Hazen

Peracetic Acid as a Pretreatment Alternative to Chlorine in a DBP Sensitive Application

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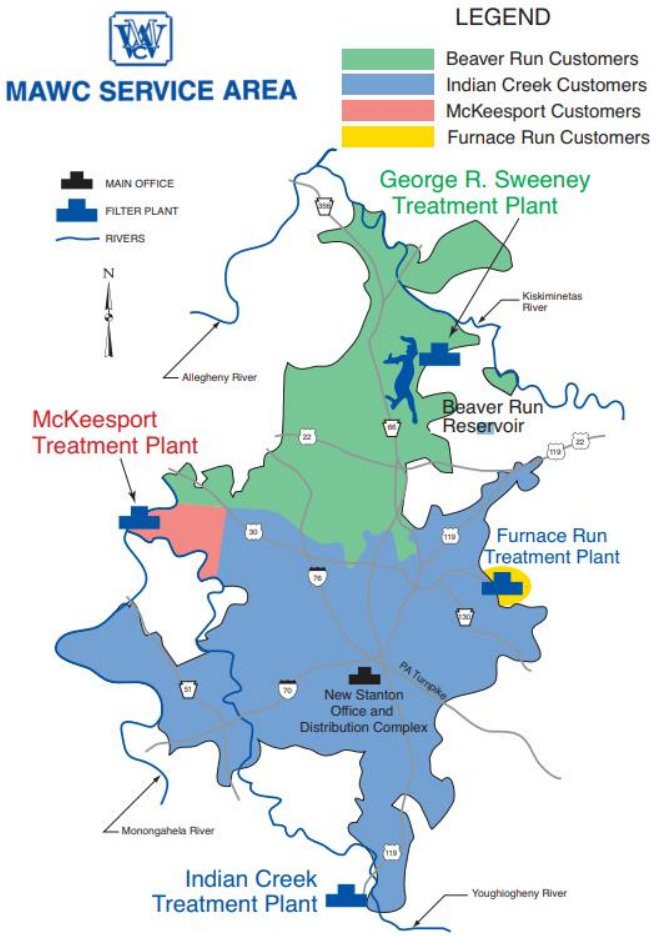
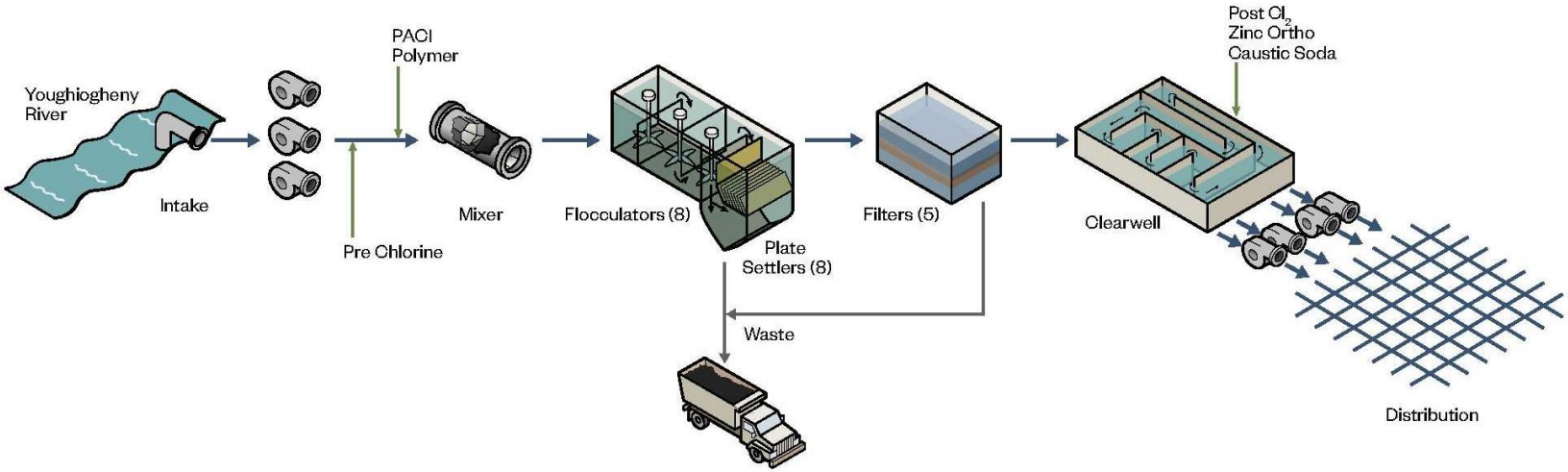
Municipal Authority of Westmoreland County (MAWC)

- McKeesport WTP
  - 10 MGD
- George R Sweeny WTP
  - 24 MGD
- Indian Creek WTP
  - 40 MGD
- Johnstown Interconnect
  - 3 MGD

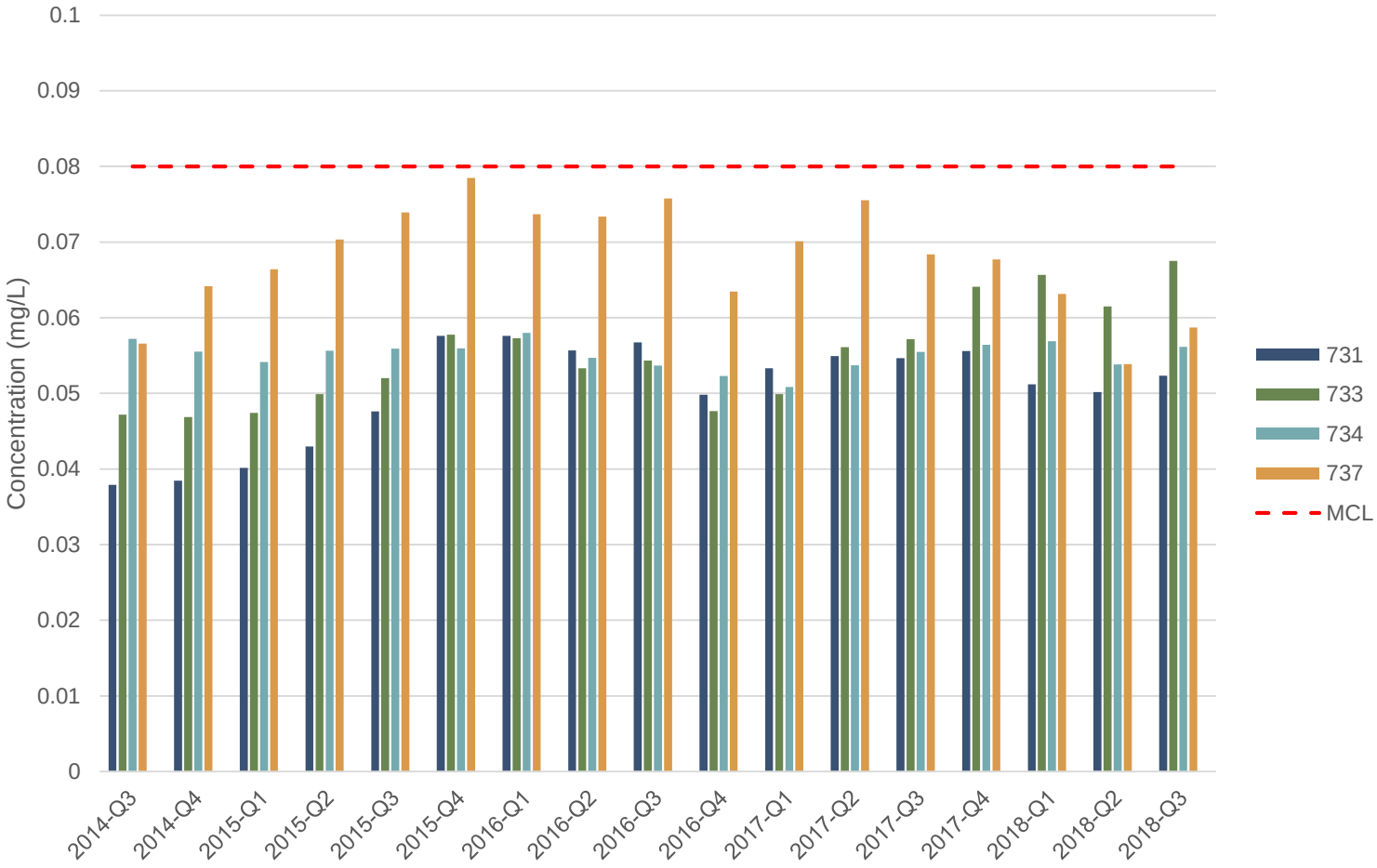


McKeesport WTP

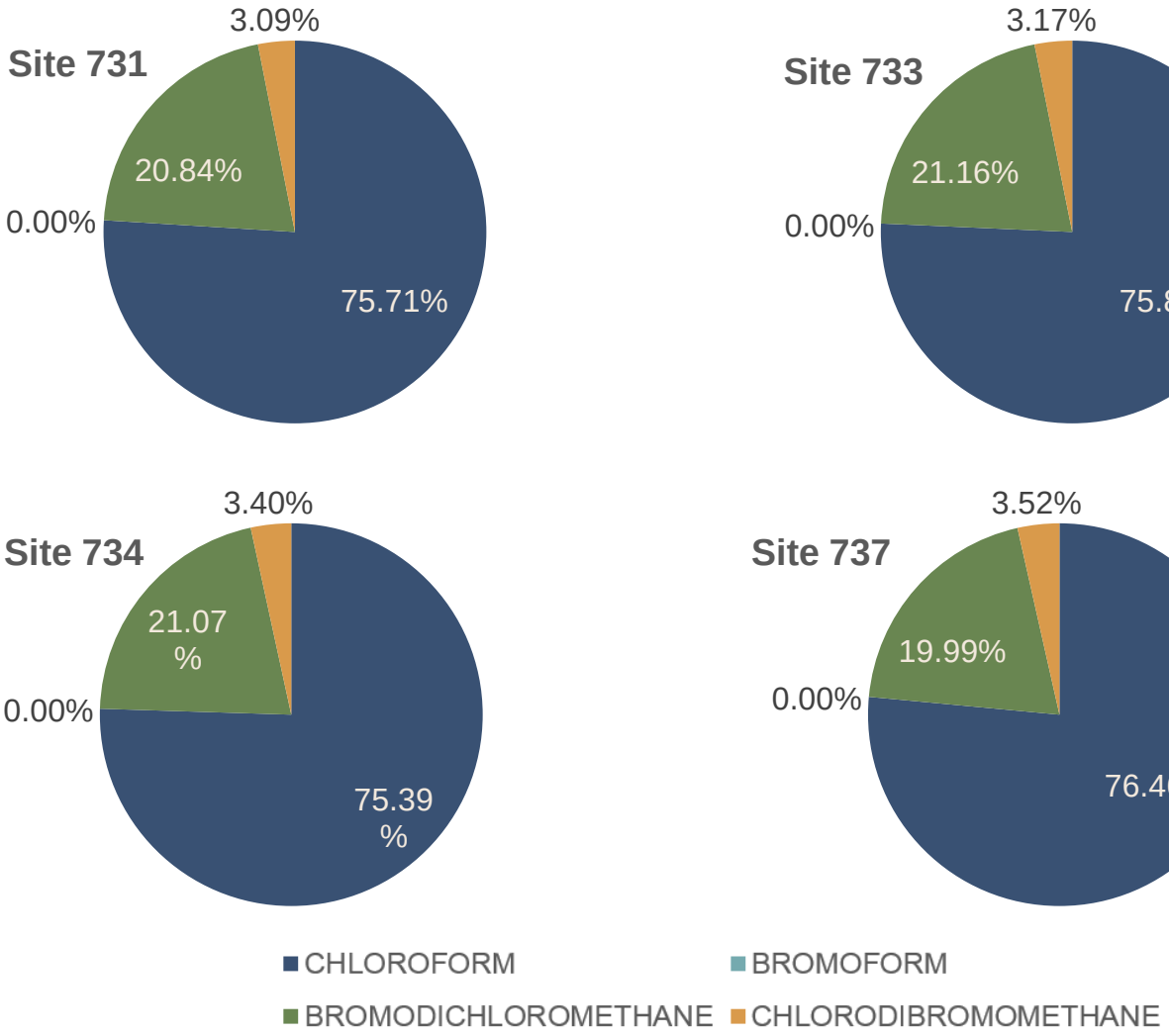


- Elevated surface water temperatures
- Flashy river, wastewater overflows, variable organic matter
- Variable Fe and Mn concentrations
- Elevated DBP concentrations – no exceedances!

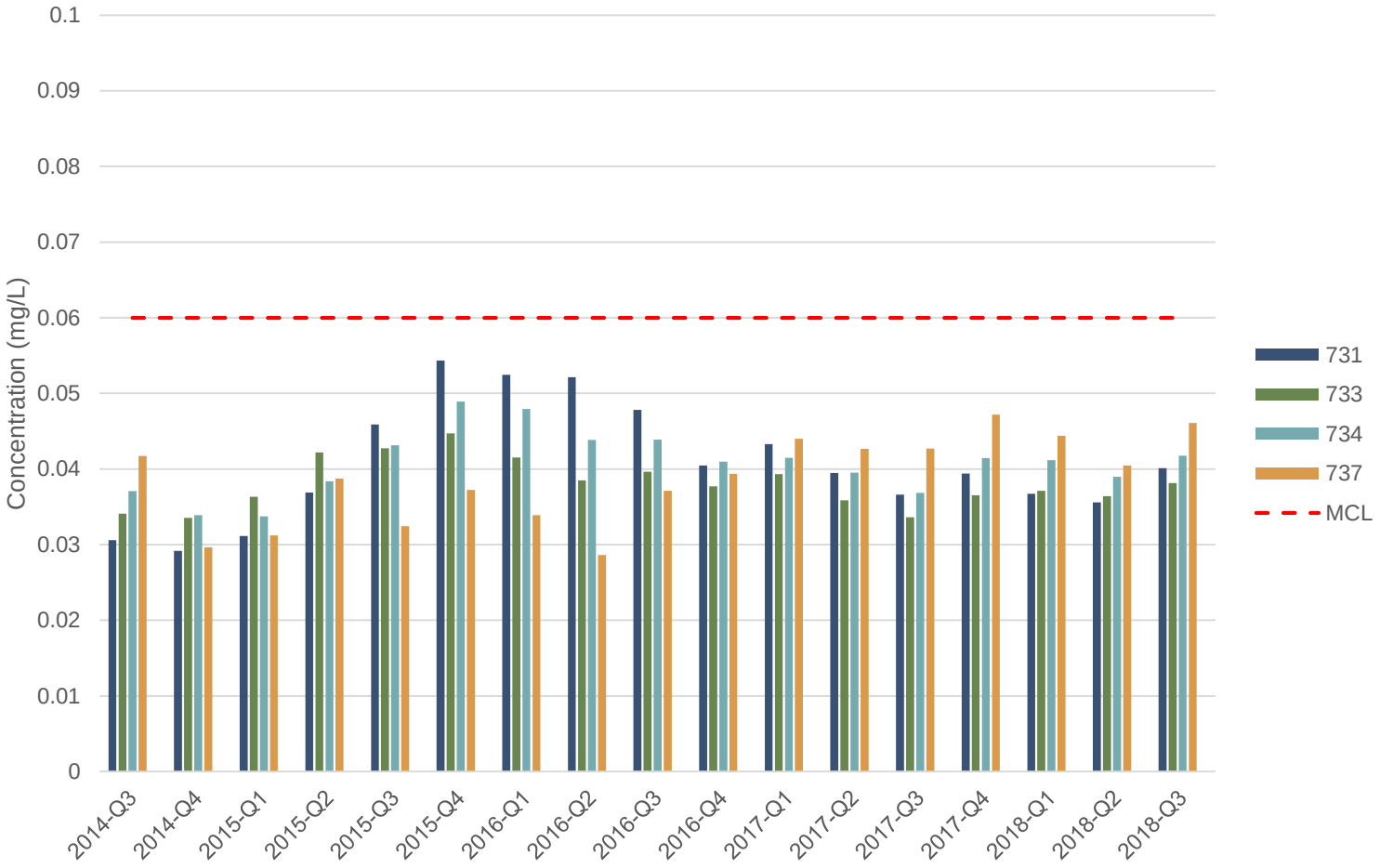
TTHM LRAA


0.1
0.09
0.08
0.07
0.06
0.05
0.04
0.03
0.02
0.01
0
Concentration (mg/L)
2014-Q3
2014-Q4
2015-Q1
2015-Q2
2015-Q3
2015-Q4
2016-Q1
2016-Q2
2016-Q3
2016-Q4
2017-Q1
2017-Q2
2017-Q3
2017-Q4
2018-Q1
2018-Q2
2018-Q3
731
733
734
737
MCL

Average TTHM Speciation (Q1 2015 - Q2 2017)



HAA5 LRAA



- Primarily di- & tri- chloroacetic acid

DBP Reduction Strategies

- Cover clarifiers
- Tank aeration
- Alternative pre-oxidant
  - Permanganate
  - Chlorine Dioxide
  - Ozone
  - Peracetic Acid

Peracetic Acid (PAA) – NSF 60 Approved

Acetic Acid 16% + Hydrogen Peroxide 23% ↔ Peracetic Acid 15% + Water 45%

Oxidant	Standard Potential (V)
Hydroxyl Radical	2.80
Ozone	2.07
Peracetic Acid	**1.81**
Hydrogen Peroxide	1.78
Potassium Permanganate	1.68
Chlorine Dioxide	1.57
Chlorine	1.36

Peracetic Acid

- Oxidant, causes cell lysis
- No known toxic or mutagenetic byproducts
  - Primarily carboxylic acids
- Extensive use in food, beverage, pulp, medical, and textile industries
- Wastewater treatment - 2005 Frankfort, KY
- Denver Metro Wastewater – 220 MGD, 2018
- Ongoing EPA Technical Assessment Report and WERF Study
  - Dallas, Austin, Denver, Memphis, NYC, SF, Vancouver

Jar Testing Methods

- Assess polymer/coagulant sequence
- Determine optimum pre-oxidant dose
  - $NaMnO_4$ and PAA
- Evaluate treatment efficacy
- Assess DBP formation

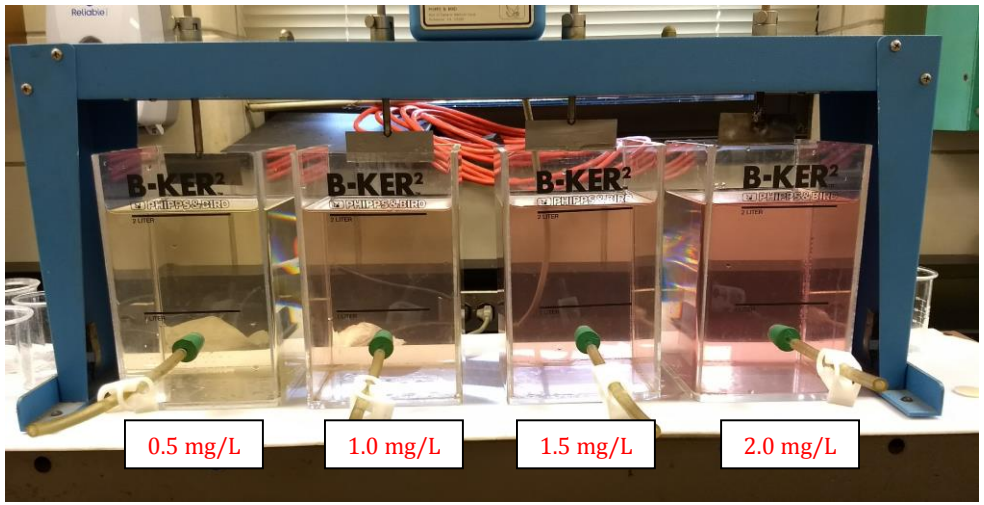
Coagulant / Polymer Sequence

- Inconclusive
- Warrants further investigation

Sequence	5 Min Settled NTU	10 Min Settled NTU
No Polymer	1.1	0.52
No Polymer	1.0	0.44
Polymer before Coagulant	1.0	0.45
Polymer after Coagulant	1.3	0.50

Optimum Pre-oxidant Dose

- PAA - HACH DPD w/ correlation factor
  - 0.105 mg/l PAA or 0.7 mg/l PAA product
- Permanganate – visual test
  - 0.7 mg/L $NaMnO_4$



Pre-oxidant Treatment Efficacy

Parameter	Pre-oxidant	Raw	Settled	Reduction
Turbidity (NTU)	Plant Settled Water (Cl_2)	4.00	1.14	72%
	PAA		**1.10**	**73%**
	$NaMnO_4$		1.18	71%
TOC (mg/L)	Plant Settled Water (Cl_2)	2.57	2.03	21%
	PAA		**1.88**	**27%**
	$NaMnO_4$		1.82	29%
UV-254 (UVA)	Plant Settled Water (Cl_2)	0.080	0.053	34%
	PAA		**0.049**	**39%**
	$NaMnO_4$		0.049	39%

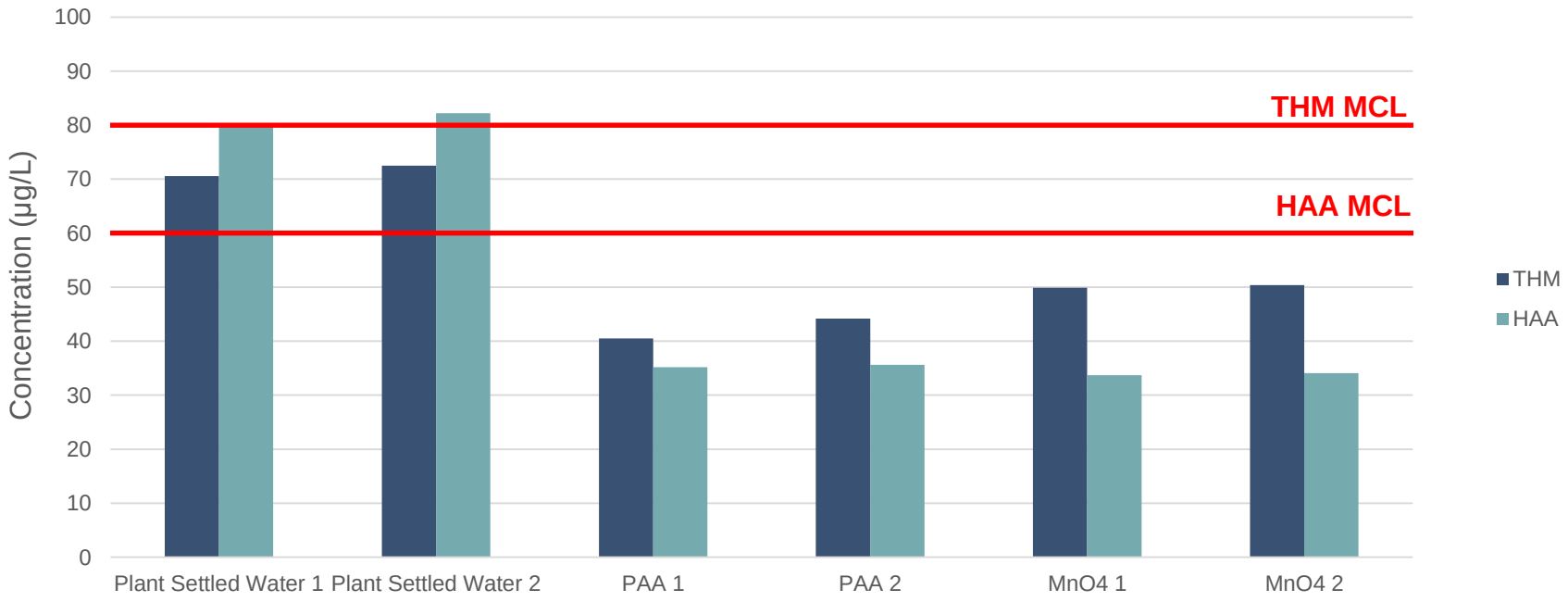
- Increased TOC removal and decreased UV-254 absorbance

	Plant Settled Water 1	Plant Settled Water 2	PAA 1	PAA 2	MnO_4 1	MnO_4 2
MPN	5.9	6.5	15.6	5.6	5.3	2.8

- Similar heterotrophic plate count MPN

DBP Formation Potential

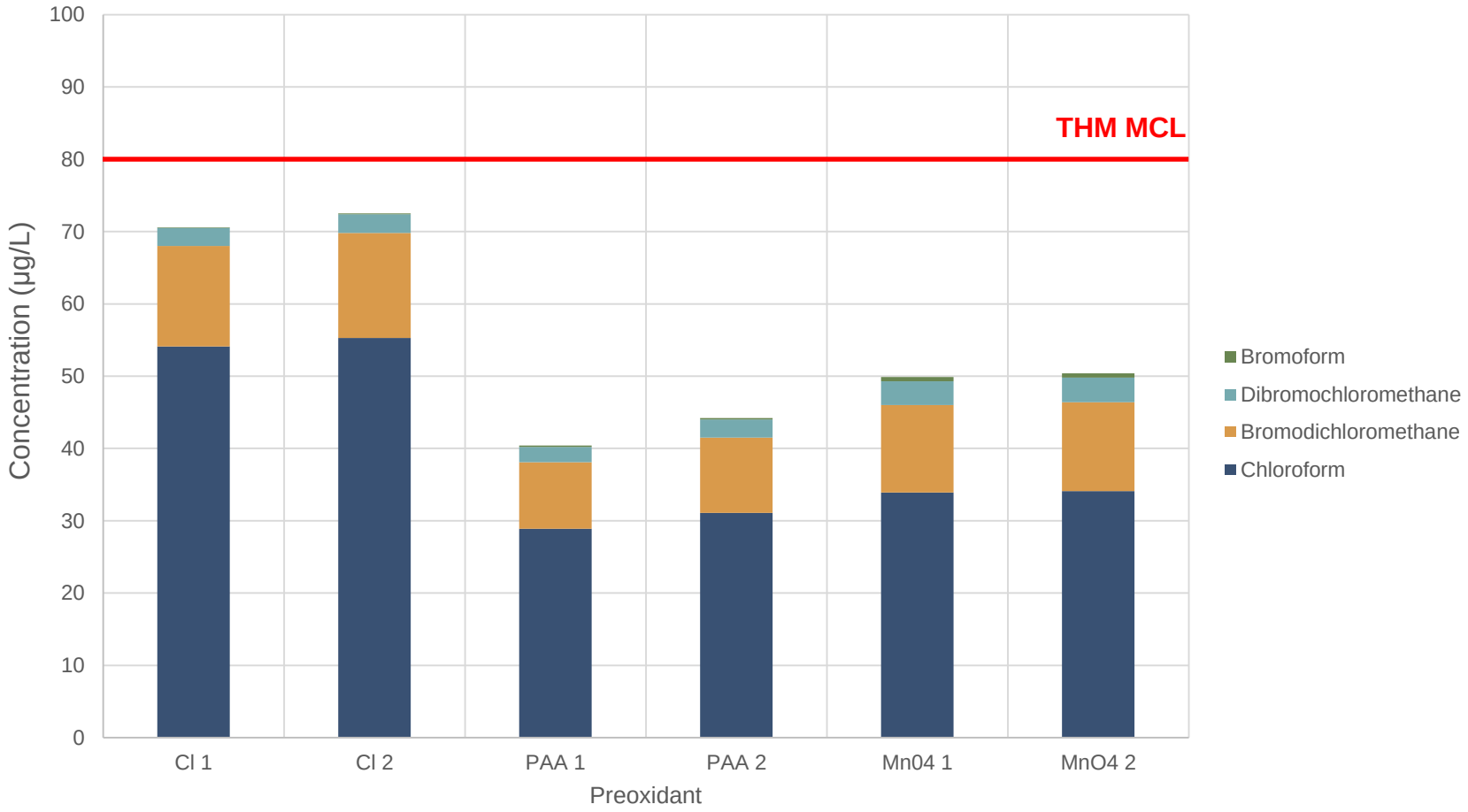
Settled Water (Not Filtered)



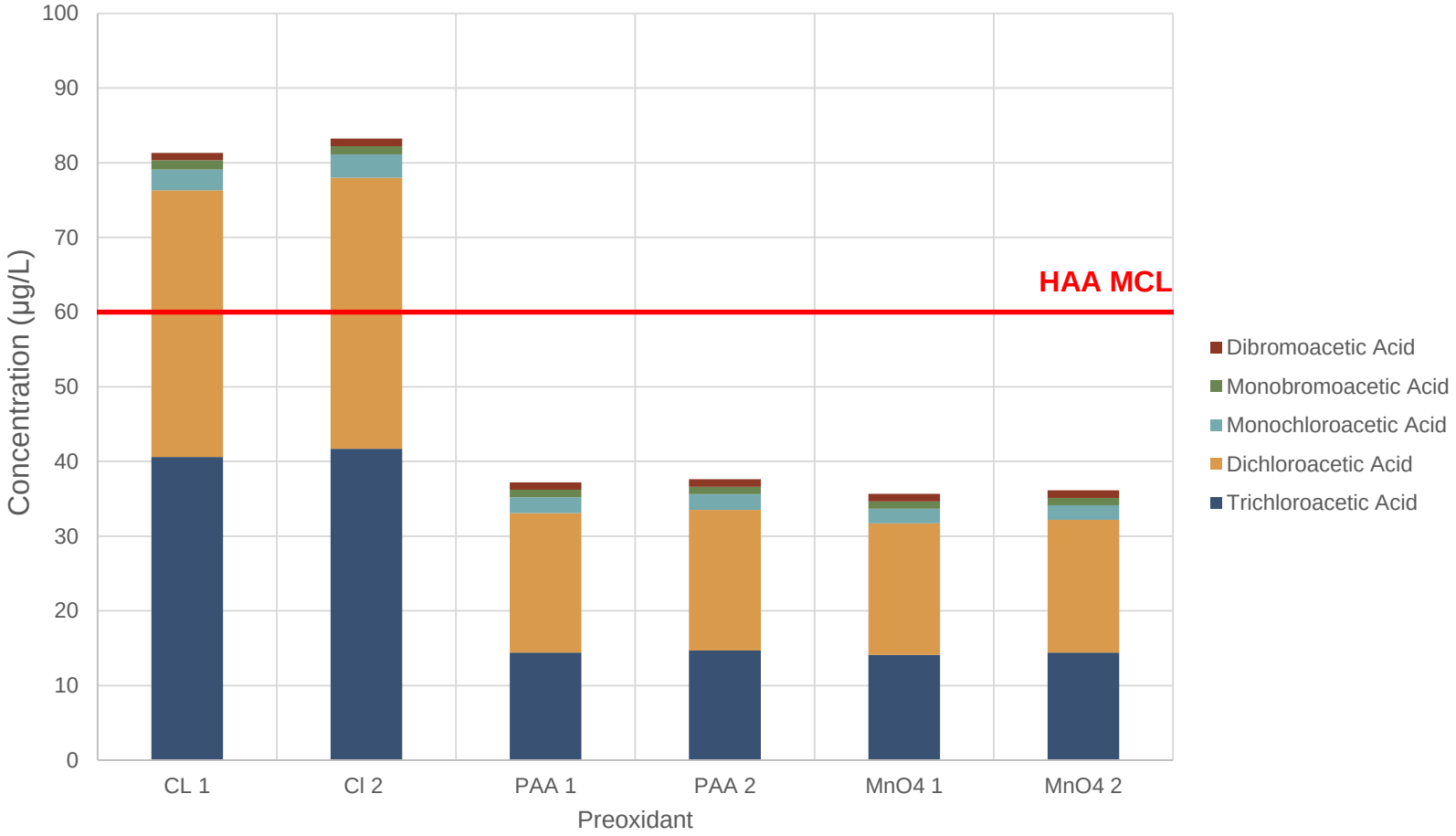
41% THM & 56% HAA REDUCTION

30% THM & 58% HAA REDUCTION

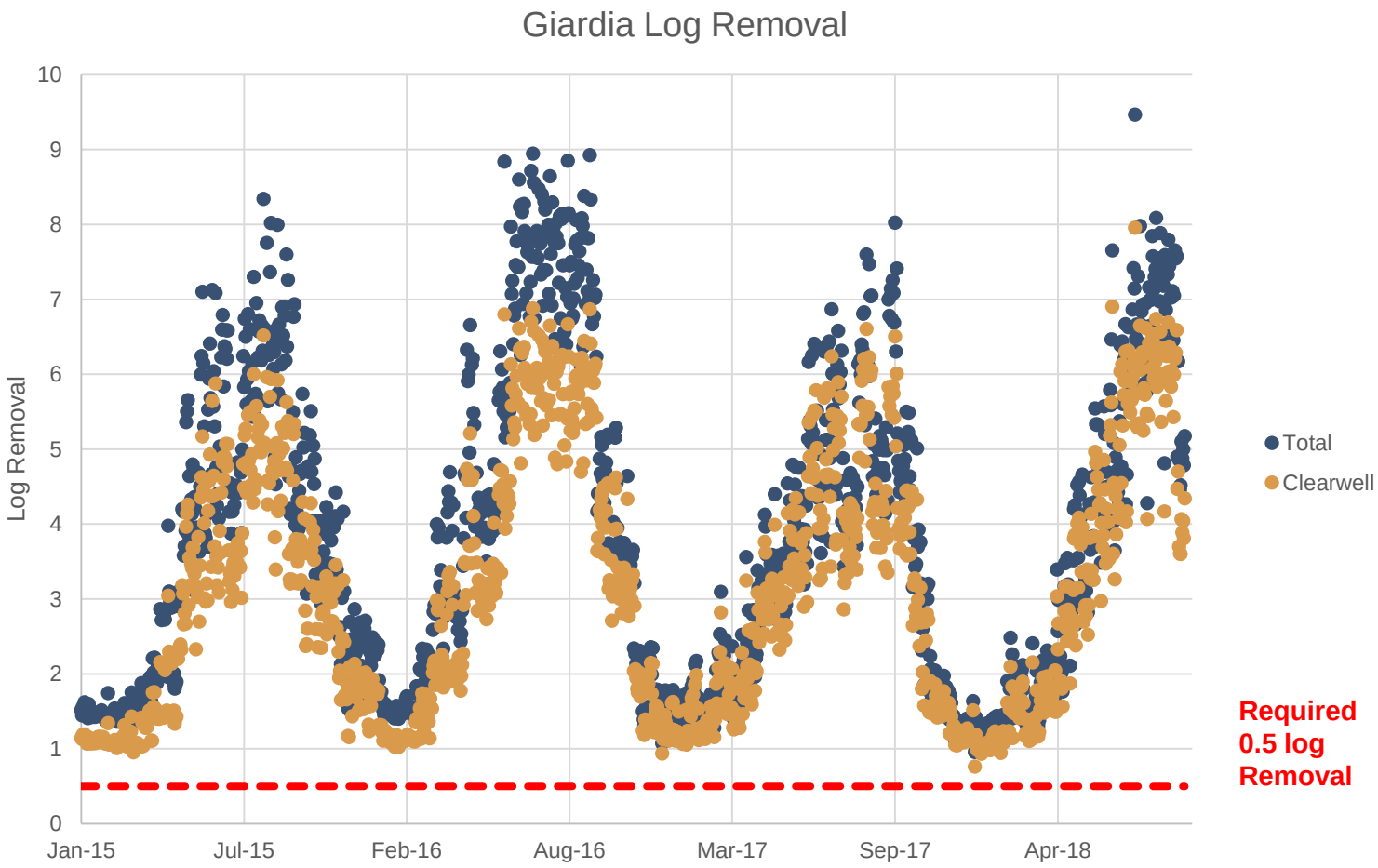
THM Speciation



HAA5 Speciation



Ensure Maintenance of CT



Next steps

- Change pre-chlorine feed location
- Optimize coagulation
- Further evaluate alternative pre-oxidant
  - Coordinate pilot testing with DEP
- Continue installation of tank aeration

Pilot Test Considerations

PA DEP Public Water Supply Manual

I C1 - Innovative Treatment Permits: Pilot Plant Studies

"Pilot plant studies are to be conducted to determine the adequacy of new treatment technologies or the suitability of an unconventional treatment scheme must be discussed with the regional water supply engineer prior to initiating the tests."

IV B2 – Disinfection

"Disinfecting agents other than chlorine can be used provided reliable application equipment is available and testing procedures for a residual are recognized in Standard Methods for the Examination of Water and Wastewater, latest edition. These methods of disinfection will be considered on a case-by-case basis."

IV I10 – Taste and Odor Control-Other Methods

"The decision to use any other method of taste and odor control should be made only after careful laboratory and/or pilot plant tests and on consultation with DEP."

V 18 – Chemical and Chemical Handling

"No chemicals shall be applied to drinking waters unless specifically permitted by DEP. Chemicals which may come in contact with or affect the quality of the water and which are certified for conformance with ANSI/NSF Standard 60 (Drinking Water Treatment Chemicals-Health Effects) are deemed acceptable to DEP."

Pilot Test Design

- Evaluate three pre-oxidant configurations
  - PAA
  - Cl
  - None
- Perform during peak DBP formation conditions
  - June-August
  - 13 weeks
- Utilize automated, plant match pilot system

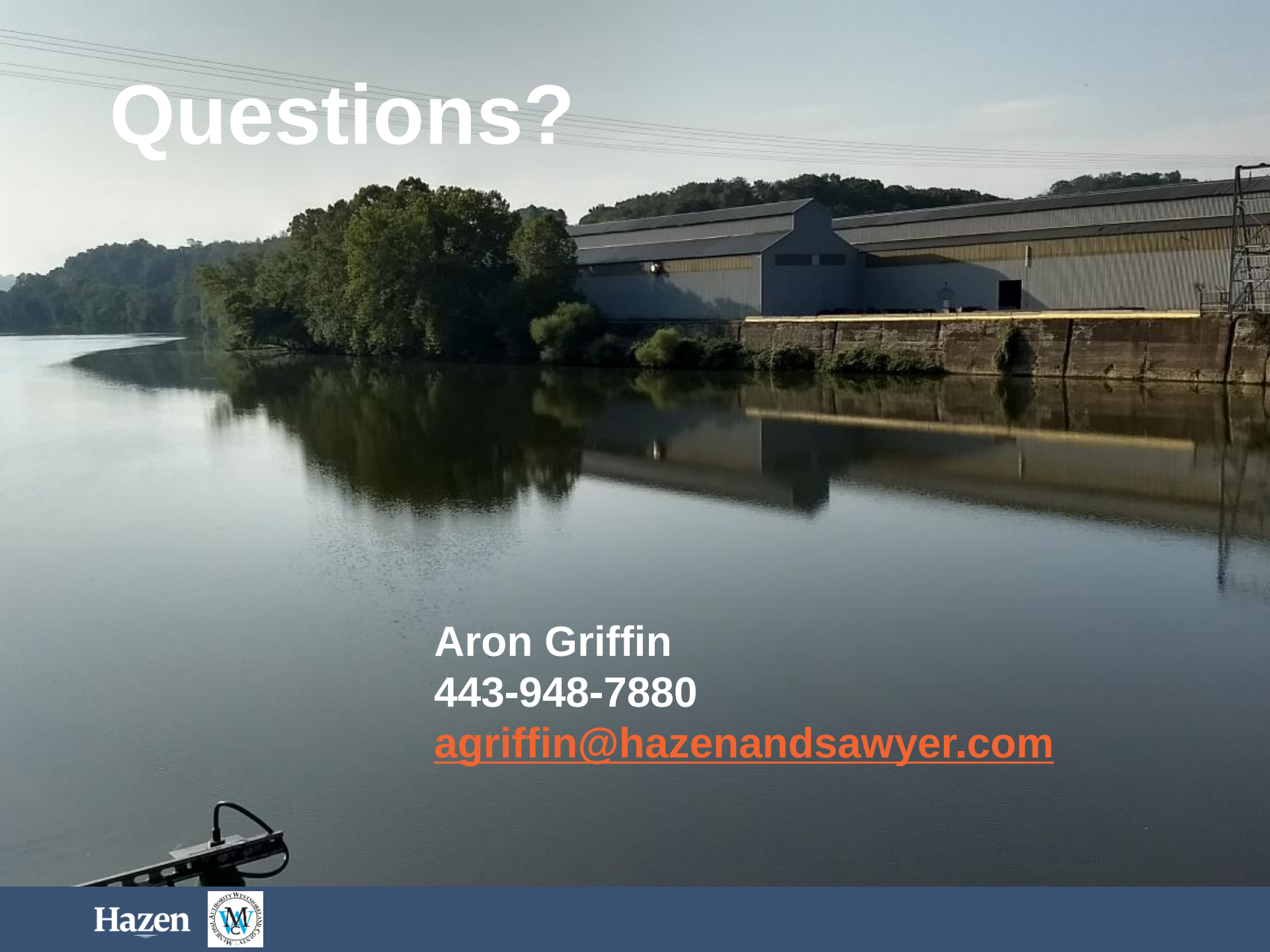
Testing Period	Pre-oxidant	Source Water	Duration (days)
1	PAA	Plant	10
2	Cl	Plant	5
3	none	Plant	5
4	PAA	Plant	10
5	Cl	Plant	5
6	none	Plant	5
7	PAA	Plant	10
8	Cl	Plant	5
9	none	Plant	5
10	TBD	TBD	5

Parameters Monitoring

- Removal of NOM
  - UV-254 & TOC
- Oxidation
  - Fe & Mn
- Plant Performance
  - turbidity
- Disinfection
  - total and fecal coliform
- Corrosion Control
  - pH, alkalinity, chloride, sulfate
- DBP Formation
  - bromide, free chlorine, speciated HAA5 & TTHm

Location	Frequency	Parameter
Raw, Settled, & Filtered	2 x day	Turbidity
		pH
		TOC
		UV-254
		Fe
		Mn
		Total Coliform
		Fecal Coliform
		Alkalinity
Raw & Filtered	1 x day	Bromide
		Chloride
		Sulfate
		Free Chlorine
Simulated Distribution	2 x testing period	HAA5 (speciated)
		TTHM (speciated)
		Free Chlorine

Questions?



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