



MI-ACE
2023

85th Annual Conference & Exhibits

In The Loop:

Corrosion Control Evaluation for
the City of Saginaw

FFA3

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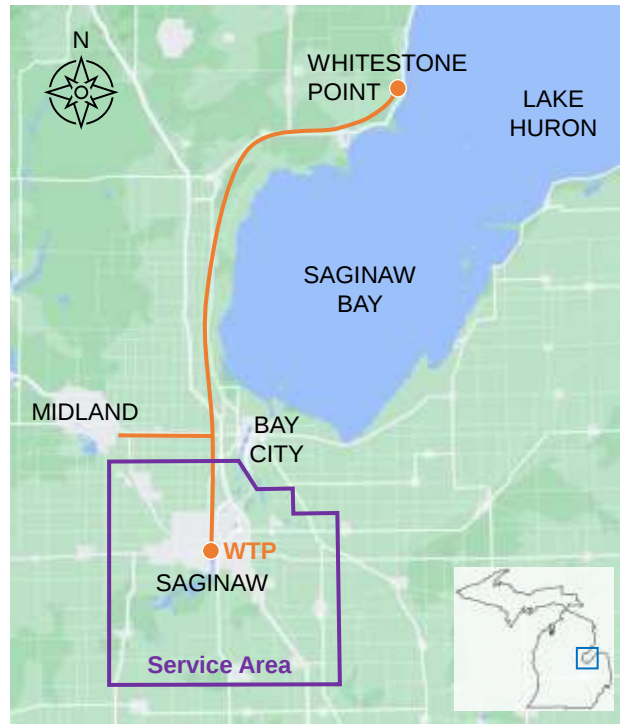
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Saginaw Water Treatment Plant

- Sources water from Lake Huron
- 52 MGD capacity
- In operation since 1929
- Serves City + 20 wholesale customers



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Lead and Copper Rule Revisions

10 ppb trigger level (LCR, 2021) and 12 ppb action level (MI, 2025)

Saginaw is proactively targeting < 5 ppb and replacing any service lines with results > 8 ppb

Lime stabilization no longer recommended for corrosion control

Saginaw wants to explore orthophosphate as an option for potential future use



Infographics from MI-EGLE and Univ of MI

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Study Objectives

Conduct an initial assessment of the impacts on lead and copper release from adjusting corrosion control treatment from alkalinity and pH control to adding orthophosphate at plant pH and low pH conditions

City of Saginaw lead service lines (LSLs):

- 2,858 known LSLs and 12,000+ unknown (potential LSLs)
- 2 sampling sites above AL

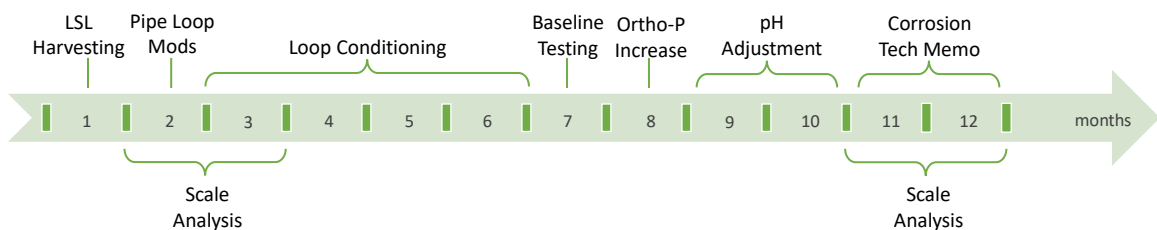
	Adrian Twp	Birth Twp	Village of Birch Run	Blackstone Twp	Blackstone Twp	Brown Twp	Carleton Twp	Farwell Twp	City of Frankenmuth	Frankenmuth Twp	James Twp	Kalamazoo Twp	City of Saginaw	Saginaw Twp	Village of St. Charles	Starbuck Twp	Swan Creek Twp	Township Twp	Thomson Twp	Tribb Twp	City of Escanaba
TTHM (ppb)	49	57	46	58	57	47	41	43	52	54	48	48	51	42	51	38	45	52	55	49	50
Low	55	57	57	51	55	55	55	55	51	51	51	51	51	51	51	51	51	51	51	51	51
High	65	75	59	59	75	64	40	40	50	58	58	52	65	50	70	57	57	58	55	55	61
Violations?	There were no TTHM or HAAS MCL violations																				
HAAS (ppb)	17	17	39	39	39	39	39	39	34	34	34	34	34	39	39	39	39	39	39	39	39
Low	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10
High	38	38	38	38	38	38	38	38	38	38	38	38	38	38	38	38	38	38	38	38	38
Copper (ppb)	0.3	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
Range low/high	0.10/0.10	0.10/0.10	0.10/0.10	0.10/0.10	0.10/0.10	0.10/0.10	0.10/0.10	0.10/0.10	0.10/0.10	0.10/0.10	0.10/0.10	0.10/0.10	0.10/0.10	0.10/0.10	0.10/0.10	0.10/0.10	0.10/0.10	0.10/0.10	0.10/0.10	0.10/0.10	0.10/0.10
Sites above AL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Violations?	There were no Lead or Copper AL violations																				
Lead (ppb)	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Range low/high	0/2	0/4	0/2	0/6	0/10	0/10	0/6	0/6	0/6	0/6	0/6	0/6	0/6	0/6	0/6	0/6	0/6	0/6	0/6	0/6	0/6
Sites above AL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Lead Serv. Lines	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Unres. Material	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total No. Lines	154	881	484	1,457	4,365	2,670	2,623	1,342	1,378	488	826	682	4,444	4,444	854	775	1,006	734	4,884	2,842	770

TTHM MCL=80 ppb MCLG=none HAAS MCL=60 ppb MCLG=none Lead AL=15 ppb MCLG=0 Copper AL=1.3 ppm MCLG=1.3 ppm

2022 Water Quality Test Results From Saginaw Region CCR

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Study Schedule – 12 Month Duration



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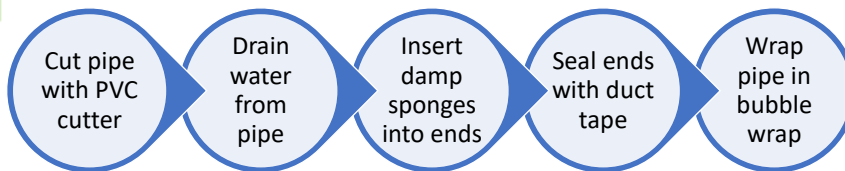
Lead Service Line Selection Criteria

- ✓ On service line inventory list for upcoming lead replacements
- ✓ Undergoing regular daily use by household
- ✓ Length is greater than 8 ft (for loop apparatus) + 2 ft segments (for scale analysis)
- ✓ Homeowners will allow significant digging on property



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Lead Service Line Harvesting Protocol



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Scale Analysis Methods

Analysis conducted at Washington University of St. Louis



SEM/EDS
Scanning electron microscopy with energy dispersive X-ray spectroscopy

XRD
X-ray powder diffraction

ICP-MS
Inductively coupled plasma mass spectrometry



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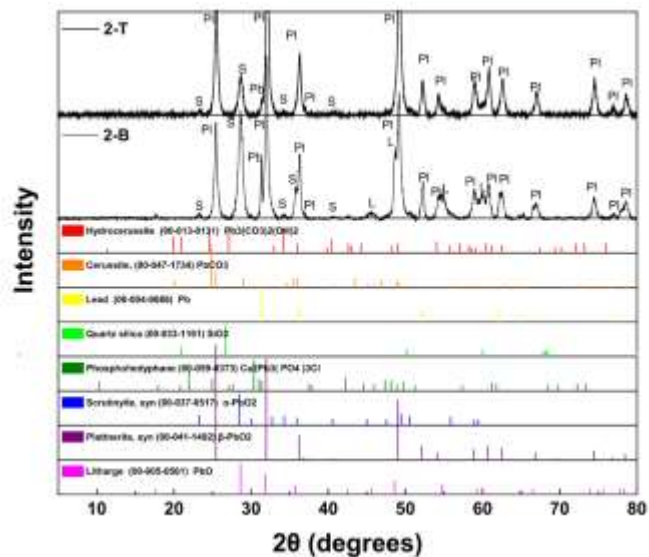
Scale Analysis Results

Predominantly composed of lead(IV) oxides:

- Plattnerite, Scrutinyite, Litharge

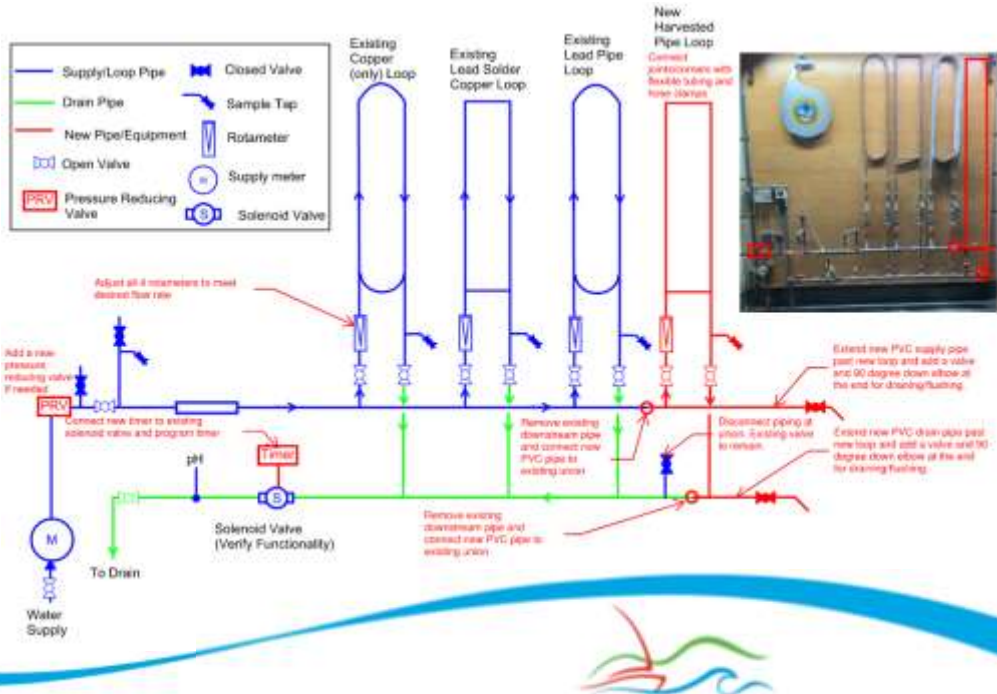
To preserve Pb(IV) scale stability and reduce lead release:

- Maintain chlorine residual
- Keep pH high



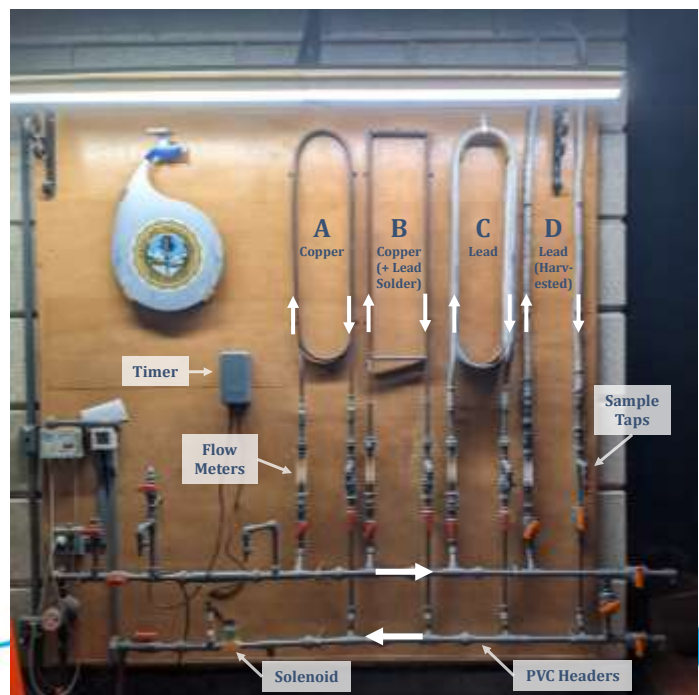
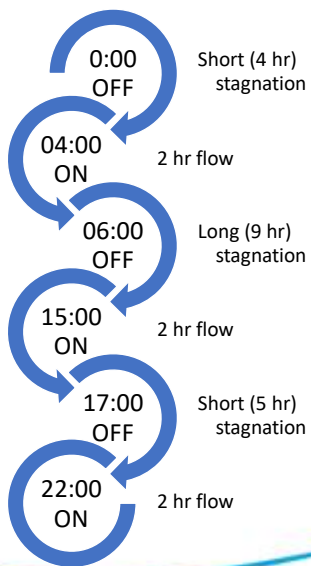
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Pipe Loop Setup



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Conditioning



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Sampling Protocol

Before Sampling

- Close effluent valve
- Discard first 50 mL of water from each sample tap

Sampling

- Fill 500 mL sample bottle from each loop

After Sampling

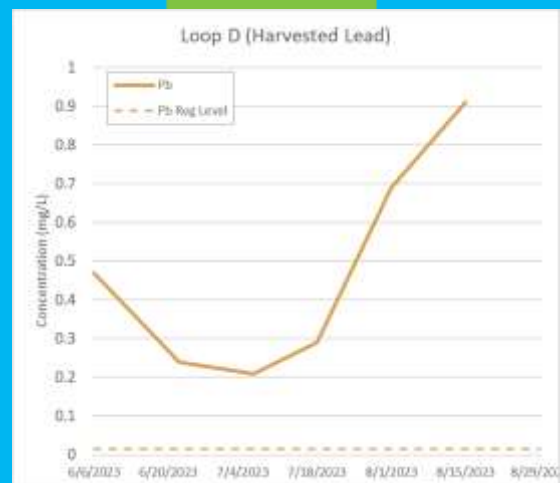
- Open effluent valve and solenoid
- Check flow rate (1.5 gpm) on each loop
- Send samples to lab for analysis

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Preliminary Conditioning Results

Possible reasons for Pb level variability:

- Has not stabilized over only 2 months
- Variability in finished water quality
- Air in pipes affecting flow rate
- Interruptions in stagnation cycle



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Pipe Loop Testing

Chemical Conditions	
Orthophosphate Concentration	mg/L as PO ₄
Gradual Increase	0.5 to 1
Sudden Increase	1 to 3
pH Level Adjustment	
Gradual Decrease	8.8 to 7.8

Operating Conditions (per Loop)	
Daily Flow/Stagnate Cycles	3
Operating Flow Rate	1-2 gpm
Water Volume per Cycle	200 gal
Stagnation Period Between Cycles	5-6 hrs
Stagnation Before Sampling	8 hrs



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ADDB

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Questions?

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