Introduction to the Stage 1 and Stage 2 Disinfectants and Disinfection Byproducts Rules

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Agenda

- Introduction
  - Drinking water disinfection
  - What are disinfection byproducts?
  - Factors influencing disinfection byproduct formation
- Regulatory History
- Stage 1 and Stage 2 Disinfectants and Disinfection Byproducts Rules Requirements
  - Disinfectants
  - Disinfection Byproducts
  - Disinfection Byproduct Precursors
- Potential Revisions of Microbial and Disinfection Byproducts Rules

Acronyms

AL: Action Level

BATs: Best Available Technologies

CCT: Corrosion Control Treatment

CWS: Community Water System

DBP: Disinfections Byproducts

DBPR: Disinfectants and Disinfection Byproducts Rule

GWR: Ground Water Rule

GWUDI: Ground Water Under the Direct Influence of Surface Water

HAA5: Five Haloacetic Acids

LCR: Lead and Copper Rule

LRAA: Locational Running Annual Average

MCL: Maximum Contaminant Level

MRDL: Maximum Residual Disinfectant Level

NPDWR: National Primary Drinking Water Regulation

NTNCWS: Non-Transient Non-Community Water System

OEL: Operational Evaluation Level

OWQP: Optimal Water Quality Parameters

PWS: Public Water System

RAA: Running Annual Average

RTCR: Revised Total Coliform Rule

SWTR: Surface Water Treatment Rule

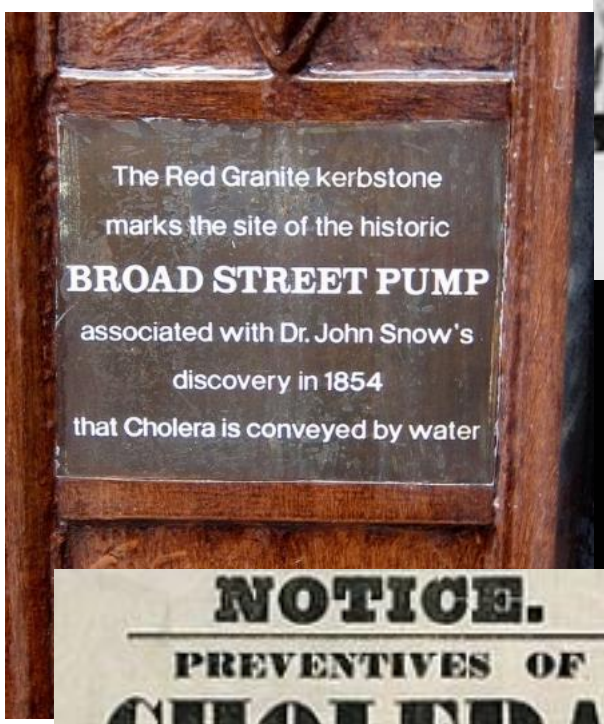
TNCWS: Transient Non-Community Water System

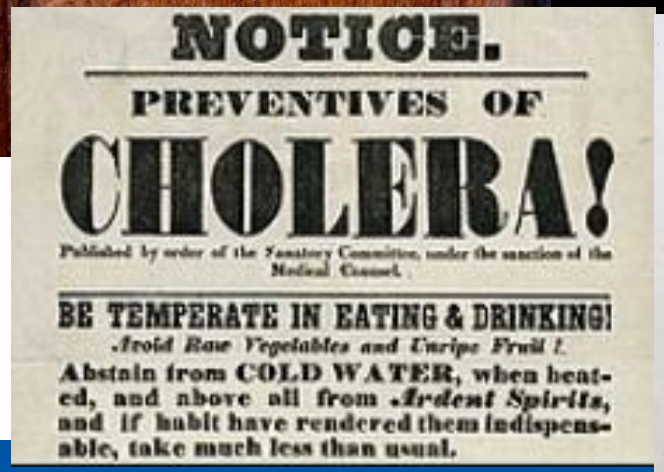
TTHM: Total Trihalomethanes

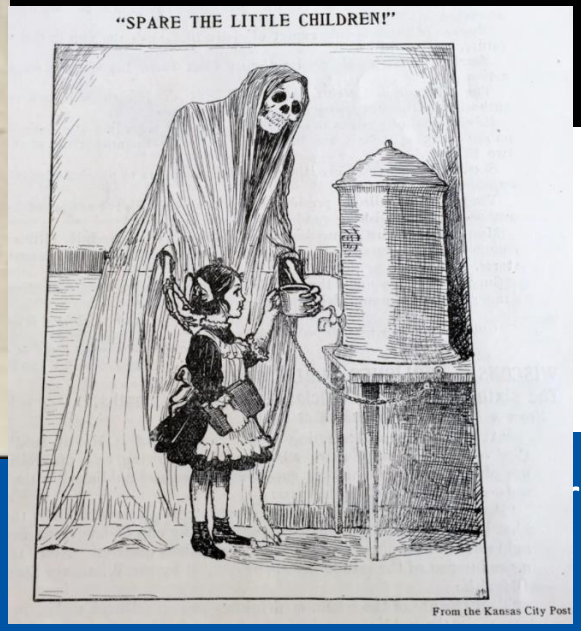
Introduction

Drinking Water Disinfection

- Historically, drinking water was dangerous
- WWI was the first recorded war where more died from combat than illness
- Diarrheal disease is the leading cause of child mortality: ~500,000 children every year
- Still occurs in high-income countries: Walkerton incident

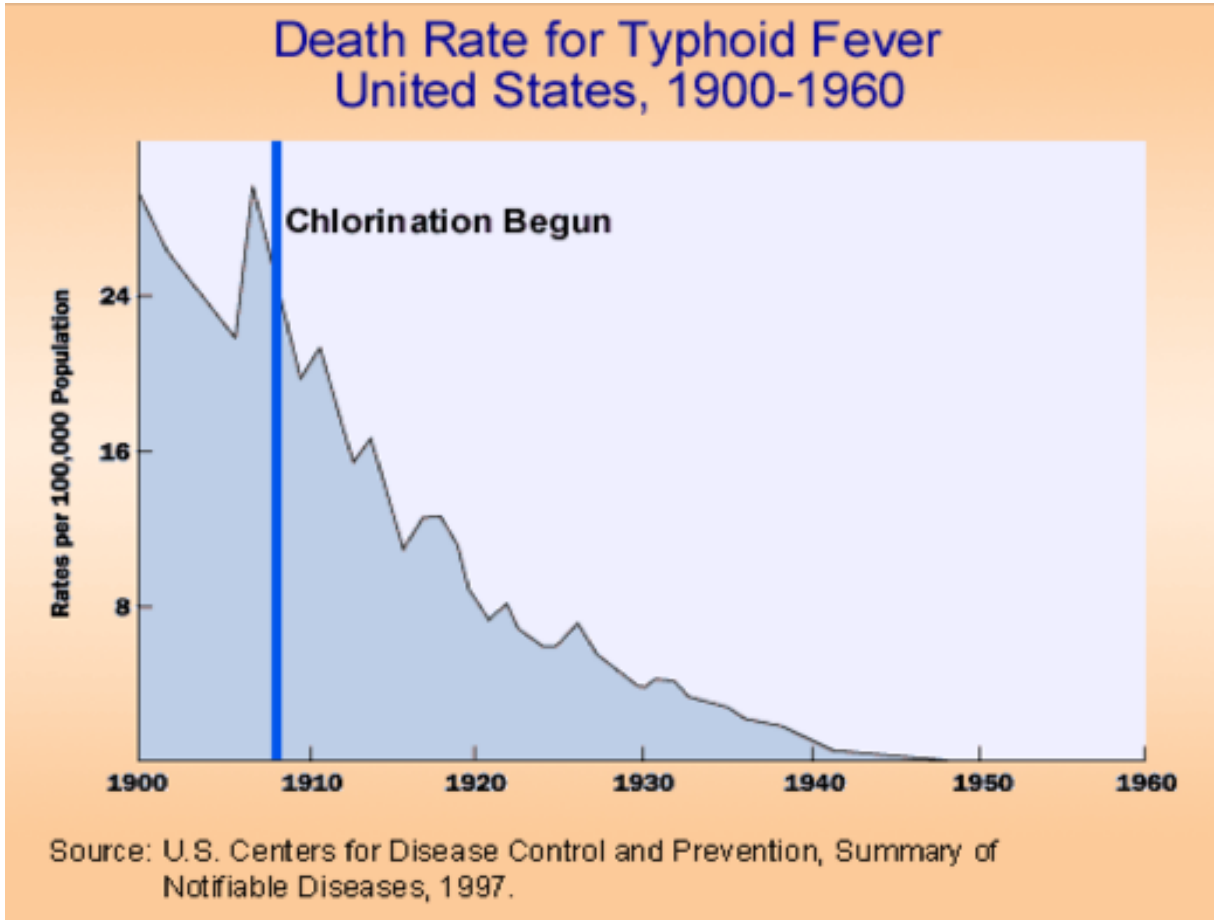






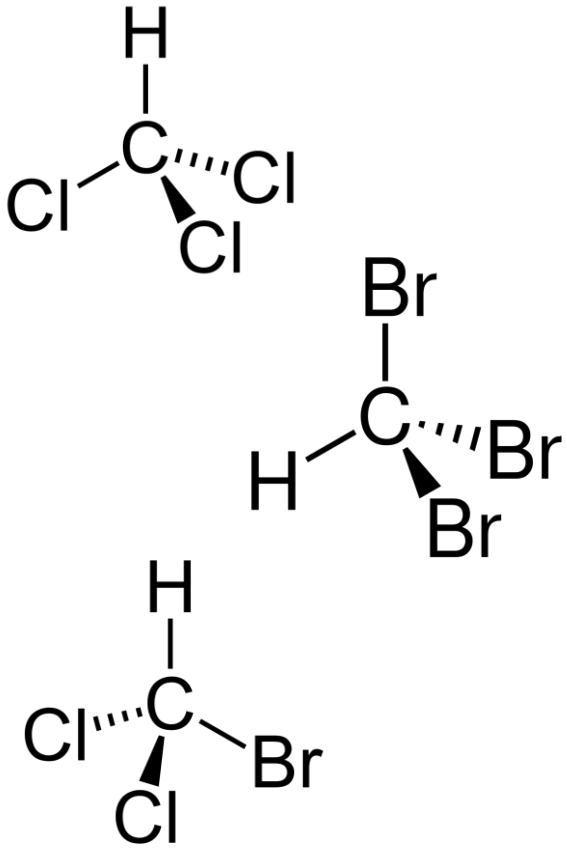
Drinking Water Disinfection

- The first permanent chlorination plant in the U.S. comes online in Jersey City, NJ on September 26, 1908
- By 1918, thousands of municipalities in the U.S. had followed suit and began routinely disinfecting their drinking water, leading to a dramatic decrease in waterborne diseases across the country
  - 90% reduction in cholera, 80% reduction in typhoid, 50% reduction in dysentery

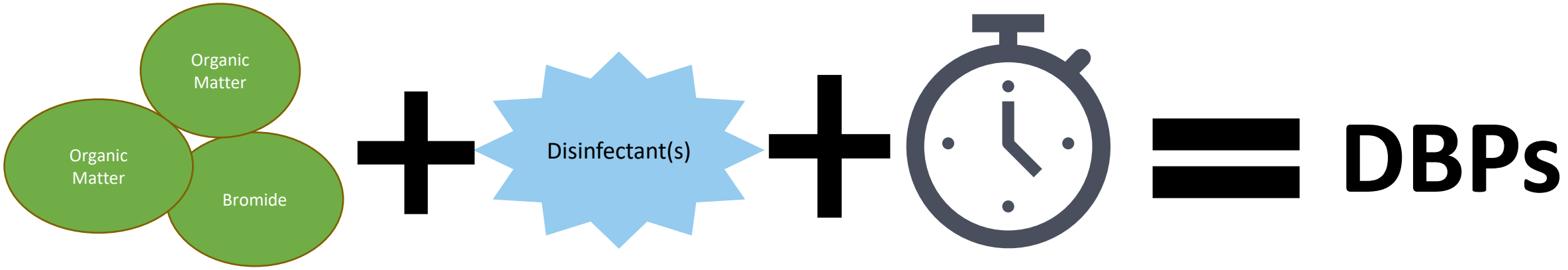


Disinfection Byproducts

- In the 1970s, research began emerging about disinfection byproduct (DBPs)
  - Disinfectants (i.e., chlorine) are strong oxidants and react with organic matter in source waters to create unwanted byproducts
  - Compounds were deemed to be a byproduct of disinfection as they were only found in chlorinated water and not in the source water
- Initial studies only identified a few chemical classes of DBPs (trihalomethanes, haloacetic acid), a vast array of DBPs have since been identified due to advances in analytical chemistry



How are DBPs formed?



Precursor in water – usually measured as total organic carbon

Chlorine, chloramine, chlorine dioxide, ozone

Contact time in clearwell plus time in distribution system

- DBPs form when organic matter reacts with disinfectant(s)
- Different combinations of organic matter (or, precursors) and disinfectants yield different DBPs

Factors influencing DBP formation

- Precursor concentration (TOC concentration(s))
- Disinfectant type and dose (chlorine vs chloramine vs chlorine dioxide vs ozone)
- Water chemistry (pH, alkalinity)
- Water temperature (higher temperatures = faster DBP formation)
- Residence time (more time in distribution = more TTHM)
- Biodegradation of HAA5 (can breakdown in areas w/ biological activity)

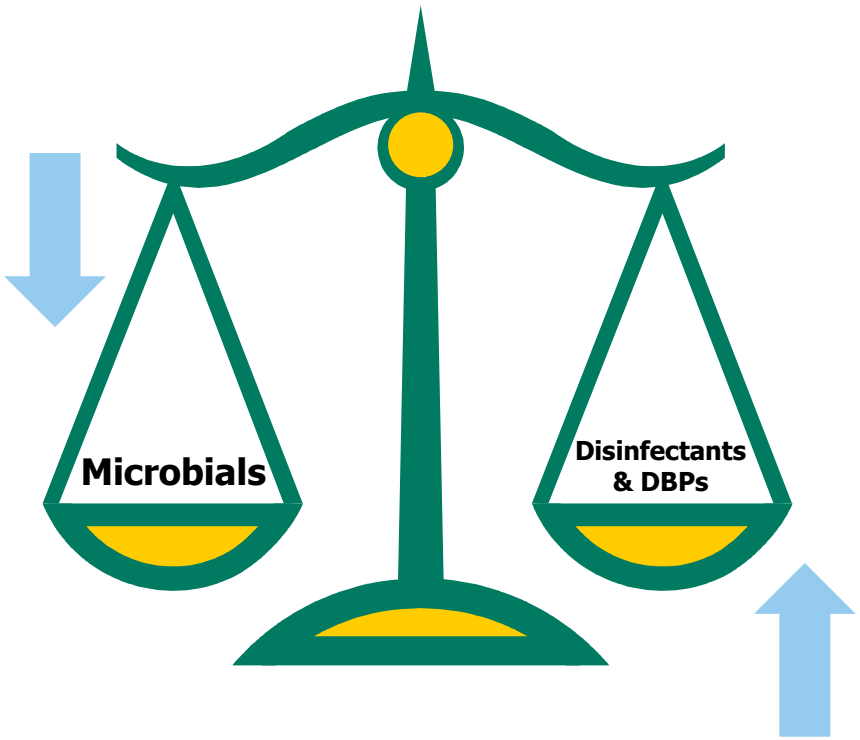
Why do we care about DBPs?

- Laboratory studies found associations between prolonged exposure to high levels of DBPs and increased rates of cancer in rodents
- Epidemiological studies indicated that cancer rates and mortality were higher in geographic areas served by surface water than in areas served by ground water
- Other potential health risks from prolonged exposure include adverse reproductive and developmental effects

Credit: Tatiana Bulyonkova / Wikimedia

A delicate balance

- Increased disinfectants reduce the microbial risk
- Microbial contaminants have acute risk (shorter term gastrointestinal illness)
  - Greater risk for immuno-compromised



- Increased disinfectants may increase DBPs
- Disinfection byproducts have chronic risk (long term issues over a prolonged period of exposure)

EPA's Regulatory Actions (as of 2024)

- 1979 – Total Trihalomethanes Rule
  - Superseded by DBPR1 and DBPR2
  - MCL for four combined trihalomethanes (TTHMs) for PWS serving >10,000
- 1998 – Stage 1 Disinfectants and Disinfection Byproducts Rule
  - DBP MCLs for TTHM and five haloacetic acids (HAA5), bromate, and chlorite
  - MRDLs for chlorine or chloramines, and chlorine dioxide
  - Apply to all CWS/NTNCWS that apply chemical disinfectants; TNCWS must only comply with chlorine dioxide MRDL
- 2006 – Stage 2 Disinfectants and Disinfection Byproducts Rule
  - Addressed concerns that monitoring sites in Stage 1 were not representative, promulgated to require more consistent and equitable protection from DBPs

Stage 1 and Stage 2 Disinfectants and Disinfection Byproducts Rules (DBPR)

DBPR in a nutshell: Who does DBPR apply to?

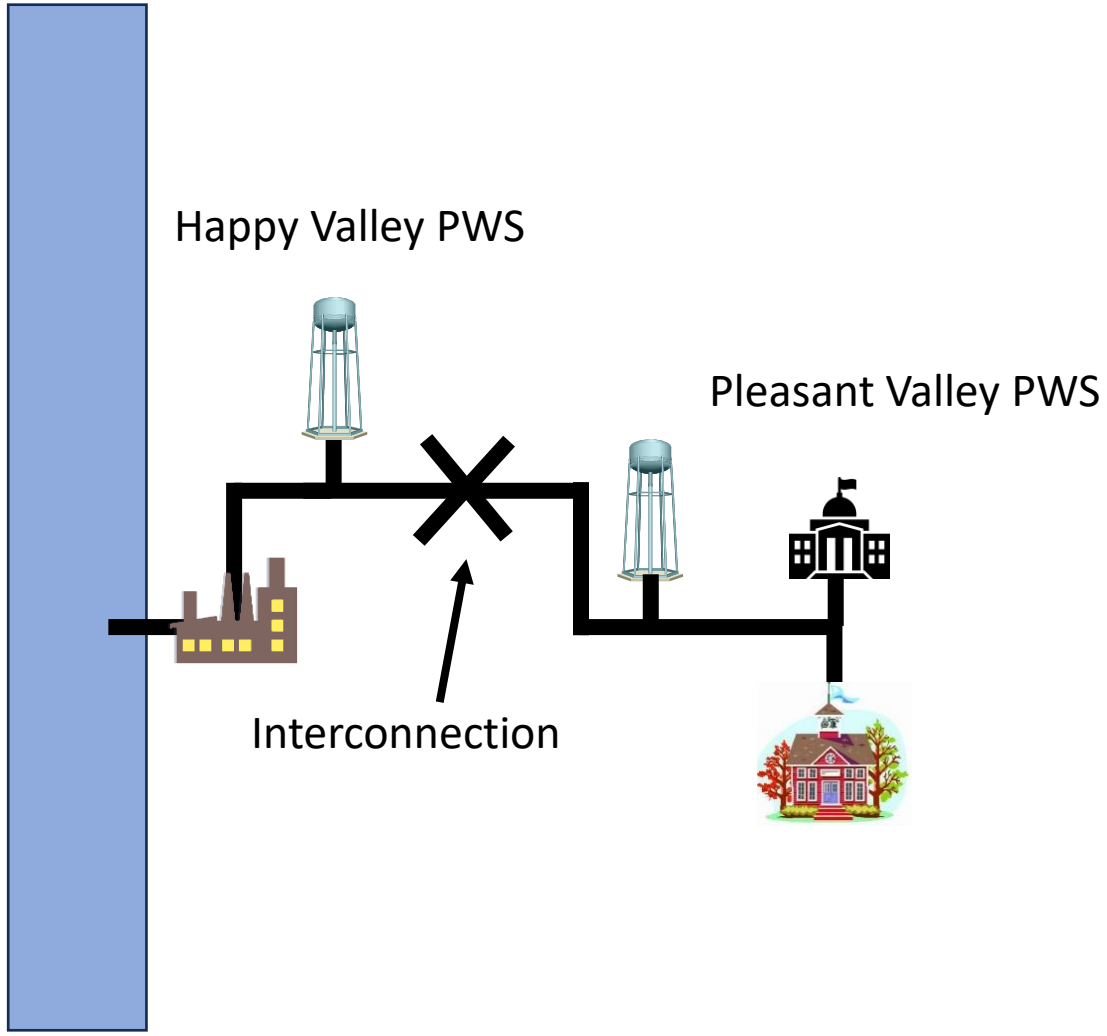
		Stage 1 DBPR	Stage 2 DBPR
Coverage	All CWSs and NTNCWSs that add disinfectant other than UV light and TNCWSs that treat with chlorine dioxide.	✓	✓
	Consecutive systems that deliver water treated with a disinfectant other than UV light.		✓
TTHM & HAA5 MCL Compliance	MCL compliance is calculated using the running annual average (RAA) of all samples from all monitoring locations across the system.	✓	
	MCL compliance is calculated using the locational RAA (LRAA) for each monitoring location in the distribution system.		✓

- All CWS and NTNCWS that apply a **chemical** disinfectant to the water in any part of the drinking water treatment process)
  - Includes consecutive CWS/NTNCWS that deliver water treated with a disinfectant other than UV light
  - Does not include CWS/NTNCWS that exclusively use UV light as a disinfectant without adding a residual disinfectant

- TNCWS that use chlorine dioxide (ClO_2)

DBPR in a nutshell: Consecutive systems

- Consecutive systems must comply with:
  - TTHM and HAA5 monitoring and MCL requirements
  - Chlorine/chloramines monitoring and MRDL requirements
  - Monitoring plan
  - OEL requirements
- Challenges for consecutive systems:
  - Little control over water quality received
  - Most BATs are for treatment plants
  - BATs for consecutive systems
    - Switch to chloramination (≥ 10,000 only)
    - Manage residence time



DBPR in a nutshell: regulatory limits

- 40 CFR Part 141 Subpart G
- MRDLs for chemical disinfectants (chlorine, chloramine, chlorine dioxide)
- MCLs for disinfection byproducts (TTHM, HAA5, chlorite, bromate)
  - MCLs for TTHM and HAA5 are set for their respective group of contaminants

Regulated Disinfectants and Disinfectant Byproducts (DBPs)

Regulated Disinfectants	MRDL (mg/L)	MRDLG (mg/L)
Chlorine	4.0 as Cl_2	4.0 as Cl_2
Chloramines	4.0 as Cl_2	4.0 as Cl_2
Chlorine dioxide	0.8	0.8

Regulated DBPs	MCL (mg/L)	MCLG (mg/L)
Total Trihalomethanes (TTHM)	0.08	
Chloroform		-
Bromodichloromethane		Zero (0)
Dibromochloromethane		0.06
Bromoform		Zero (0)
Haloacetic Acids (HAA5)	0.06	
Monochloroacetic acid		-
Dichloroacetic acid		Zero (0)
Trichloroacetic acid		0.3
Bromoacetic acid		-
Dibromoacetic acid		-
Bromate	0.01	Zero (0)
Chlorite	1	0.8

DBPR Monitoring Requirements and Compliance Determinations: **Disinfectants**

DBPR monitoring requirements: **general requirements**

- Take samples during normal operating conditions
- Failure to monitor in accordance with the state-approved monitoring plan is a monitoring violation
- Failure to monitor will be treated as a violation for the entire period covered by the annual average where compliance is based on a running annual average of monthly or quarterly samples or averages and the system's failure to monitor makes it impossible to determine compliance with MCLs or MRDLs.

Disinfectant monitoring requirements: **chlorine and chloramines**

- CWS and NTNCWS that use chlorine or chloramine must measure the residual disinfectant level in the distribution system at the same point in the distribution at the same time as total coliforms are sampled
  - Example of simultaneous compliance
- **Monitoring may not be reduced**

Disinfectant compliance determinations: **chlorine and chloramines**

- Compliance based on **running annual arithmetic average**, computed quarterly, of monthly averages of **all** samples collected by the system. System is also in violation if the average covering any consecutive four-quarter period exceeds the MRDL.
- For systems switching between chlorine & chloramine during the year, compliance is determined based on monitoring results of **all** samples.

Disinfectant monitoring requirements: **chlorine dioxide**

- Daily chlorine dioxide samples must be taken at entry point (entrance to the distribution system)
- If daily sample exceeds MRDL (0.8 mg/L), system must take follow up samples in the distribution system the next day **in addition to daily entry point sample**
- Follow up distribution sampling:
  - If chlorine dioxide, chloramines are used to maintain a residual in the system, or if chlorine is used for a residual and there is no booster chlorination:
    - Three samples as close to the first customer as possible, at intervals of at least six hours
  - If chlorine is used as a residual and there is booster chlorination:
    - One sample as close to first customer as possible, one sample at average residence time, and one sample as close to maximum residence time as possible
- **Monitoring may not be reduced**

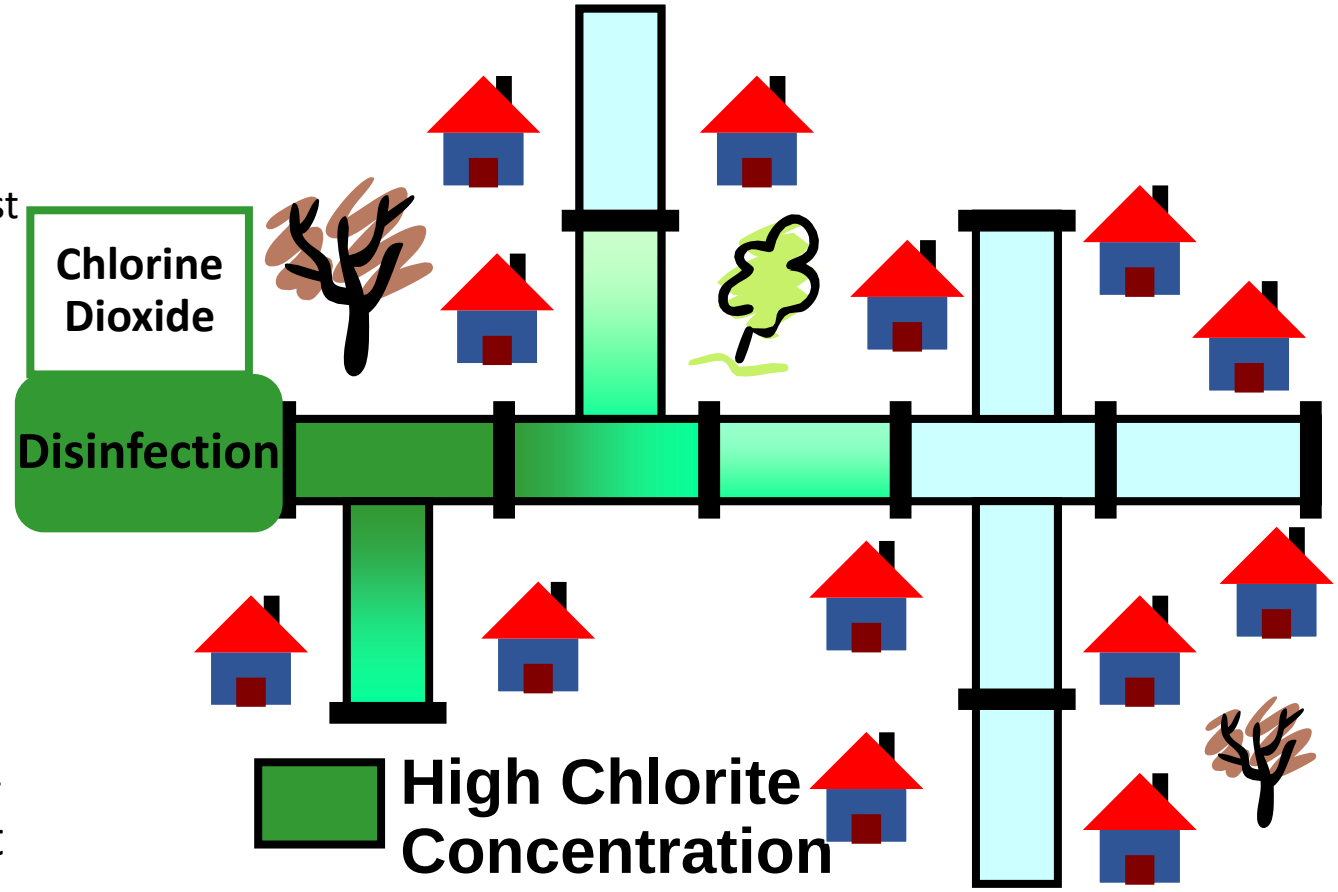
Disinfectant compliance determinations: **chlorine dioxide**

- Compliance based on consecutive daily samples
- **Acute Violations:**
  - If any daily EP sample exceeds MRDL, and one or more of the follow up distribution samples exceed the MRDL -> **acute MRDL violation**
  - Failure to conduct follow up distribution samples is also an acute MRDL violation
- **Nonacute violations:**
  - If any two consecutive EP samples exceed the MRDL but all distribution samples are below MRDL **-> nonacute violation**
  - Failure to monitor at EP the day after a MRDL violation is also a nonacute MRDL violation

DBPR Monitoring Requirements and Compliance Determinations: **Byproducts**

DBP monitoring requirements: **chlorite**

- **Only applicable to systems using chlorine dioxide**
- **Routine monitoring:**
  - **Daily:** Systems must take daily samples at EP
    - For any daily EP sample that exceeds MCL, system must take three additional samples the next day in distribution at first customer, average residence time, maximum residence time
  - **Monthly:** Systems must take a three-sample set each month in distribution: first customer, average residence time, maximum residence time. Requirement can be met by triggered additional daily monitoring.
- Daily monitoring requirement cannot be reduced. Monthly monitoring may be reduced to one sample-set per quarter after one year of monitoring without daily sample chlorite MCL exceedance.

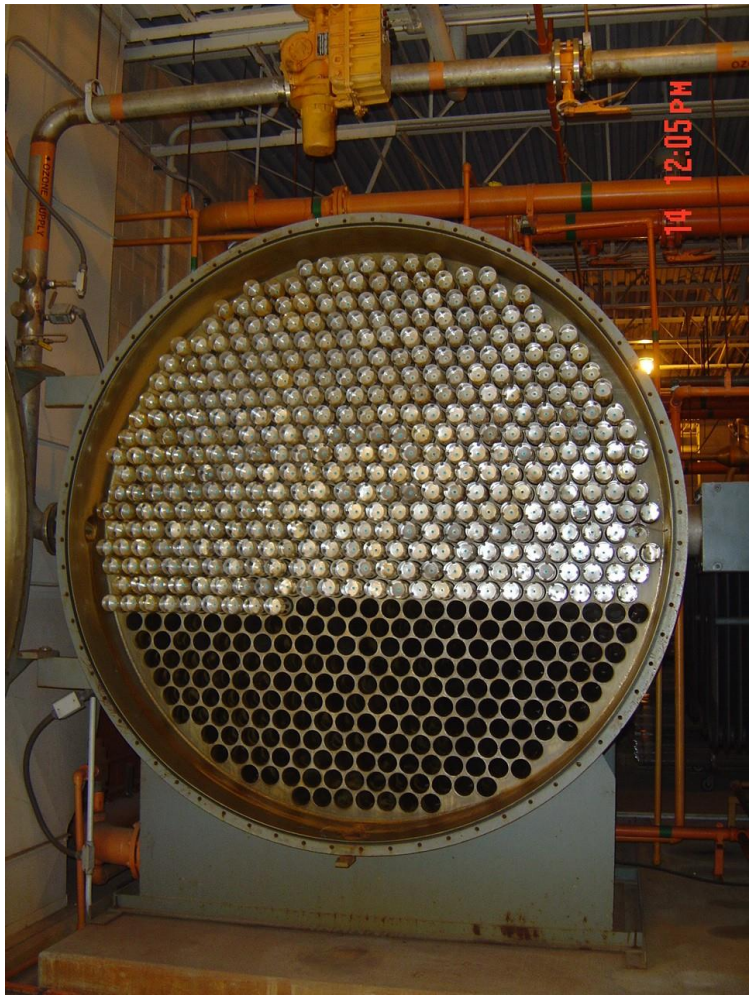


DBP compliance determinations: **chlorite**

- Compliance based on arithmetic average of each three sample set taken in the distribution
  - Applies both to triggered monitoring (from EP MCL exceedance) and routine distribution samples
  - If arithmetic average of any three sample-set exceeds MCL -> violation

DBP monitoring requirements: **bromate**

- **Only applicable to systems using ozone**
- **Routine monitoring:**
  - One sample per month for each treatment plant in the system using ozone at EP.
- May reduce monitoring from monthly to quarterly if the system's annual running average is <= 0.0025 mg/L based on routine monitoring results for the most recent four quarters. May remain on reduced monitoring as long as running annual average is <= 0.0025 mg/L.
- Bromate monitoring may also be reduced based on source water bromide concentrations are <0.05 based on representative monthly measurements for one year; must continually monitor

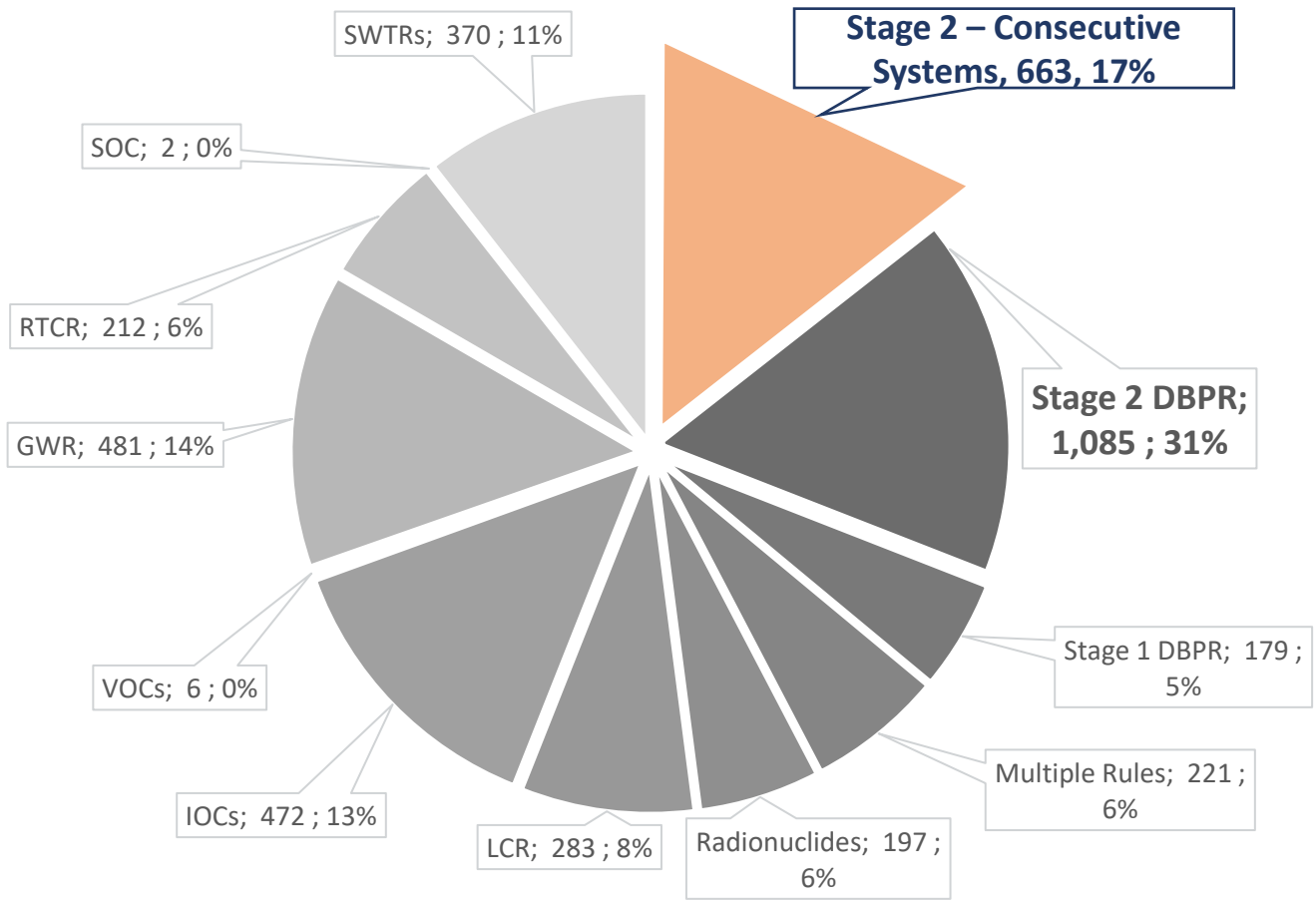


DBP compliance determinations: **bromate**

- Compliance based on **running** annual arithmetic average computed quarterly of monthly samples (or average of all samples taken during the month)
- System is in violation if the average of samples covering any consecutive four-quarter period exceeds the MCL
- If a system failed to complete 12 consecutive months' worth of monitoring, compliance is calculated based on average of available data

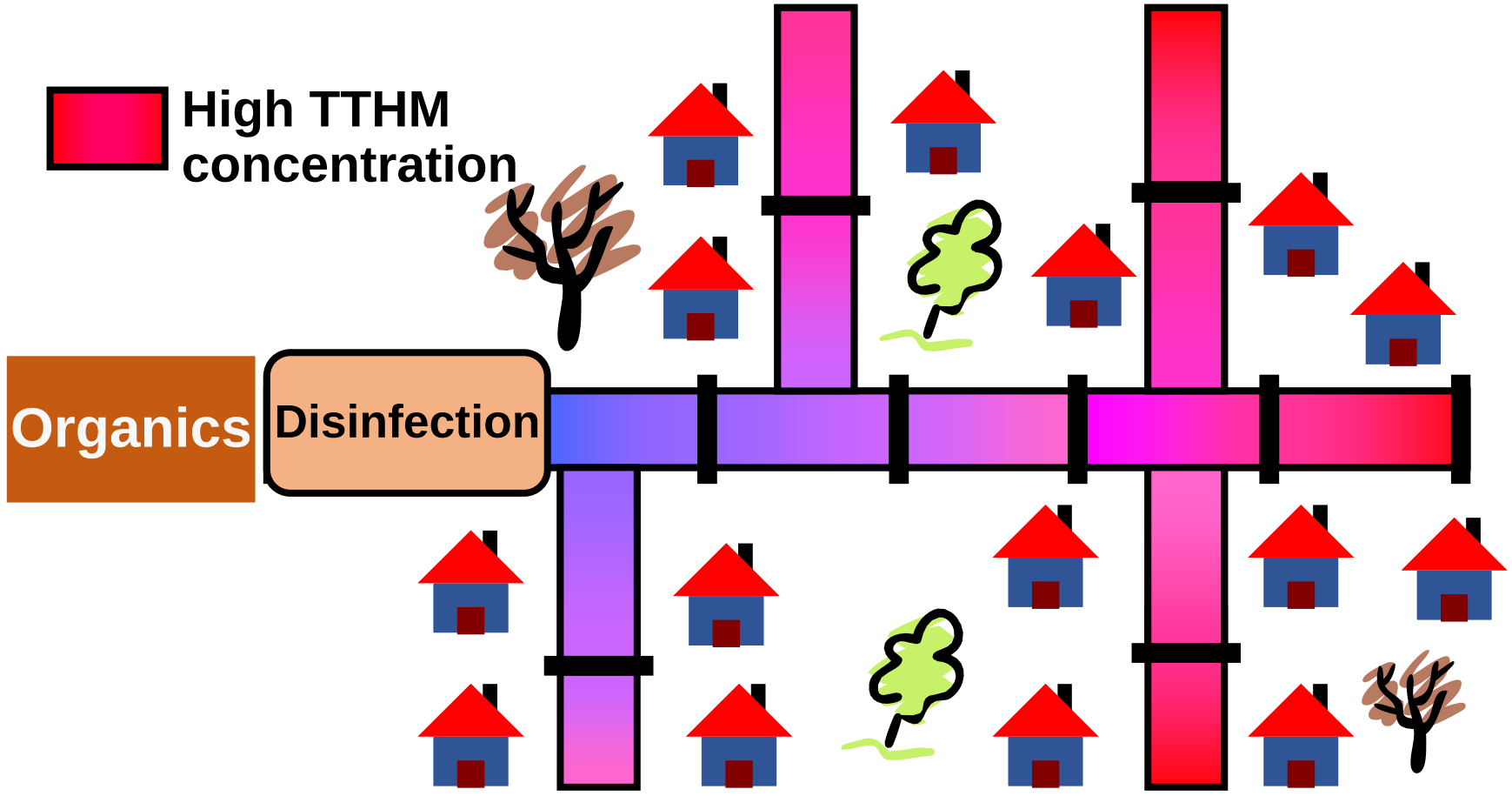
DBP monitoring requirements: **TTHM & HAA5**

- TTHM and HAA5 have regulatory requirements from both Stage 1 and Stage 2 DBPR
- Stage 1 DBPR set MCLs of 0.08 mg/L for TTHM and 0.06 mg/L for HAA5 evaluated as a running annual average, as well as a treatment technique of DBP precursors
- Stage 2 DBPR increased coverage to consecutive systems, revised the evaluation of TTHM/HAA5 to be based on ***locational*** running annual averages that better reflected maximum TTHM/HAA5 concentrations, instituted an "early warning" system when MCLs may be exceeded



DBP monitoring requirements: TTHM & HAA5

- DBPR2: Locational running annual averages (LRAA)
- Why locational running averages?
- Different factors affecting TTHM vs HAA5 formation & concentration



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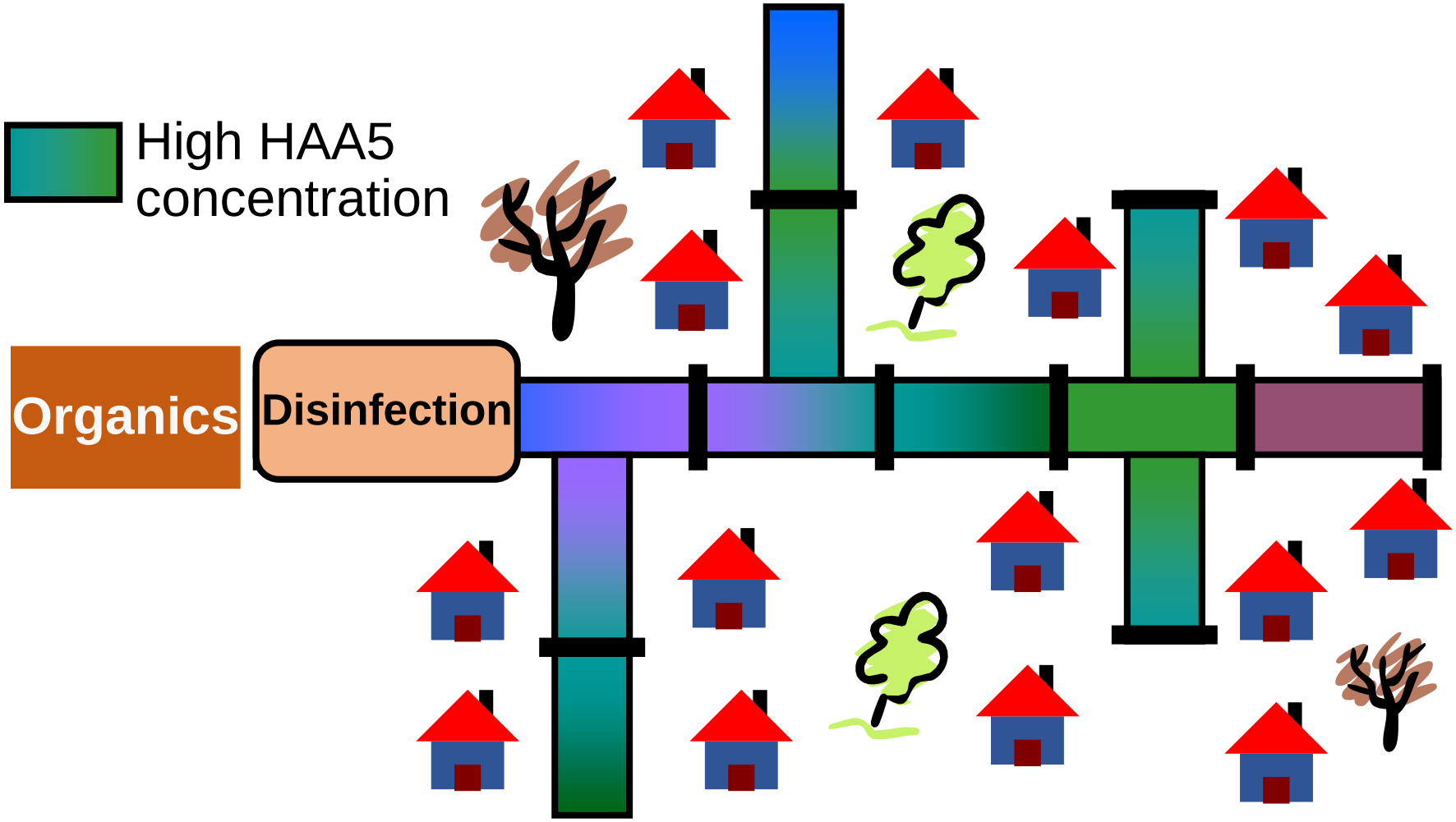
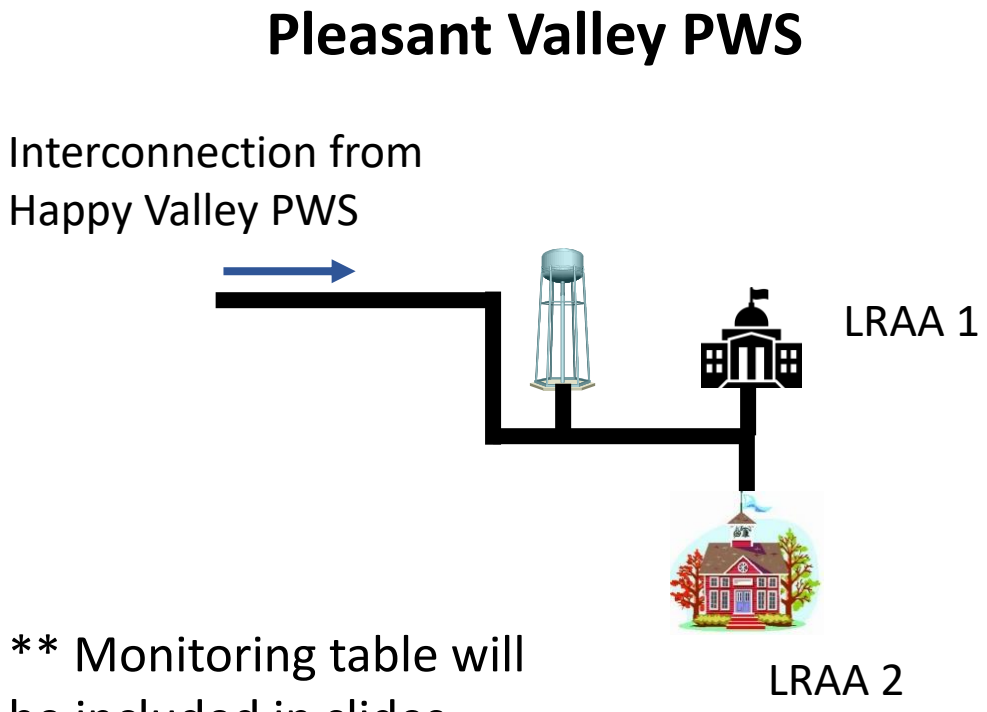


DBP monitoring requirements: **TTHM & HAA5**

- Number of HAA5/TTHM samples based on source water type and population
- Sample locations to calculate LRAAs based on Initial Distribution System Evaluation (IDSE) requirements
  - Caveat: systems that came online after the promulgation of Stage 2 were/are not required to do an IDSE. Thus, these systems will need to work with their State on a 40 CFR 141 Subpart V compliant monitoring plan that will determine sampling locations. (40 CFR 141.622)



** Monitoring table will be included in slides posted to EPA.gov **

TTHM & HAA5 Routine Monitoring Frequency

Source water type	Population size category	Monitoring Frequency[1]	Distribution system monitoring location total per monitoring period[2]
Subpart H systems: (Surface water, groundwater under the direct influence systems utilizing conventional filtration)	<500	per year	2
	500-3,300	per quarter	2
	3,301-9,999	per quarter	2
	10,000-49,999	per quarter	4
	50,000-249,999	per quarter	8
	250,000-999,999	per quarter	12
	1,000,000-4,999,999	per quarter	16
	≥5,000,000	per quarter	20
Ground Water systems:	<500	per year	2
	500-9,999	per year	2
	10,000-99,999	per quarter	4
	100,000-499,999	per quarter	6
	≥500,000	per quarter	8

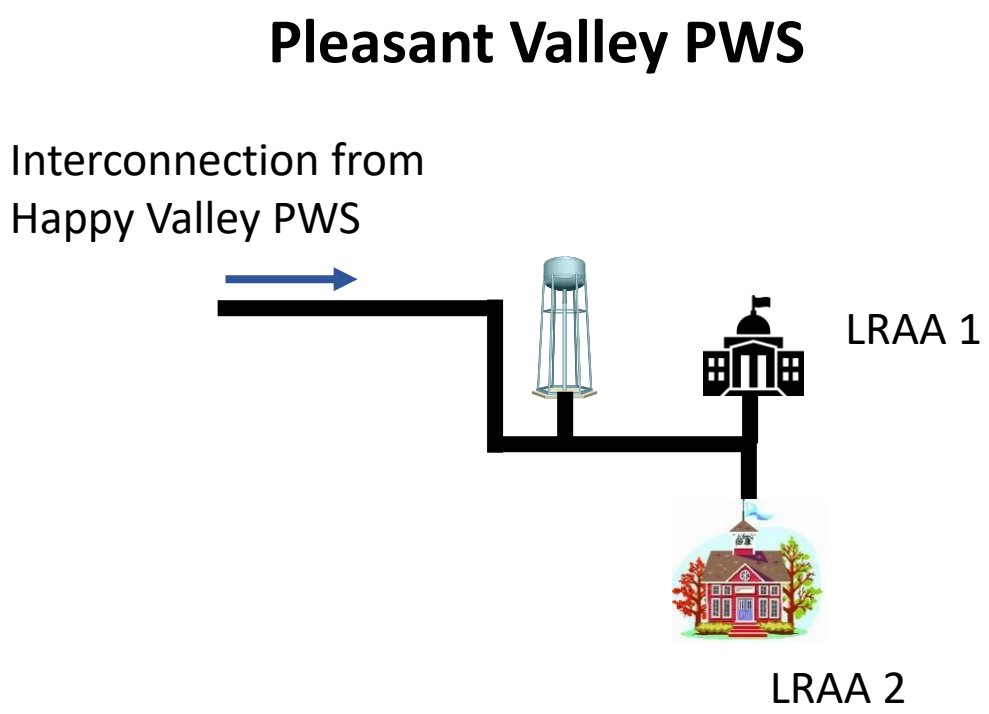
1) All systems must monitor during month of highest DBP concentrations.

2) Systems on quarterly monitoring must take dual sample sets every 90 days at each monitoring location, except for subpart H systems serving 500-3,300. Ground water systems serving 500-9,999 on annual monitoring must take dual sample sets at each monitoring location. All other systems on annual monitoring and subpart H systems serving 500-3,300 are required to take individual TTHM and HAA5 samples (instead of a dual sample set) at the locations with the highest TTHM and HAA5 concentrations, respectively. For systems serving fewer than 500 people, only one location with a dual sample set per monitoring period is needed if the highest TTHM and HAA5 concentrations occur at the same location and month.

DBP compliance determination: **TTHM & HAA5**

- For systems monitoring quarterly, compliance is based on TTHM and HAA5 LRAAs: each LRAA must not exceed the MCLs. If a system does not complete four consecutive quarters of monitoring, compliance based on available data.

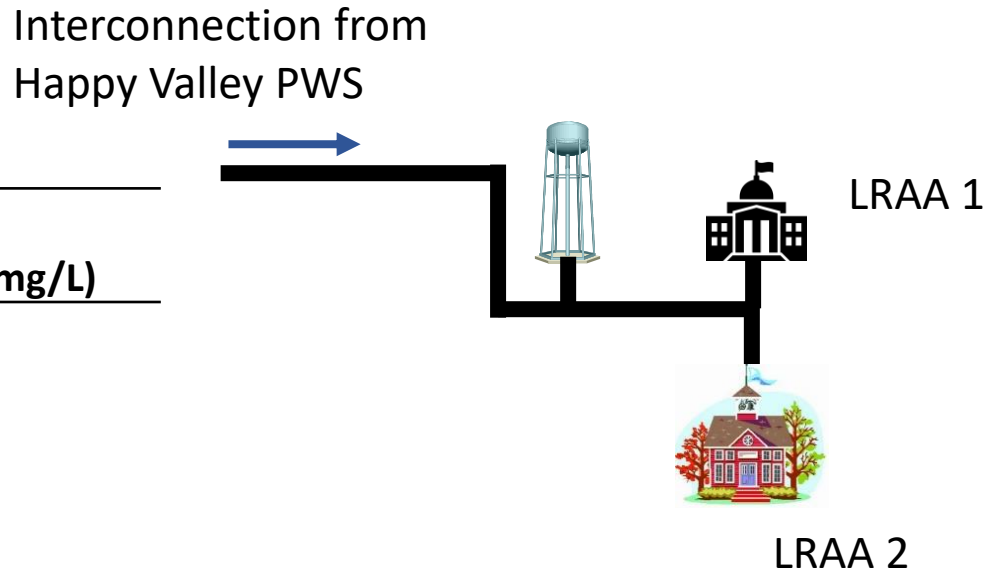
- For systems monitoring yearly or less frequently, each individual sample must be less than the MCL. If any sample exceeds the MCL, system must increase monitoring.



Calculating LRAAs

Example LRAA calculation

Pleasant Valley PWS

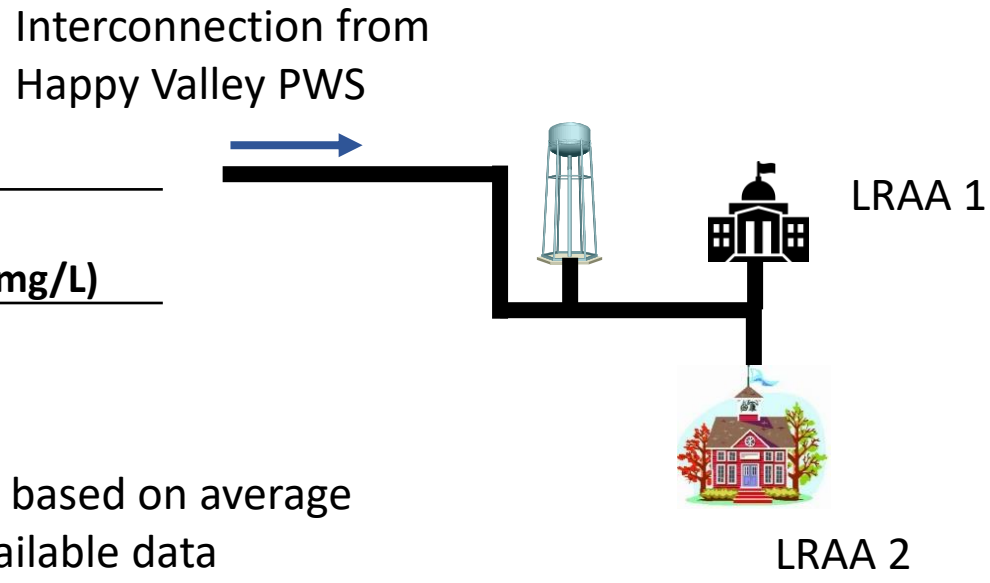


LRAA 1: Town Hall

TTHM Sample Results			
Quarter	TTHM (mg/L)	LRAA Calculation	TTHM LRAA (mg/L)
Q1 2022	0.013		
Q2 2022	0.042		
Q3 2022	0.069		
Q4 2022	0.086		
Q1 2023	0.033		
Q2 2023	0.088		
Q3 2023	0.103		
Q4 2023	0.120		

Example LRAA calculation

Pleasant Valley PWS



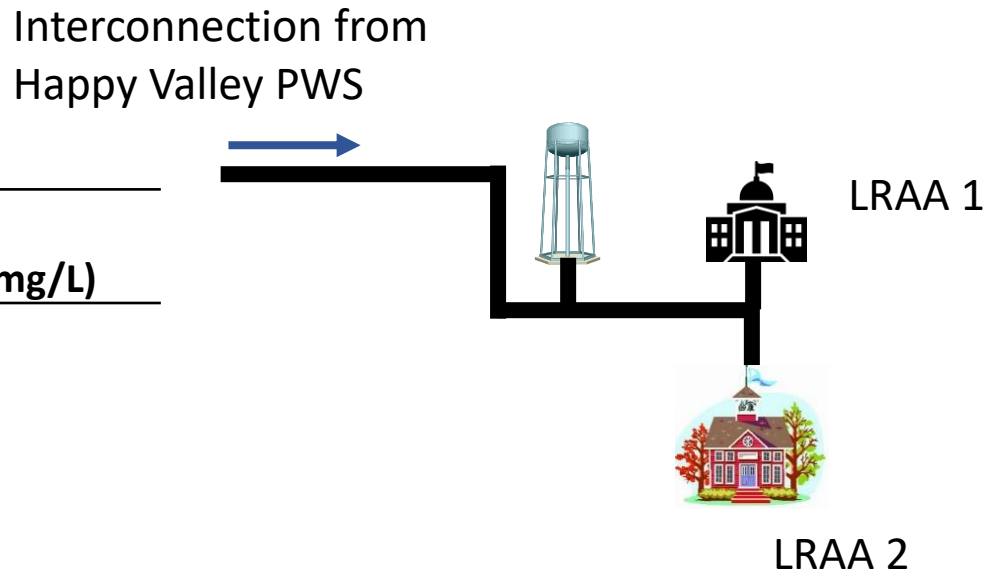
LRAA 1: Town Hall

TTHM Sample Results			
Quarter	TTHM (mg/L)	LRAA Calculation	TTHM LRAA (mg/L)
Q1 2022	0.013	(Q1 ‘22)	
Q2 2022	0.042	(Q2 ‘22 + Q1 ‘22)/2	
Q3 2022	0.069	(Q3 ‘22 + Q2 ‘22 + Q1 ‘22)/3	
Q4 2022	0.086	(Q4 '22 + Q3 '22 + Q2 '22 + Q1 '22)/4	
Q1 2023	0.033	(Q1 '23 + Q4 '22 + Q3 '22 + Q2 '22)/4	
Q2 2023	0.088	(Q2 '23 + Q1 '23 + Q4 '22 + Q3 '22)/4	
Q3 2023	0.103	(Q3 '23 + Q2 '23 + Q1 '23 + Q4 '22)/4	
Q4 2023	0.120	(Q4 '23 + Q3 '23 + Q2 '23 + Q1 '23)/4	

LRAA based on average of available data

Example LRAA calculation

Pleasant Valley PWS



LRAA 1: Town Hall

TTHM Sample Results			
Quarter	TTHM (mg/L)	LRAA Calculation	TTHM LRAA (mg/L)
Q1 2022	0.013	(Q1 ‘22)	0.013
Q2 2022	0.042	(Q2 ‘22 + Q1 ‘22)/2	0.028
Q3 2022	0.069	(Q3 ‘22 + Q2 ‘22 + Q1 ‘22)/3	0.041
Q4 2022	0.086	(Q4 '22 + Q3 '22 + Q2 '22 + Q1 '22)/4	0.053
Q1 2023	0.033	(Q1 '23 + Q4 '22 + Q3 '22 + Q2 '22)/4	0.058
Q2 2023	0.088	(Q2 '23 + Q1 '23 + Q4 '22 + Q3 '22)/4	0.069
Q3 2023	0.103	(Q3 '23 + Q2 '23 + Q1 '23 + Q4 '22)/4	0.078
Q4 2023	0.120	(Q4 '23 + Q3 '23 + Q2 '23 + Q1 '23)/4	0.086

Operational evaluation levels

- Early warning system for when a system may exceed TTHM/HAA5 MCLs
- OEL is exceeded at any location where sum of two previous quarters' results plus twice the current quarter's result exceeds the MCL
- **Example:**

LRAA 1: Town Hall

TTHM Sample Results			
Quarter	TTHM (mg/L)	OEL Calculation	TTHM OEL (mg/L)
Q1 2022	0.013		
Q2 2022	0.042		
Q3 2022	0.069	(Q1 '22 + Q2 '22 + (2 * Q3 '22)/4	0.048
Q4 2022	0.086	(Q3 '22 + Q2 '22 + (2 * Q4 '22)/4	0.071
Q1 2023	0.033	(Q4 '22 + Q3 '22 + (2 * Q1 '23)/4	0.055
Q2 2023	0.088	(Q1 '23 + Q4 '22 + (2 * Q2 '23)/4	0.074
Q3 2023	0.103	(Q2 '23 + Q1 '23 + (2 * Q3 '23)/4	**0.082**
Q4 2023	0.120	(Q3 '23 + Q2 '23 + (2 * Q4 '23)/4	0.108

DBPR Requirements: **DBP precursors**

DBP Precursor Monitoring Requirements

- Conventional filtration surface water or GWUDI systems (aka Subpart H systems) must monitor each plant for total organic carbon (TOC) post treatment, no later than the point of combined filter effluent turbidity monitoring
- Subpart H systems must also monitor for TOC in the source water (prior to treatment)

Paired sample

- Must monitor for alkalinity at source water at the same time as source water sample
- **One paired sample and one source water alkalinity sample per month per plant**

DBP Precursor Monitoring Requirements

- Subpart H systems with an **average treated water** TOC < 2.0 mg/L for two consecutive years, or < 1.0 mg/L for one year, may reduce monitoring for both TOC and alkalinity to one paired sample/one alkalinity per plant per quarter
- Back to routine monitoring in the month following a quarter of annual average treated TOC >= 2.0 mg/L

DBP Precursor Control Requirements

- Conventional filtration Subpart H systems are required to achieve a certain level of TOC removal through either enhanced coagulation or enhanced softening, or qualify through at least one alternative compliance criteria

Table 5 - Step 1 TOC - Required Percent Removal of TOC

Source Water TOC (mg/L)	Source Water Alkalinity, mg/L as CaCO3		
	0-60	> 60-120	>120
> 2.0 to 4.0	35.0%	25.0%	15.0%
> 4.0 to 8.0	45.0%	35.0%	25.0%
> 8.0	50.0%	40.0%	30.0%

DBP Precursor Control Requirements

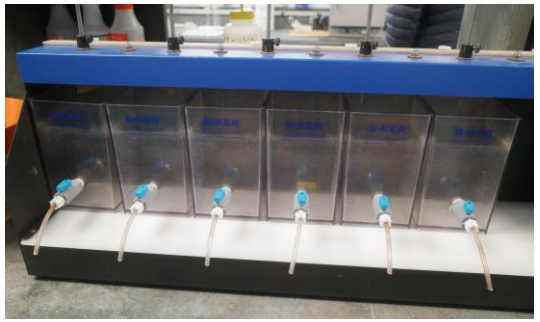
- Alternate compliance criteria for enhanced coagulation and enhanced softening systems:
  - (i) The system's source water TOC level, measured according to § 141.131(d)(3), is less than 2.0 mg/L, calculated quarterly as a running annual average.
  - (ii) The system's treated water TOC level, measured according to § 141.131(d)(3), is less than 2.0 mg/L, calculated quarterly as a running annual average.
  - (iii) The system's source water TOC level, measured according to § 141.131(d)(3), is less than 4.0 mg/L, calculated quarterly as a running annual average; the source water alkalinity, measured according to § 141.131(d)(1), is greater than 60 mg/L (as $CaCO_3$), calculated quarterly as a running annual average; and either the TTHM and HAA5 running annual averages are no greater than 0.040 mg/L and 0.030 mg/L, respectively; or prior to the effective date for compliance in § 141.130(b), the system has made a clear and irrevocable financial commitment not later than the effective date for compliance in § 141.130(b) to use of technologies that will limit the levels of TTHMs and HAA5 to no more than 0.040 mg/L and 0.030 mg/L, respectively. Systems must submit evidence of a clear and irrevocable financial commitment, in addition to a schedule containing milestones and periodic progress reports for installation and operation of appropriate technologies, to the State for approval not later than the effective date for compliance in § 141.130(b). These technologies must be installed and operating not later than June 30, 2005. Failure to install and operate these technologies by the date in the approved schedule will constitute a violation of National Primary Drinking Water Regulations.
  - (iv) The TTHM and HAA5 running annual averages are no greater than 0.040 mg/L and 0.030 mg/L, respectively, and the system uses only chlorine for primary disinfection and maintenance of a residual in the distribution system.
  - (v) The system's source water SUVA, prior to any treatment and measured monthly according to § 141.131(d)(4), is less than or equal to 2.0 L/mg-m, calculated quarterly as a running annual average.
  - (vi) The system's finished water SUVA, measured monthly according to § 141.131(d)(4), is less than or equal to 2.0 L/mg-m, calculated quarterly as a running annual average.

DBP Precursor Control Requirements

- Additional alternative compliance criteria for softening systems:
  - (i) The system's source water TOC level, measured according to § 141.131(d)(3), is less than 2.0 mg/L, calculated quarterly as a running annual average.
  - (ii) The system's treated water TOC level, measured according to § 141.131(d)(3), is less than 2.0 mg/L, calculated quarterly as a running annual average.
  - (iii) The system's source water TOC level, measured according to § 141.131(d)(3), is less than 4.0 mg/L, calculated quarterly as a running annual average; the source water alkalinity, measured according to § 141.131(d)(1), is greater than 60 mg/L (as $CaCO_3$), calculated quarterly as a running annual average; and either the TTHM and HAA5 running annual averages are no greater than 0.040 mg/L and 0.030 mg/L, respectively; or prior to the effective date for compliance in § 141.130(b), the system has made a clear and irrevocable financial commitment not later than the effective date for compliance in § 141.130(b) to use of technologies that will limit the levels of TTHMs and HAA5 to no more than 0.040 mg/L and 0.030 mg/L, respectively. Systems must submit evidence of a clear and irrevocable financial commitment, in addition to a schedule containing milestones and periodic progress reports for installation and operation of appropriate technologies, to the State for approval not later than the effective date for compliance in § 141.130(b). These technologies must be installed and operating not later than June 30, 2005. Failure to install and operate these technologies by the date in the approved schedule will constitute a violation of National Primary Drinking Water Regulations.
  - (iv) The TTHM and HAA5 running annual averages are no greater than 0.040 mg/L and 0.030 mg/L, respectively, and the system uses only chlorine for primary disinfection and maintenance of a residual in the distribution system.
  - (v) The system's source water SUVA, prior to any treatment and measured monthly according to § 141.131(d)(4), is less than or equal to 2.0 L/mg-m, calculated quarterly as a running annual average.
  - (vi) The system's finished water SUVA, measured monthly according to § 141.131(d)(4), is less than or equal to 2.0 L/mg-m, calculated quarterly as a running annual average.

DBP Precursor Control Requirements

- If a system cannot meet required TOC removal levels or qualify through alternative compliance criteria, the system will need to do bench- or pilot-scale testing to determine the coagulant dose and pH such that an incremental addition of 10 mg/L of alum (or equivalent ferric salt) results in a TOC removal of <= 0.3 mg/L
- **Results of bench- or pilot- testing must be approved by the State**



Bench- or pilot-scale testing of enhanced coagulation must be conducted by using representative water samples and adding 10 mg/L increments of alum (or equivalent amounts of ferric salt) until the pH is reduced to a level less than or equal to the enhanced coagulation Step 2 target pH shown in the following table:

Enhanced Coagulation Step 2 target pH

Alkalinity (mg/L as $CaCO_3$)	Target pH
0-60	5.5
>60-120	6.3
>120-240	7.0
>240	7.5

Potential Revisions of Microbial and Disinfection Byproducts Rules

- In January 2017, EPA identified eight NPDWRs as candidates for revisions:
  - Chlorite
  - Haloacetic acids
  - Total trihalomethanes
  - Heterotrophic bacteria
  - *Cryptosporidium*
  - *Giardia lamblia*
  - *Legionella*
  - Viruses
- EPA is currently conducting analyses to further evaluate the eight NPDWRs for potential regulatory revisions
- EPA is also evaluating information on unregulated DBPs, including chlorate and nitrosamines
- **EPA anticipates proposing MDBP rule revisions in Summer 2025**