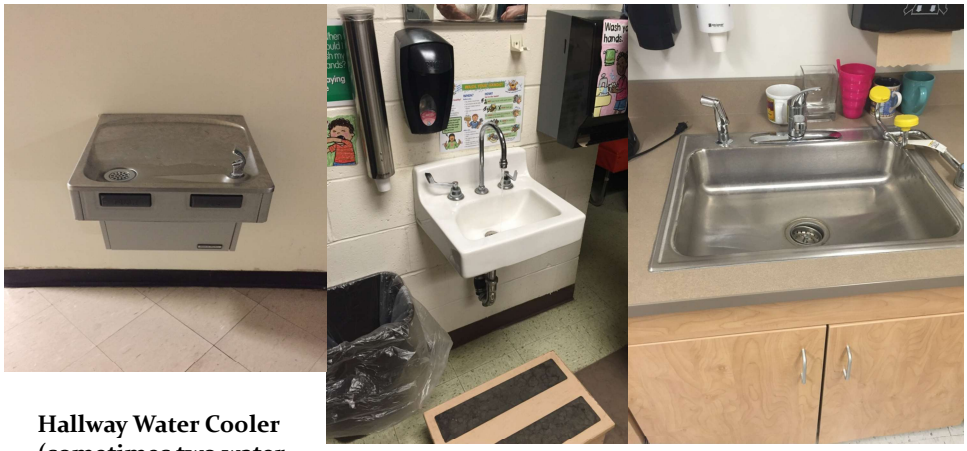
What to Sample (continued)



Hallway Water Cooler (sometimes two water coolers side-by-side, each gets Primary and Flush samples)

Nurse's Office Sink (cold only)

Teacher's Lounge Sink (cold only)

all are P-F

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Filtered Fountain & Bottle Filling Station

MA SWIG Program providing grants ($3000/fixture, installed) for schools to replace fountains with Pb > 1 ppb based on appropriate testing procedures

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Laboratory Analysis Result Reporting

- Laboratories reported all analytical results electronically to MassDEP (eDEP system)
  - Performed only by Massachusetts DEP-certified laboratories that were e-DEP compliant
- MassDEP Phase (1) or UMass (Phase 2) emailed the analytical results (attached Excel file) to school system (1 to several schools at a time) along with DEP contacts, information links, and template letters for parents
- DEP transferred the Sampling Results to the online LCCA Management Tool
- DEP posted results on public website ~ 2 weeks after sending to schools (see website below for all MA LCCA data) (https://eeaonline.eea.state.ma.us/Portal/#!/search/leadandcopper)
- MassDPH followed-up with an email with information about Pb and Cu and health and additional guidance

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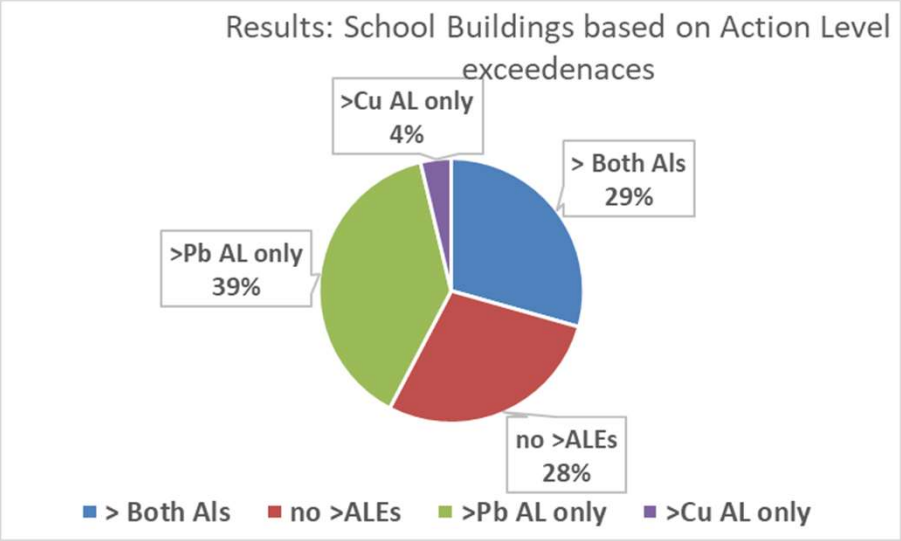
Overall Results: School Buildings Basis (974 schools)



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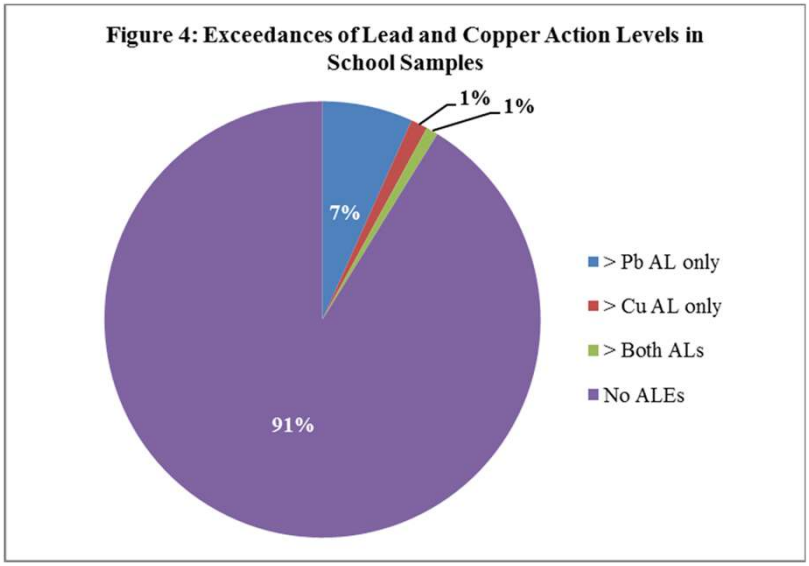
Action Level Exceedances: Number of samples basis



Source: MassDEP Assistance Program Final Report, May 2017

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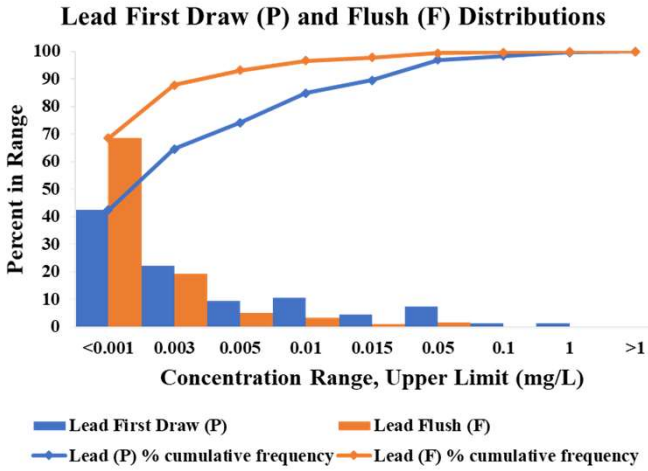
Results, Sample Basis: Lead Concentration Distribution

First Draw Samples: ~ 11 % > 15 ppb, 26 % > 5 ppb, 58% > 1 ppb
Flush Samples: ~ 2.1 % > 15 ppb, 6.9% > 5 ppb, 31% > 1 ppb
- Significant impact of 30 sec flush on decreasing Pb levels



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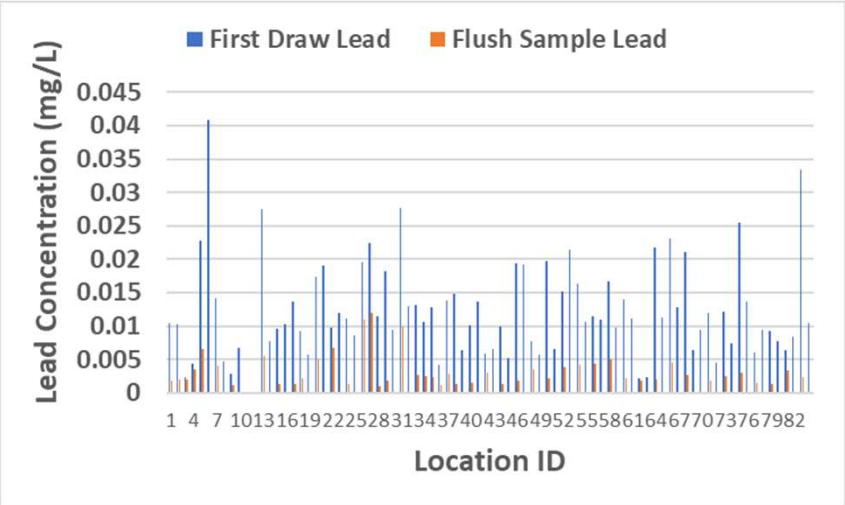
One school: large impact of 30 sec flush on lead levels



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Remedial Actions by Schools

- MassDEP has these recommendations:
- Contact Local Public Water System and MassDEP Drinking Water Program for assistance
- Immediate Measures
  - Shut Off Problem Fixtures
  - Implement a Flushing Program (track via Manual Flushing Log) (this is a temporary measure, helpful, not a solution)
- Conduct Outreach to Staff and Parents
  - Transparency is critical
- Determine if the source of the contamination is the fixture or the plumbing
  - Check Plumbing Profile
  - Possibly replace plumbing
  - Install POU lead removal treatment (focus of SWIG program)
  - Follow-up Sampling & Analyses
- Develop Plan of Permanent Measures
- Report remedial actions taken on the MassDEP online Management Tool

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Old school fixtures

New ("Pb free") school fixtures
(NSF/ANSI 372 since 2014)

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Control of Pb & Cu Levels Premise Plumbing

- **Removal/elimination of all Pb and Cu from water system materials:**
  - **Very challenging due to cost, but significant progress has been made, and more needs to be done (LSLs, premise plumbing)**
- **Source water treatment to remove Pb & Cu? NOT the issue, very rarely the source.**
- **Source water treatment to minimize corrosion of materials containing Pb and Cu – YES, very important**
  - **pH, alkalinity (DIC), phosphate, oxidants, chloride/sulfate, etc.**
  - **Use optimal corrosion control treatment (OCCT)**
- **Flushing of water fixtures by consumers prior to consumption, drawing cold water for consumption – YES, but requires consumer education; unknown duration of effective impact**
- **Point of use (POU) treatment for Pb removal: significant implementation (e.g., Flint, MI; schools; other), O&M ?**
- **US EPA LCR and guidance, and public health guidance, reflect all these measures**

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MassDEP Assistance Program Findings

- **It is common (69%) for a school building to have at least one sample that has lead > 15 ppb; very rare for a school to have all samples < 1 ppb lead**
- **Most of the sample AL exceedance results for Pb are for the primary or first draw sample (11%) versus flush sample (2.3%), highlighting the short-term benefits of flushing.**
- **Exceedances of the copper Al of 1.3 mg/L are infrequent and similar for first draw (3.2%) and flush (1.8%) samples. Elevated copper levels are more systematic, and could possibly be controlled by optimum corrosion control.**

- ***Important to sample all fixtures in a building as not possible to predict which fixtures are a problem, i.e., there are not usually "representative" fixtures for a building (unless all are below detection limits!).***

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Acknowledgements (1): who did the work!

- **UMass Amherst based Project Team**
  - **John Tobiason, David Reckhow, *co-Principal Investigators***
  - **Rick Larson, Bob Hoyt, Marie-Francoise Hatte, *co-Program Managers***
  - **Tom Bienkiewicz (MRWA), Gene Brunelle, Harrison Corbett, Jim Dillon, Kate Gallagher, Mark Griffin, Marie Iken, Ted Kenney, Lynda Laine (MRWA), Thom Martens, Heather Minott, Wayne Southworth, Anita Wolovick, *Technical Assistance Providers***
  - **Donna Asher, Marie-Francoise Hatte, Kelley, Ives, *Administrative***
  - **Kaavya Ram, Graduate Student, many undergraduate students**
- **Commonwealth & MassDEP Team (a few of the many!)**
  - **Governor Charlie Baker, Secretary Matt Beaton, MA Clean Water Trust**
  - **Martin Suuberg, Bethany Card, Douglas Fine, Rebecca Weidman**
  - **Jeffrey Mickelson, Michael Maynard, Marc LaPlante, Michael Celona**
  - **Yvette Depeiza, Damon Gutterman, Andrew Durham, Margaret Finn, Ken Pelletier, Tio Yano, Nicole Della Porta, Jessica Sibirski**
- **All the school, PWS, and other municipal employees**

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Acknowledgements (2): who did the work!

- **Massachsuetts Water Resources Authority**
  - **Sample bottles, sample analyses (~8000 for this Program)**
  - **MWRA has conducted many more analyses for member communities outside of this program, at no charge to those communities**
- **Commercial Laboratories**
  - **12 different laboratories**
  - **provided important communication, sample bottles, analysis**
  - **Large workload, short time period**

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Questions?

Thank you for your attention!

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Ask the Experts

Sandra Kutzing
CDM Smith

Carol Rego
CDM Smith

Sophie Manley
City of Chicago
Department of
Water Management

Kiran Udayakumar
Arcadis

John Tobiason
University of
Massachusetts at
Amherst

Enter your **question** into the **question pane** at the lower right-hand side of the screen.

Please specify to whom you are addressing the question.

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- As part of your registration, you are entitled to an additional 30-day archive access of today's program.

- Until next time, keep the water safe and secure.

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Presenter Biography Information

- Sandra Kutzing is a Principal Engineer at CDM Smith with 18 years of experience in drinking water. Ms. Kutzing has a BS from the University of Illinois in Civil Engineering and an MS from the University of Washington in Civil Engineering. For the past few years, Ms. Kutzing has been working with utilities specifically on optimizing corrosion control and establishing and managing lead service line replacement programs.
- Carol Rego is among the water industry's leading experts in water quality and corrosion control treatment. With almost four decades of experience as a water supply and treatment specialist at CDM Smith, Carol's expertise spans treatability studies, process selection and drinking water research, water supply planning, water treatment plant evaluation, operations, and design, as well as Safe Drinking Water Act (SDWA) and Lead and Copper Rule (LCR) compliance.
- Sophie Frances Manley: Sophie graduated from the University of Notre Dame with a degree in Environmental Engineering. Since 2016, she has been working with the City of Chicago Department of Water Management as an engineer in the Division of Water Quality. She is passionate about working for a water utility.
- Kiran Udayakumar: Kiran graduated with a Master's Degree in Environmental Engineering from Michigan Technological University. He works for Arcadis as a Water Quality Engineer in the Water Business Line. He is experienced in water quality, treatment & corrosion control and incorporating digital solutions in his work.
- John E. Tobiason is Professor and Department Head of Civil and Environmental Engineering at the University of Massachusetts at Amherst. BS in Civil Engineering University of New Hampshire (1976), MS in Environmental Engineering University of North Carolina at Chapel Hill (1979), PhD in Environmental Engineering Johns Hopkins University (1987). Past President of AEESP and past Chair of the AWWA Water Science Research Division Board of Trustees. He is a registered Professional Engineer (NH), and a Board Certified Environmental Engineer by the AAEES.

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