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CONTAMINANTS OF CONCERN:
Managing Lead and Manganese
WEBINAR SERIES
May 19th, 2020 | 1:00 – 2:30p.m (Mountain)
Regulatory Concerns and Updates for Inorganic Contaminants
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Webinar Moderator

Chad Seidel

President

Corona Environmental Consulting, LLC

Chad Seidel, Ph.D., P.E. is President of Corona Environmental Consulting, LLC and an active member of the AWWA Inorganic Contaminants Research Committee. He focuses on improving public health protection by solving water-related engineering, science, and policy challenges.

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Panel of Experts

Steve Via
Director Federal Relations
American Water Works Association

Roger Arnold
Associate
Hazen and Sawyer

Andy Eaton
Technical Director Emeritus
Eurofins Eaton Analytical

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Agenda

I. **Regulatory Update on Inorganics**
Steve Via, American Water Works Association

II. **Evolving Utility Perspectives and Experiences with Corrosion Control – Results from a National Utility Survey**
Roger Arnold, Hazen and Sawyer

III. **An overview of Inorganics findings in UCMR4**
Andrew Eaton, Eurofins Eaton Analytical

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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American Water Works Association

Regulatory Update

Steve Via

Director, Federal Relations

American Water Works Association

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Agenda

- Safe Drink Water Act Regulatory Processes
- Perchlorate
- Lead and Copper Rule
- Waterkeeper Alliance v EPA
- Fluoride
- Summary

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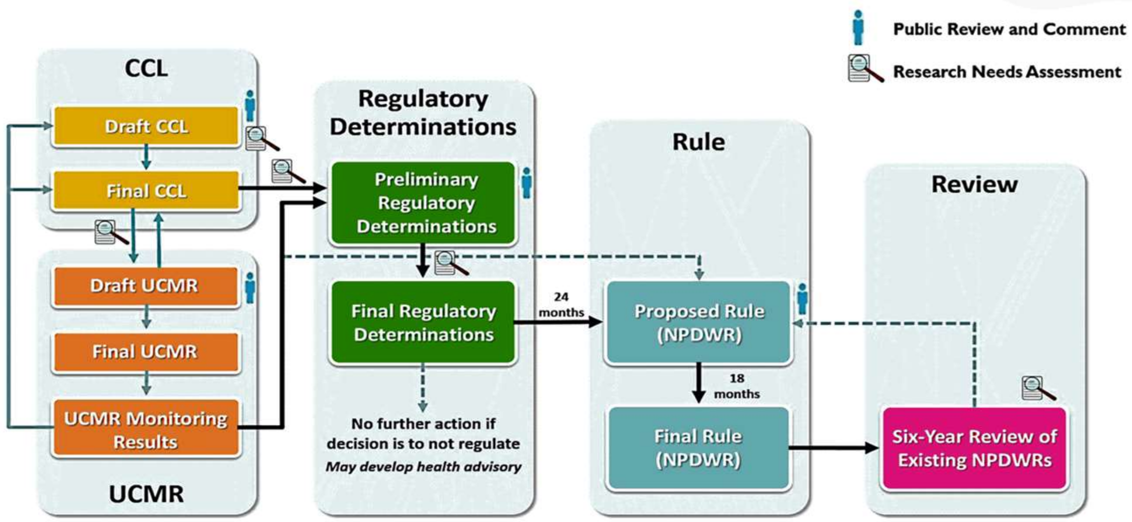
Safe Drinking Water Act Processes



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Inorganics on the Contaminant Candidate List

Contaminant	Reg-Det 3 Short List	Occurrence Data	Health Risk Assessment
Chlorate	Yes	UCMR 3	*"To be evaluated…"*
Cobalt	Yes	UCMR 3	*"Updated assessment needed"*
Germanium		UCMR 4	*"No health assessment"*
Manganese		UCMR 4	Existing Drinking Water Health Advisory; Health Canada Guideline
Molybdenum	Yes	UCMR 3	*"Updated assessment needed"*
Vanadium	Yes	UCMR 3	On IRIS Workplan

Source: Quotations from Preliminary Determinations on 4th CCL, 85 FR 14098

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Inorganics and Unregulated Contaminant Rule Monitoring

Contaminant	Reference Level (µg/L)	Utilities Sampled	Utilities above MRL	Utilities above RL	UCMR Cycle
Chlorate	210	4,918	3,391	1,896	UCMR3
Cobalt	70	4,922	247	3	UCMR3
Germanium	---	4,210	528	---	UCMR4 (ongoing)
Manganese	300	4,211	3,729	79	UCMR4 (ongoing)
Molybdenum	40	4,922	2,546	40	UCMR3
Vanadium	21	4,922	3,625	163	UCMR3

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Chlorate

- Disinfection byproduct considered in Stage 1 DBP rule dialogue but not regulated
- April, 2011 AWWA <u>Recommendations for Handling and Storage of Hypochlorite Solutions</u>
- Monitoring in UCMR3 (2013 – 2016) recognized broad occurrence
- 1,

Threshold Concentration	National Estimate of Number of Sample Locations with Locational Average Concentration > Threshold (Percent[1])	National Estimate (in million) Population Served by Sample Locations with Locational Average Concentration > Threshold (Percent[1])
> HRL (210 µg/L)	24,868 (16.59%)	52 (17.43%)
> 2xHRL (420 µg/L)	10,168 (6.78%)	15 (5.06%)
> 3xHRL (630 µg/L)	5,124 (3.42%)	6 (2.00%)

Source: EPA, Six-Year Review, Technical Support Document for Chlorate, 2016

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Public Outreach Requirements

UCMR4 Analyte	Method Reporting Level (µg/L)	Reference Concentration (µg/L)	Chronic	Short-term
Manganese	0.4	300	Y	Y
Tebuconazole	0.2	190	Y	Y
Microcystins (Total, LA, LF, LR, LY, RR, YR)	0.3 / 0.008 / 0.006 / 0.02 / 0.009 / 0.006 / 0.02	0.3 / 1.6	Y	Y
Cylindrospermopsin	0.09	0.7 / 3	Y	Y

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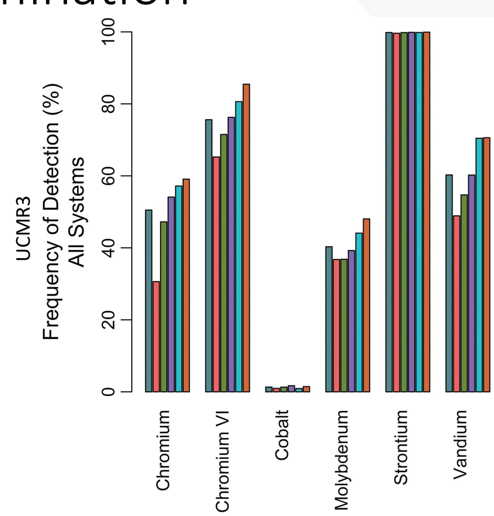
Fourth Regulatory Determination

- Proposed Fourth Regulatory Determination (March 10, 2020)
- Comments due June 10, 2020
- Final due January, 2021
- Inorganics
  - Strontium – No action
- Focus of notice
  - Perfluorooctanesulfonic acid (PFOS)
  - Perfluorooctanoic acid (PFOA)



Journal AWWA, DOI: (10.5942/jawwa.2018.110.0029)

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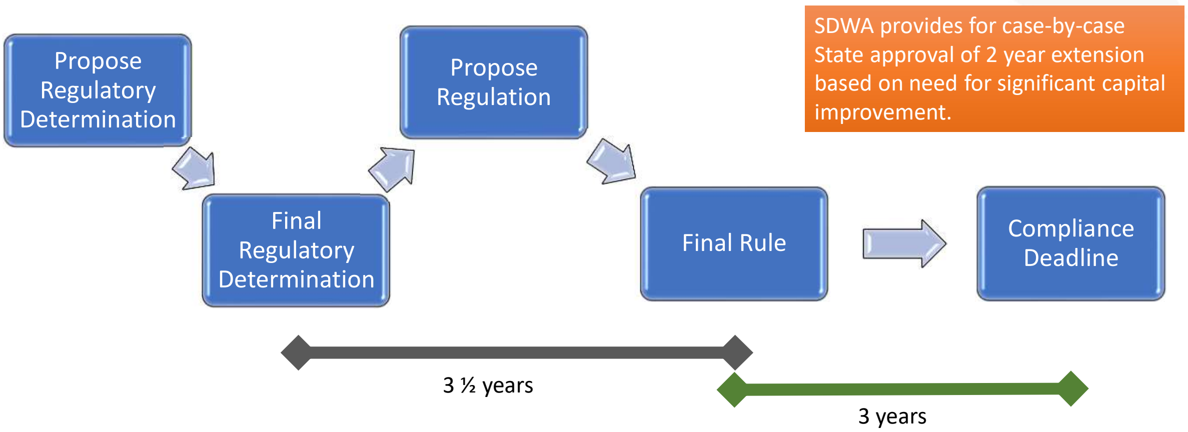
From Notice of Intent to Full Compliance



See AWWA PFAS Resource Page for Summary of State Policies to Protect Drinking Water

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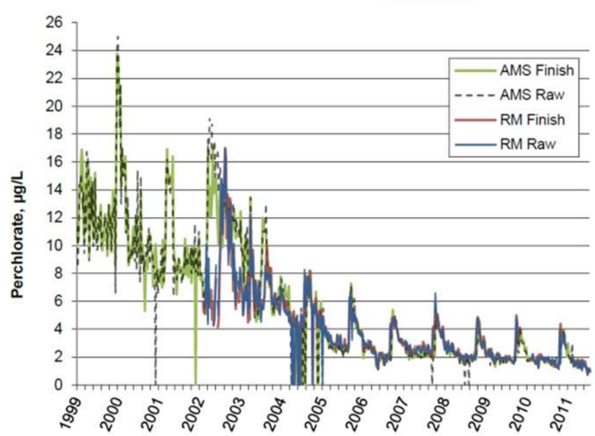
Perchlorate

- February, 2016 NRDC complaint led to a negotiated schedule
  - October, 2018 deadline for proposed rule was extended to May, 2019
  - December, 2019 deadline for final rule was extended to June, 2020
- June 26, 2019 EPA proposed an MCLG and MCL of 56 µg/L and sought comment on withdrawal, MCLG of 18 µg/L, and MCLG of 90 µg/L
- May 15, 2020 EPA released "Reductions of Perchlorate in Drinking Water"



Data from Two SNWA Facilities Drawing from Lower Colorado River

Source: EPA-815-F-20-002, May 2020

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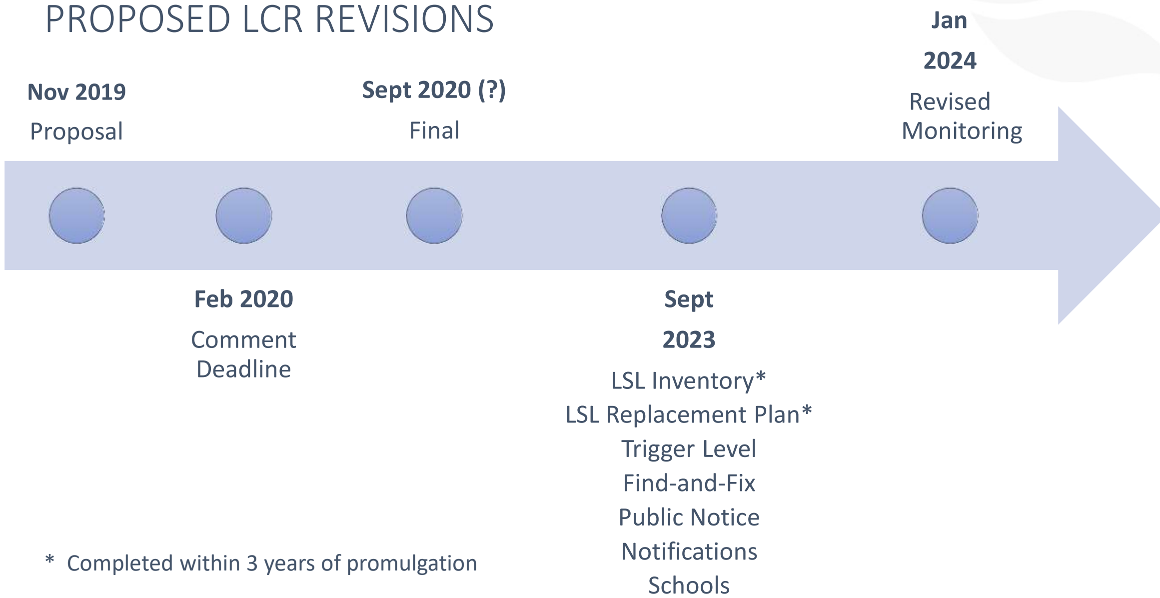
PROPOSED LCR REVISIONS



* Completed within 3 years of promulgation

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COMMUNITY WATER SYSTEMS IMPACTED BY RULE

System Category	Service Population (persons served)	Number of CWS	Corrosion Control	
			With	Without
Small	<10,000	45,758	25%	75%
Medium	10,000 - 50,000	3,331	64%	36%
Large	>50,000	978	99%	1%

Note: LCR applies to all 50,067 CWSs as well as 17,589 non-transient noncommunity water systems.

Source: Extracted from Lead and Copper Rule Revisions Economic Analysis

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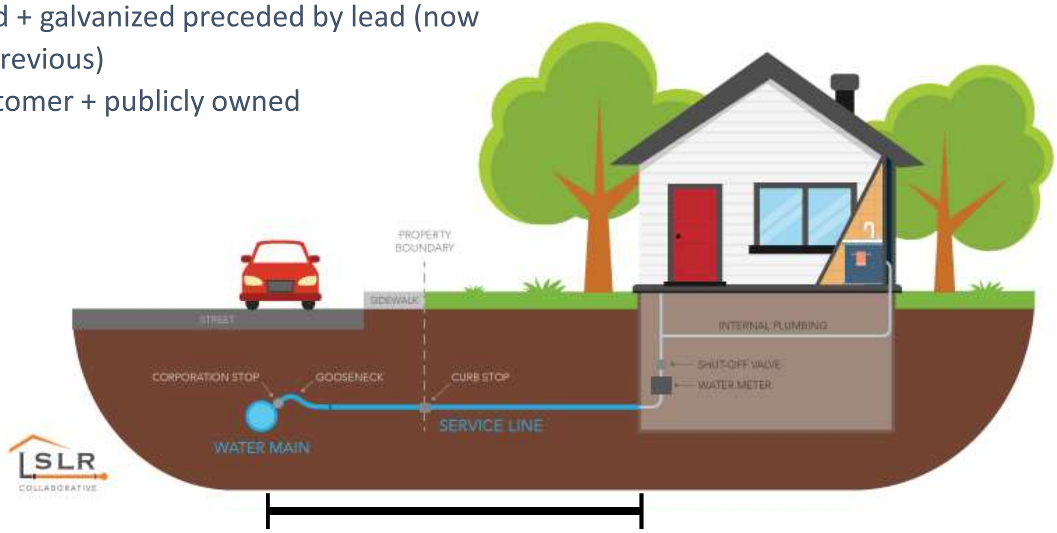
WHAT IS A LEAD SERVICE LINE?

- Lead + galvanized preceded by lead (now or previous)
- Customer + publicly owned



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WHAT IS A LEAD SERVICE LINE REPLACEMENT?

Components Between Water Main and Interior Plumbing	Include in LSL Inventory	Counts as a Replacement
Lead pipe anywhere between gooseneck and interior plumbing	Yes	When all lead is removed
Unknown pipe material anywhere between gooseneck and interior plumbing	Yes	Where lead pipe is found and all lead is removed
Galvanized pipe if preceded by lead (pipe, gooseneck, etc.) at any time	Yes	When replaced along with any preceding lead pipe
Lead gooseneck with non-lead pipe between gooseneck and interior plumbing	No	No*

* Must replace if utility-owned when encountered during planned or emergency work. Must offer to replace, but not pay, if customer-owned

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LEAD TRIGGER LEVEL

- Adds "trigger Level" at 90^{th} percentile value >10 µg/L
- All CWSs and NTNCWSs that exceed the lead trigger level must:
  - Increase monitoring to annual
  - Conduct corrosion control treatment or re-optimization study
  - Conduct public outreach to customers with lead service lines or service lines of unknown materials
  - Implement goal-based lead service line replacement plan
- Large systems that exceed the lead trigger level must re-optimize corrosion control treatment

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FIND AND FIX

1. Applies to individual samples >15µg/L
2. Required samples
   - Water quality parameter sample at or near the site where the high lead sample was collected within 5 days of learning of the lead results
   - Lead tap samples within 30 days of learning the results
3. The new WQP sample site is used in future routine WQP monitoring
4. Systems must determine if a corrosion control treatment "fix" is needed
5. State approves "fix" and water system implements

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CORROSION CONTROL TREATMENT

1. Optimal corrosion control treatment options
    1. Orthophosphate
    2. pH / alkalinity
    3. Silicate-based corrosion
2. Corrosion control study must evaluate
    1. Orthophosphate at 1 and 3 mg/L
    2. pH/alkalinity
3. State agrees on corrosion control strategy
4. System implements treatment modifications
5. State designates water quality control parameters
6. System must operate within water quality parameters

Once study is triggered, system must complete study. Once action level exceedance occurs then treatment is installed or re-optimized*

* Small system flexibility provision

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NOTIFICATION REQUIREMENTS

- Single tap sample >15 µg/L
    - Provide value and information in <24-hour
- Disturbance of lead service line
    - Applies to service lines made of "unknown" material
    - Major disturbance … notify and provide pitcher filter
    - Minor disturbance … notify
- 90th percentile lead action level exceedance
    - Tier 1 Notice (e.g., within 24 hours)

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SCHOOL AND CHILDCARE FACILITY SAMPLING

- Develop list of schools (K-12) and licensed childcare facilities and update every 5 years
- Collect lead samples at 20 percent per year (2 per childcare facility, 5 per school)
- Provide facilities EPA's guidance on lead in water at schools
- Document facilities that decline to participate
- Provide results to the facility, primacy agency, health departments within 30 days

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WaterKeeper Alliance Vs. Wheeler

- January 30, 2019 – Compliant filed in US District Court for Southern District of New York
- April 16, 2020 – EPA requested public comment on draft settlement agreement
- July 18, 2022 and Nov. 17, 2026 -- Sets deadlines for next two CCLs
- July 31, 2024 – Deadline for proposal revisiting seven specific primary standards
  - Chlorite
  - *Cryptosporidium*
  - *Giardia lamblia*
  - Haloacetic acids
  - Heterotrophic bacteria
  - *Legionella*
  - Total trihalomethanes
- Three years after the final Cr(VI) risk assessment to determine if regulatory action is needed on existing chromium standard
  - Draft IRIS assessment is currently slated for 3rd Quarter 2021

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Fluoride

- June 8, 2020 the Northern District Court of California, San Francisco Division, will hear arguments
- EPA is currently defending community fluoridation
- If EPA were to lose the petition, absent an appeal, the Agency would face the prospect of initiating a rulemaking under TSCA
- TSCA Section 6 provides for a range of remedies including prohibition, minimum warnings and instructions, notice, recordkeeping,

An Abbreviated History

2016

- National Toxicology Program completed its systematic review of the potential health effects of fluoride
- Court ruled against EPA on limiting the scope of the record to be considered

2017

- Six-Year Review notice indicates lower priority issue
- CDC statement on safety and effectiveness of fluoridation
- EPA Denied TSCA Section 21 Petition
- Petitioners filed a civil action under TSCA seeking to ban fluoridation

2018

- Court ruled against EPA on limiting the scope of the record to be considered

2020

- Peer Review of the NTP Monograph on Systematic Review
- Court ruled that initial phase of case does not include consideration of the benefits of fluoridation

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Summary

- EPA is moving rapidly to finalize perchlorate rulemaking per consent agreement
- Revising the LCR by the end of September continues to be EPA's objective for the rulemaking
- EPA is under significant pressure to advance proposed regulatory action for PFAS.
  - That pressure makes preparation of other standards challenging by drawing limited available resources to PFAS-related activities
- Current administration is agreeing to complete a revision of M/DBP rules within the next four years

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Additional resources

LCR

- AWWA Lead Resource Community
- EPA: Proposed Revisions to the Lead and Copper Rule
- Lead and Copper Corrosion: An Overview of WRF Research
- Lead Service Line Replacement Collaborative
- EPA: 3Ts for Reducing Lead in Drinking Water Toolkit

PFAS

- AWWA PFAS Resource Page
- Summary of State Policies to Protect Drinking Water

Chlorate

- AWWA B300-18 Hypochlorites
- Hypochlorite Assessment Model

Brominated DBPs

- AWWA DBP Resource Page

Fluoride

- M4 Water Fluoridation Principles and Practices

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Hazen

EVOLVING UTILITY PERSPECTIVES AND EXPERIENCES WITH CORROSION CONTROL – RESULTS FROM A NATIONAL UTILITY SURVEY

Roger B. Arnold, PE
Associate
Hazen and Sawyer

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PURPOSE

- To benchmark current utility practices for corrosion control and Lead and Copper Rule (LCR) compliance
- To gain insight into the impacts of the proposed LCR Revisions on utilities
- Opportunity to compare corrosion control treatment and compliance strategies with other systems

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AGENDA

- Background
- Survey Approach
- Utility Responses and Characteristics
- Results Analysis
  - LCR Compliance
  - Corrosion Control Treatment
  - Lead Service Lines
  - Utility Experiences
- Impacts of LCR Revisions

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BACKGROUND AND CONTEXT

WHY NOW?

- 2016 USEPA Corrosion Control Treatment Guidelines
- Anticipated LCR Revisions (USEPA White Paper, 2016)
- State-level LCR policy changes
- Proactive utility optimization studies
- National survey conducted in early 2019
- Draft LCR Revisions proposed October 2019

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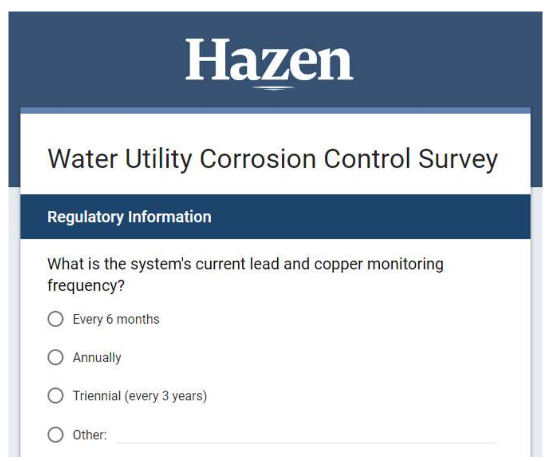
SURVEY APPROACH

- Over 350 utilities across the country contacted by phone and email
- Online survey platform with multiple-choice and open-ended survey questions
- Received responses from 60 utilities



Online Survey Interface

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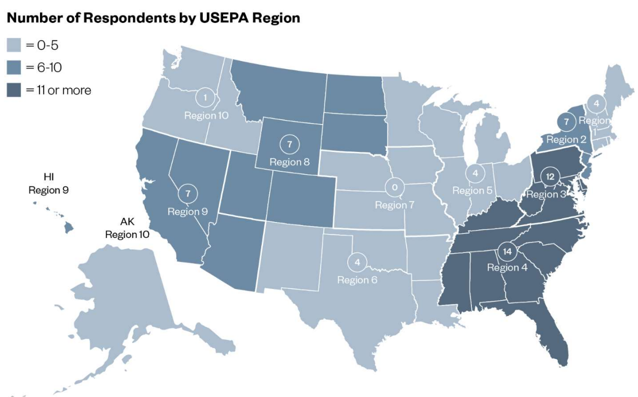
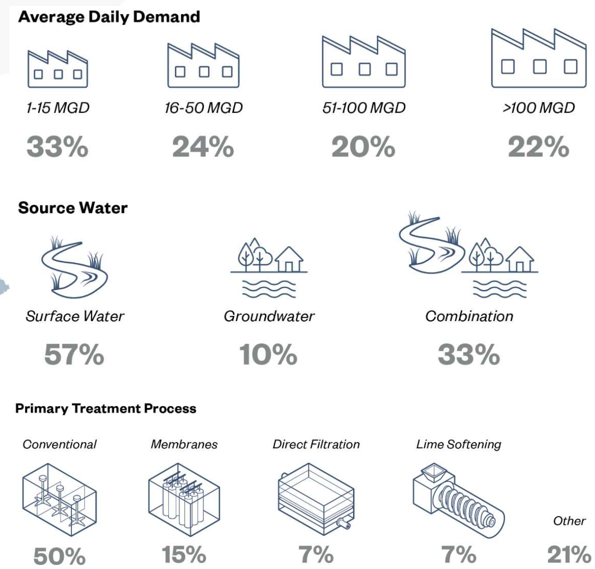
PARTICIPATING UTILITY CHARACTERISTICS

- Goal to obtain a diverse and representative dataset





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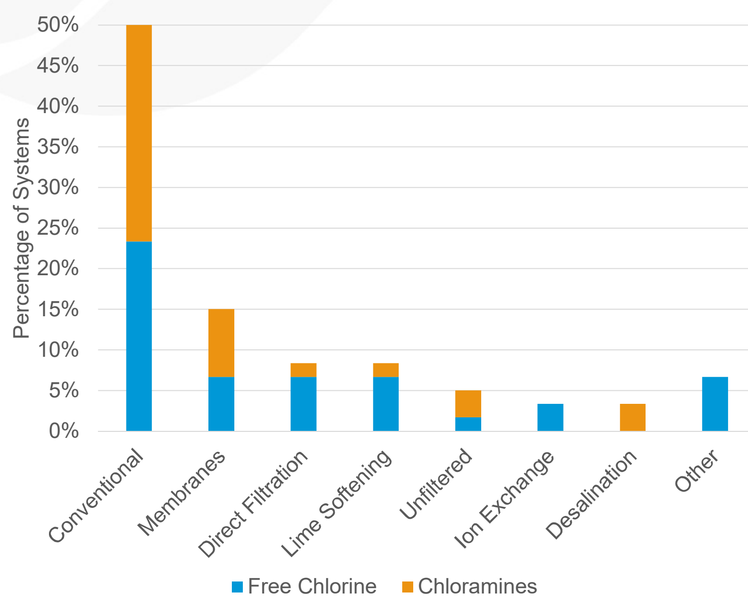
TREATMENT PROCESSES

- Participating systems had a variety of treatment processes
- Included systems with free chlorine and chloramines
- Reported rates of conventional treatment consistent with prior USEPA survey



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LCR COMPLIANCE RESULTS

KEY FINDINGS

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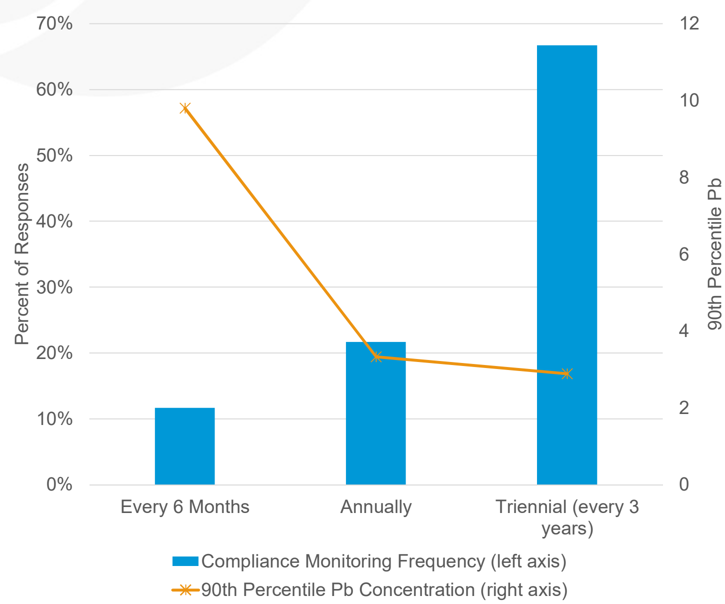
LCR COMPLIANCE MONITORING

- Most systems performed triennial monitoring (every 3 years)
- Lower lead levels in systems with triennial monitoring
- *12% of systems* in the survey exceeded the Action Level in the last 10 years
  - Most in the 51-100 MGD range
  - 4 of 7 exceedances in systems with lead service lines



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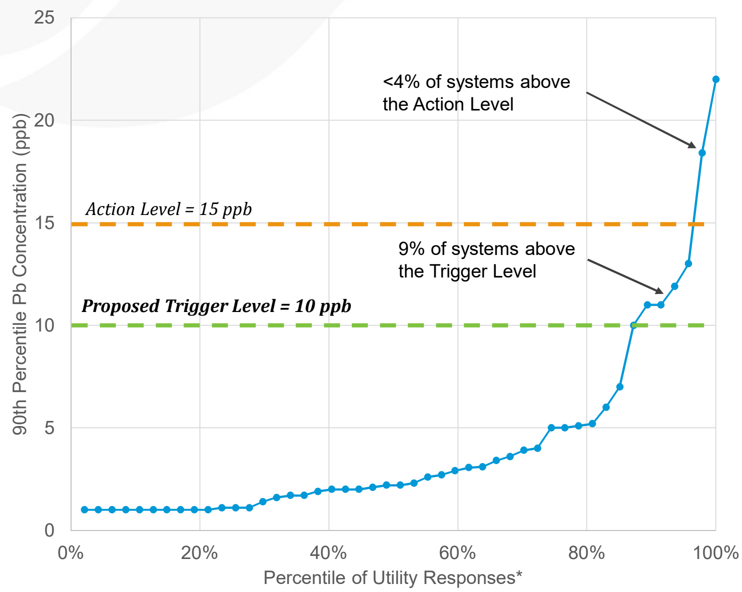
90[TH] PERCENTILE LEAD LEVELS

- Data used to evaluate baseline impacts of the proposed Trigger Level
- Does not account for impacts of proposed sampling changes



*Data from the most recent monitoring period.

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CORROSION CONTROL TREATMENT

KEY FINDINGS

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CORROSION CONTROL TREATMENT OVERVIEW

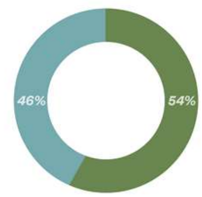
- Reported rate of corrosion inhibitor use (54%) higher than prior industry surveys
- Corrosion inhibitor use more common in surface water systems
- Corrosion inhibitors more common in systems with lead service lines

Corrosion Control Treatment was ranked by participating utilities as the most important topic related to the LCR.

Utilities using a pH/ alkalinity adjustment

The most common treatment chemicals included:

48% sodium hydroxide
34% lime
7% soda ash



Utilities using corrosion inhibitors

The most common corrosion inhibitors included:

38% zinc orthophosphate
28% blended ortho/poly phosphate
28% orthophosphate

Average reported 90th percentile lead valves were lower for systems with a corrosion inhibitor than systems using pH/alkalinity adjustment.

pH Process Control

USEPA guidance suggests maintaining a finished water pH range of ***+/- 0.2 units.***

32% of systems reported pH control within this range

The majority of systems reported greater pH variability up to a range of 2.2 pH Units.

Corrosion Inhibitor Doses

USEPA guidance suggests an ***orthophosphate dose of 1-3 mg/L as*** PO_4.

56% of systems reported an orthophosphate dose within this range

36% had doses below this range

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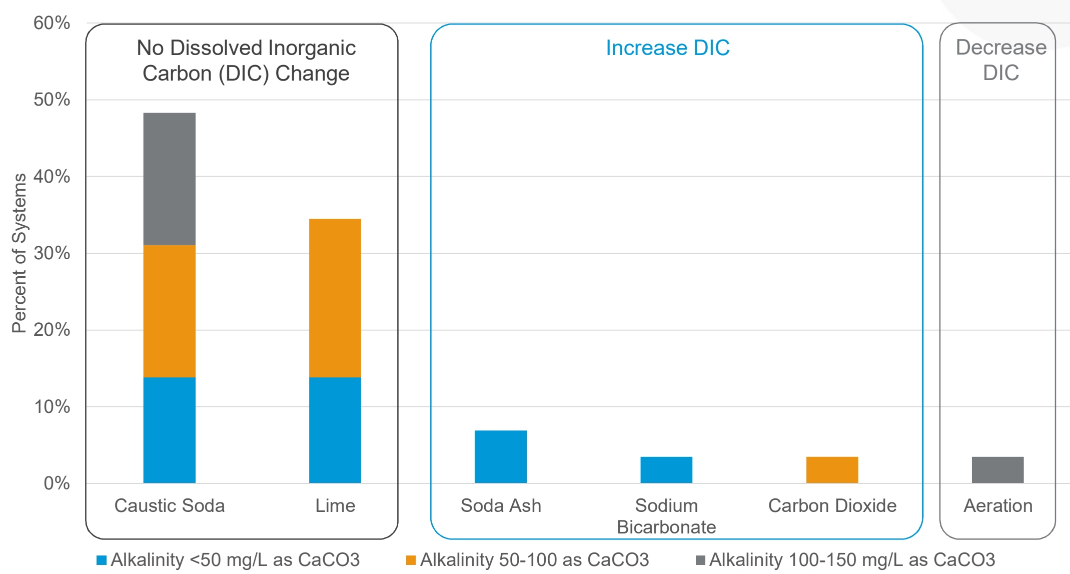
pH/ALKALINITY ADJUSTMENT METHODS



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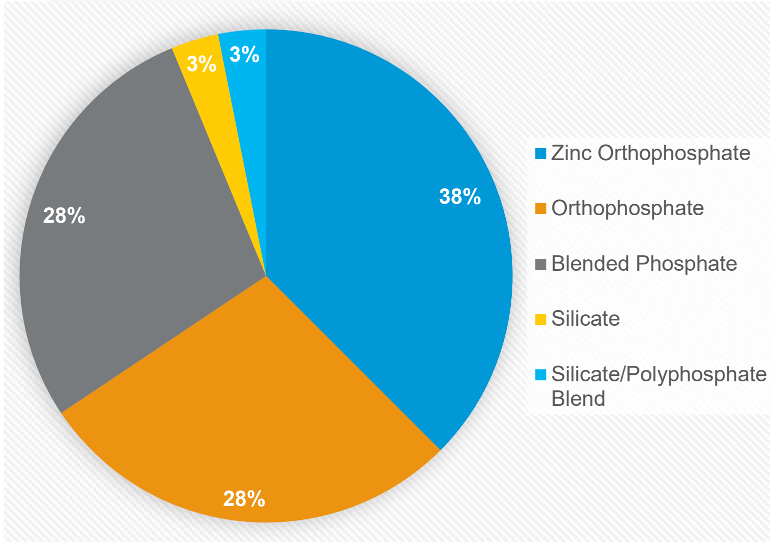
WHICH CORROSION INHIBITORS ARE MOST COMMON?



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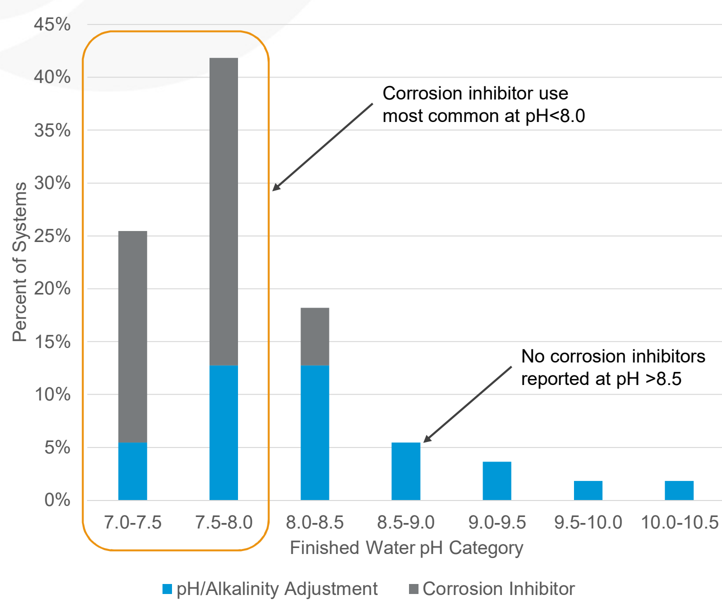
HOW DOES pH INFLUENCE CORROSION INHIBITOR USE?

- Optimal pH range for orthophosphate is 7.2 to 7.8 in USEPA guidelines
- Combination of corrosion inhibitor and pH adjustment



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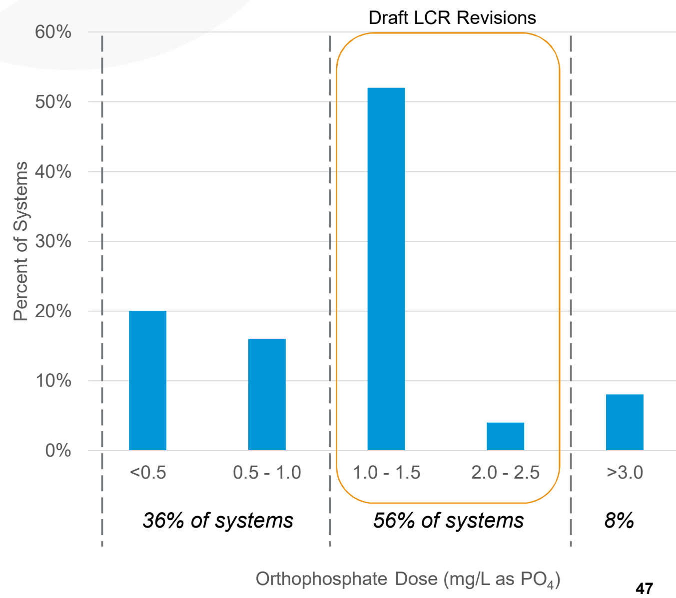
WHAT ORTHOPHOSPHATE DOSES ARE USED FOR CORROSION CONTROL?

- Proposed LCR Revisions require systems to evaluate orthophosphate doses of 1 mg/L and 3 mg/L as PO_4
- Regulatory changes could substantially increase orthophosphate use



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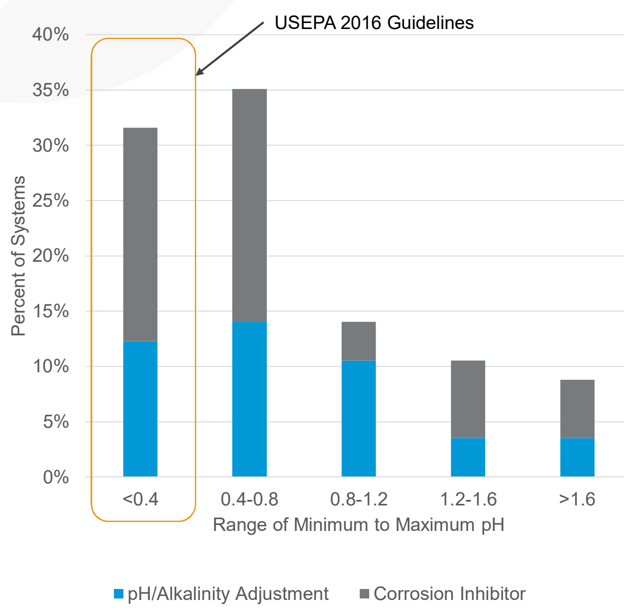
WATER QUALITY PARAMETERS AND PROCESS CONTROL

- Many systems experienced significant finished water pH variability



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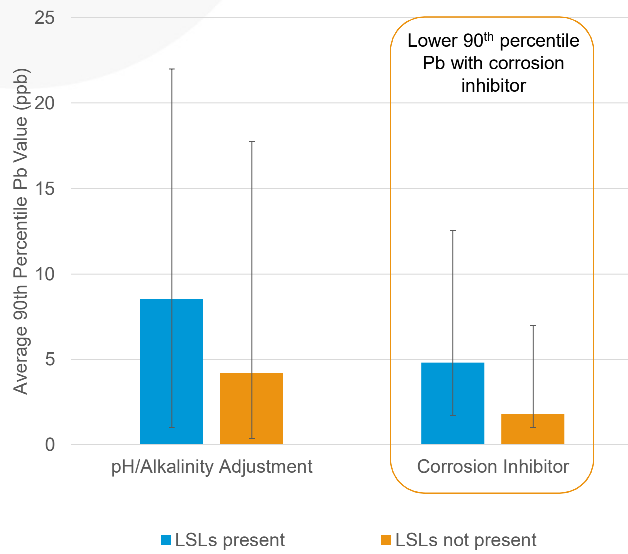
HOW DOES CCT AFFECT LEAD AND COPPER COMPLIANCE RESULTS?

- Survey results add to evidence from prior studies that orthophosphate is effective for controlling lead release.
- Copper findings:
  - Lower copper levels at higher pH values
  - Higher levels in systems with blended corrosion inhibitors (polyphosphate)



Columns represent average 90th percentile compliance values; error bars represent minimum and maximum 90th percentile values.

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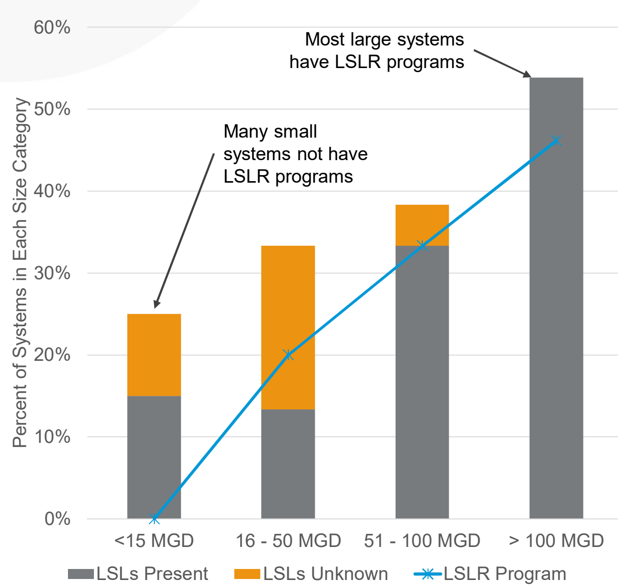
LEAD SERVICE LINES

- 27% of systems reported LSLs
- 12% were unsure if LSLs were present
- Proposed LCR Revisions:
  - Publicly-available service line inventory
  - LSL replacement plan
  - Replace LSLs after exceedance
  - Small systems and systems with *unknown service lines* most impacted



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UTILITY EXPERIENCES

CORROSION CONTROL AND LCR COMPLIANCE

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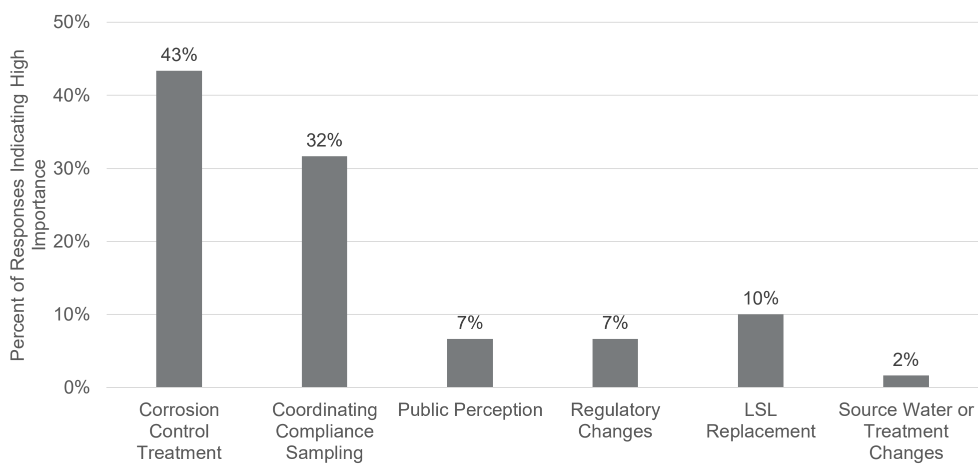
UTILITY PRIORITIES

- "Most important" priority for utilities is corrosion control treatment (CCT)
- LCR Revisions place greater emphasis on CCT and may prompt systems to change treatment



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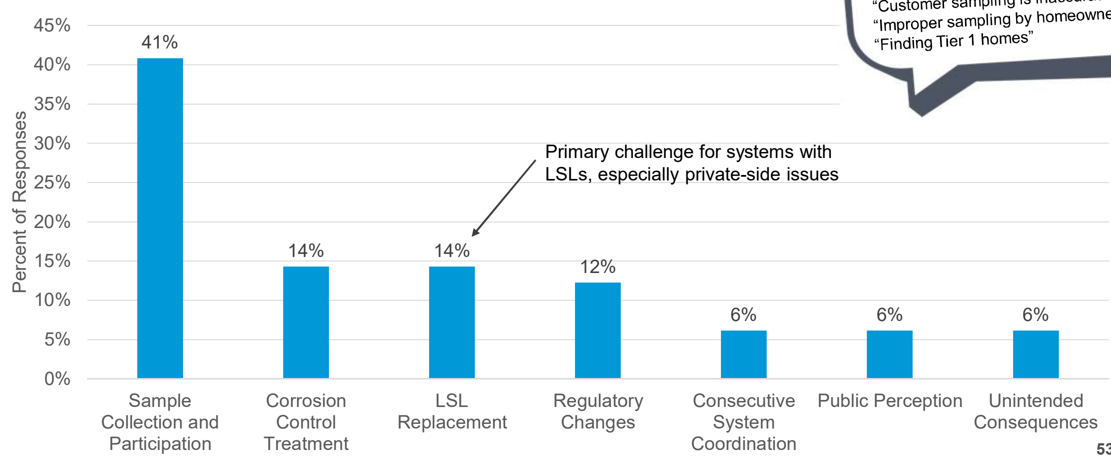
WHAT ARE UTILITIES' GREATEST CHALLENGES?

- "Most challenging" area is conducting compliance tap sampling
- LCR Revisions modify sample site selection tiers and increase customer coordination needs

Open-ended responses:
"Finding appropriate sampling points"
"Difficulty in collecting compliance samples"
"Finding willing customers"
"Customer sampling is inaccurate"
"Improper sampling by homeowners"
"Finding Tier 1 homes"



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HOW WILL THE LCR REVISIONS IMPACT UTILITIES?

Trigger Level
- >9% of systems may exceed the proposed Trigger Level

Tap Sampling
- Utilities' greatest challenge
- Update sampling plan for new Tier criteria
- "Find-and-Fix"
- Sampling in schools

Corrosion Control Treatment
- Further increases to orthophosphate use and doses up to 3 mg/L as PO_4
- Greater attention to WQP ranges

LSL Inventory & Replacement
- **Full** replacement strongly encouraged
- Greatest impacts to small systems and systems with unknown service lines

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SUMMARY OF KEY FINDINGS

- Corrosion control treatment is the top priority for many systems
- Results add to evidence from other studies that orthophosphate is effective for controlling lead release
- Continuing trend towards increase use of orthophosphate corrosion inhibitors
- Systems with LSLs had higher Pb levels and more Action Level exceedances
- Significant pH variability common in many systems
- Low pH and polyphosphate are concerns for copper release

- Although a basic tenet of the LCR, compliance sampling is the greatest challenge related to the LCR
- Full LSL replacement is a challenge for many systems

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THANK YOU!

QUESTIONS?

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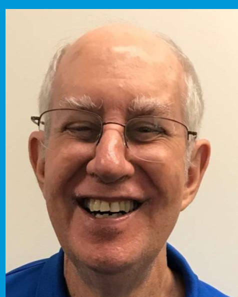
An Overview of Inorganics Findings in UCMR 4



Andy Eaton, PhD, BCES
Technical Director Emeritus
Eurofins Eaton Analytical, LLC
Monrovia, CA

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AGenda

- UCMR Overview and Inorganics
- Comparison databases
- Occurrence observations for metals in UCMR 4
- DBP indicators in source waters
- Implications and conclusions

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Brief History of Unregulated Contaminant Monitoring Rules

- Every 5 years
- No more than 30 compounds per UCMR
- Traditionally mostly organics (emerging contaminants)
- But there have often been some inorganics mixed in.
  (nitrate was part of UCMR 1…)
- UCMR 3 had a lot of metals plus ClO3/ClO2
  (and Mn and Ge were added for small systems)
- UCMR 4 includes Mn, Ge and source water Br and TOC

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Other Relevant Comparison Databases

- The Information Collection Rule, aka ICR (1997) included Br and TOC for source waters.
  - Fewer systems (~300 serving >100K population)
  - More frequent testing (monthly)
- UCMR 3 (2013-15) included Mn and Ge for small systems only.
  - ~800 systems
  - Only systems serving < 10K population

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UCMR 4 Overview

- 2018-2020 monitoring
- ~2300 surface water systems
- ~2500 ground water systems
- ~35,000 samples overall for entry points when done
- ~ 20,000 samples overall for source waters when done
- 30 contaminants (2 inorganics, 3 cyanotoxins, 25 organics) for EP or MR plus TOC/Br for sources

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UCMR 4 Overview (continued)

- About ¾ of systems have reported data already.
- Overall patterns of occurrence are unlikely to change (new data just released in April is similar).

	% of samples with hits				% of PWS with hits			
	0119	0519	1019	0120	0119	0519	1019	0120
germanium	7.0%	7.4%	8.0%	7.6%	12.3%	12.6%	12.6%	12.4%
manganese	69%	68%	70%	70%	83%	85%	88%	88%
HAA5 (regulated)	97%	97%	97%	97%	98%	98%	98%	98%
HAA6Br	95%	95%	95%	95%	97%	97%	96%	97%
HAA9	97%	97%	97%	97%	98%	98%	98%	100%
~ Total chemistry	4500	9000	18000	22000	1100	1900	3200	3700
~ Total DBPs	7000	15000	30000	37000	1100	1900	3200	3600

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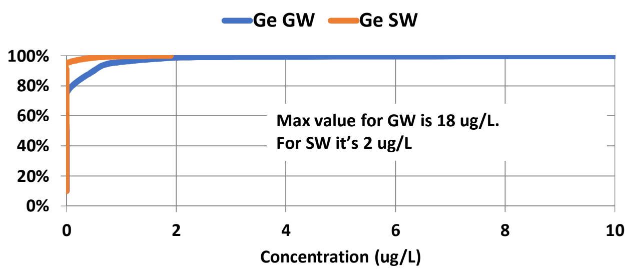
SW vs GW Source Waters for Metals (by PWS)

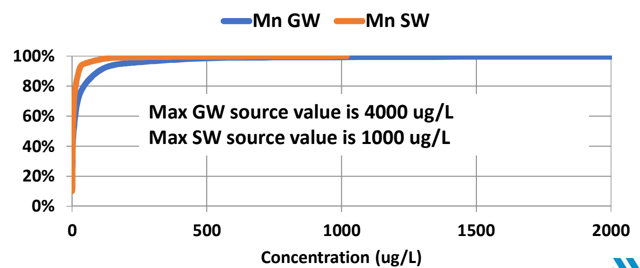


Ge, as expected, is predominantly a GW source issue.

Concentrations are higher and detection more frequent for GW source PWS.

Mn is also mainly from GW source plants, but there are also significant SW plants with high levels (not necessarily a source water issue).

Concentrations are also higher and detection more frequent for GW source PWS.



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How Does This Compare With UCMR 3 Data?

- UCMR 3 included only a small set of samples.
- UCMR 3 included only small systems (<10K pop).
- Reporting limits were different (1 ug/L for both in UCMR 3 and 0.4 ug/L (Mn) and 0.3 ug/L (Ge) in UCMR 4).

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UCMR 3 Mn and Ge Data (Small Systems)

Statistic	Mn Overall	Mn GW sources	Mn SW sources	Ge Overall	Ge GW sources	Ge SW sources
Mean	17	22	9	<1	<1	<1
Median	1.7	2.2	1.4	<1	<1	<1
Maximum	3550	3550	1400	13	13	1.1
95th percentile	68	97	28	<1	<1	<1
90th percentile	29	46	14	<1	<1	<1
10th percentile	<1	<1	<1	<1	<1	<1
Total samples	5935	3564	2019	5935	3564	2019

- 800 small water systems (representing ~6000 samples)
- Higher reporting limits than UCMR 4
- Semi-annual (GW) or quarterly (SW) monitoring

Data in ug/L

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UCMR 3 Data (Small Systems) Observations

- Sites with GW sources were higher than sites with SW sources (duh!).
- Mn occasionally exceeded the SMCL.
- There were some VERY high Mn sites present.
- Mn could vary significantly at the same site, suggesting that it’s not all a source water issue.
- Ge was pretty much a non-issue.

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Germanium and Manganese- a Deeper Dive

	Manganese		Germanium	
	UCMR 3	UCMR 4	UCMR 3	UCMR 4
% Hits	60%	70%	1%	8%
Median	1.7	1.8	<1	<0.3
95th percentile	68	56	<1	0.5
99th percentile	271	240	<1	1.3
MRL	1	0.4	1	0.3

- Results are actually very comparable if one corrects for the greater sensitivity used in UCMR 4.
- Although germanium appears to be much more frequently detected in UCMR 4, 98% of samples are <1 ug/L.

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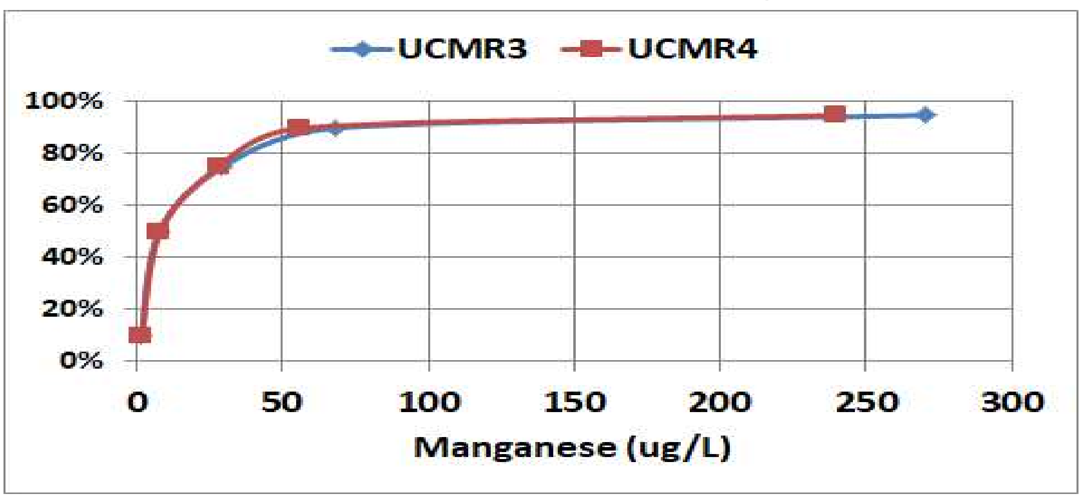
Probability Plot Comparison UCMR 3 vs UCMR 4 for Manganese



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Manganese: % of Samples/Systems Above Different Thresholds as of April 2020

	% of samples		% of PWS
N	27194		4211
50 ppb SMCL	3.9%		12%(495)
120 ppb Canadian Guideline	1.6%		5.3%(224)
300 ppb HAL	0.5%		1.9% (79)

At the SMCL or even slightly higher levels, there are a number of systems that would be impacted if EPA or states imposed a primary standard.

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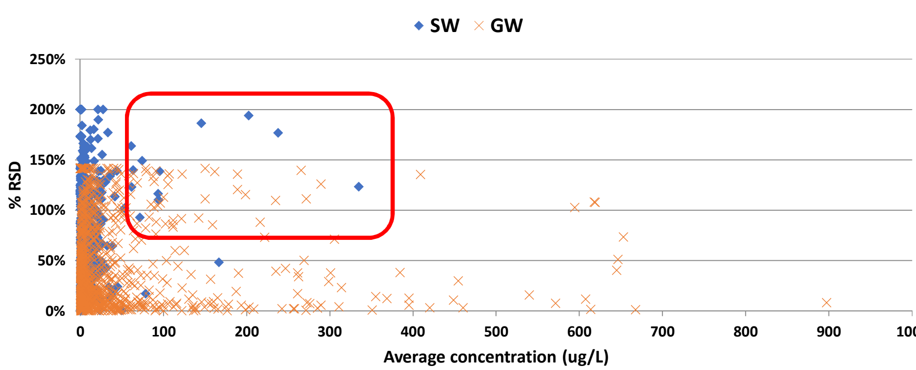
OTHER Observations on ucmr 4 Mn data

- One can't easily tease out the influence of source waters versus permanganate treatment, but high %RSD and high average concentrations in some SW plants make it likely it's not just source influences.



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Switching the Focus to Source Waters

- Source water bromide and TOC act as precursors for HAA species, which is the main reason they were included in UCMR 4.
- There has been literature showing bromide influences from anthropogenic sources, like power plants and potential impacts on DBPs.

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ICR Data (1997)

Statistic	TOC (mg/L)	Bromide (ug/L)
Mean	2.8	69
Median	2.4	36
Maximum	27.5	2230
90^{th} percentile	5.3	160
10^{th} percentile	<0.35	<10
Total samples	7504	7959

- 296 water systems (representing 500 treatment plants)
- Lower reporting limits than UCMR 4

From: Information Collection Rule Data Analysis (AWWARF 2002)

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Overall Source Water Measurements comparison

Statistic	ICR TOC (mg/L)	UCMR 4 TOC (mg/L)	ICR Bromide (ug/L)	UCMR 4 Bromide (ug/L)
Mean	2.8	1.3	69	136
Median	2.4	<1	36	38
Maximum	27.5	57	2230	73000
90th percentile	5.3	4.0	160	193
10th percentile	<0.35	<1	<10	<20
Total samples	7504	15127	7959	15225

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Why Are the ICR and UCMR Results So Different?

- Mainly because its different sample sets.
  - ICR was only 100K+ systems
  - UCMR 4 includes a lot more GW; = lower TOC
- Changes in source waters over time?
  - More saline sources? < TOC, higher Bromide
- Other bromide sources that have become more important in the last 20 years (anthropogenic)?

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Large System Source Water Measurements

Statistic	ICR TOC (mg/L)	UCMR 4 TOC (mg/L)	ICR Bromide (ug/L)	UCMR 4 Bromide (ug/L)
Mean	2.8	1.8	69	151
Median	2.4	1.2	36	40
Maximum	27.5	27.6	2230	50020
90th percentile	5.3	4.7	160	230
10th percentile	<0.35	<1	<10	<20
Total samples	7504	2333	7959	2336

Luckily, one can just pull the subset of large systems from UCMR 4, and that confirms changes in source waters for both TOC and Bromide.

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Why Have Both TOC and Bromide Changed in Large System Source Waters?

- TOC likely reasons for decrease?
  - Systems changed sources to minimize DBP formation potential?
  - Climate change impacts?

- Bromide likely reasons for increase?
  - Climate change?
  - More saline water sources?
  - Coal ash impact?

This is obviously worth exploring more because of the DBP implications but is not the focus here (and its still speculative).

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UCMR 4 Large System (>100K) SW vs GW

Statistic	SW TOC (mg/L)	GW TOC (mg/L)	SW Bromide (ug/L)	GW Bromide (ug/L)
Median	2.9	<1	30	57
Maximum	16	27.6	3130	10100
90th percentile	6.1	1.6	160	274
10th percentile	1.4	<1	<20	<20
Total samples	1013	1260	1013	1260

As expected, TOC is higher in SW systems , whereas bromide is higher in GW systems.

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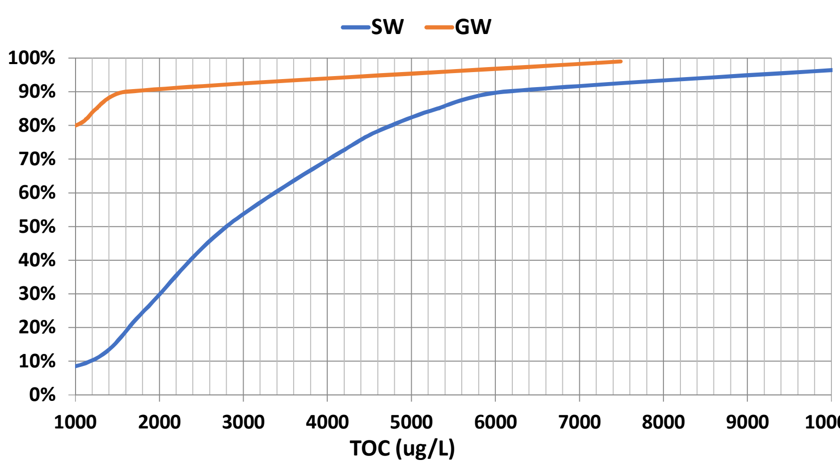
GW vs SW TOC- All UCMR 4 Samples



Although, as expected, TOC is much higher in SW systems than GW systems, nearly 10% of GW samples have TOC > 3000 ug/L, which could lead to measureable DBPs.

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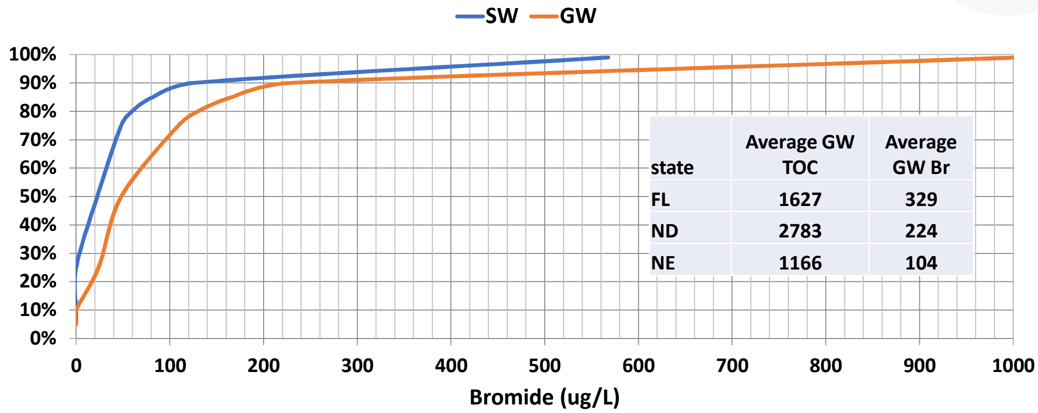
GW vs SW Bromide- All UCMR 4 Samples



state	Average GW TOC	Average GW Br
FL	1627	329
ND	2783	224
NE	1166	104

Br levels in GW systems are generally higher than SW, but won't have as big an effect on DBPs because of lower TOC levels. FL, ND, and NE all are likely to have Brominated HAA in GW systems.

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Conclusions

- Significant occurrence of Mn at levels above the SMCL in UCMR 4 suggest the possibility of regulation.
- GW systems are more susceptible to high levels of manganese, but it can be a SW system issue also.
- DBP precursor concentrations appear to have changed in the last 20+ years (post ICR) and the cause needs to be determined, along with the implications for DBPs.

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Questions?

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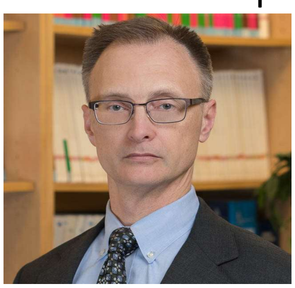
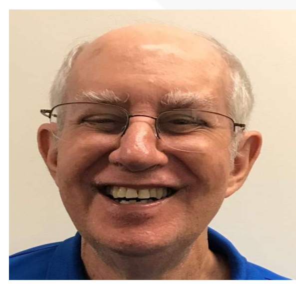
Ask the Experts



Steve Via
Director Federal Relations
American Water Works Association

Roger Arnold
Associate
Hazen and Sawyer



Andy Eaton
Technical Director Emeritus
Eurofins Eaton Analytical

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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- **May 22 - 1:00 PM - 2:30 PM**
- Strategies for Understanding and Managing Risk from Lead (Contaminants of Concern: Managing Lead and Manganese)
- **May 26 - 1:00 PM - 2:30 PM**

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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

- Steve Via is Director of Federal Relations for the American Water Works Association (AWWA) working in AWWA's Washington, D.C., office. Mr. Via's primary responsibilities are two-fold. First, working with the Environmental Protection Agency (EPA) and other federal agencies on the development of policy and regulations that affect the water sector, and secondly, communicating the basis and substance of federal policy and regulations to the water sector. Mr. Via has more than 30 years' experience in environmental regulatory compliance assistance.
- Roger Arnold is an Associate with Hazen and Sawyer and serves as a subject matter expert in corrosion control and Lead and Copper Rule compliance. Mr. Arnold has 10 years of experience in planning and design of water supply, treatment, and conveyance projects and specializes in distribution system water quality. Mr. Arnold holds a B.S. in Civil Engineering and a M.S. in Environmental Engineering from Virginia Tech and is a licensed professional engineer in Virginia.
- Andy Eaton, PhD, BCES is the soon to be retired technical director emeritus for Eurofins Eaton Analytical (EEA), the country's largest potable water focused laboratory. He has a BA from Antioch College, a PhD from Harvard University, and did postdoctoral work at CalTech. He is the recipient of the Fuller Award from AWWA and the Charlie Carter award from NEMC and previously served as a member of the Joint Editorial Board of Standard Methods. In his 40 years with EEA (and its predecessor organizations – JMM and MWH labs) he has focused on emerging contaminants and trying to tease interesting conclusions out of sometimes boring large datasets.

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