

**The Stage 1  
Disinfectants/Disinfection  
Byproduct Rule**

# Background

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- **Public Health Protection For:**
  - **Acute Microbial Risks**
  - **Chronic DBP Risks**
- **Cross-Over Impacts**

# Background (cont.)

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- **Public Health Protection for DBPs and Disinfectants**
  - Balance Risks
  - Optimization of Protection
- **A Product of 6 Years of Collaboration**
  - RegNeg in 1992
  - FACA in 1997
- **Participants**
  - Water Supply Industry
  - Environmental and Public Health Groups
  - Local, State, and Federal Governments

# Background (cont.)

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- **Staged Process**
  - 1996 Information Collection Rule
  - On-Going Research
- **First Set: Moderate Action to Balance Risks**
  - Stage 1 DBPR
  - IESWTR

# Background (cont.)

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- **Planned Rules**

- **Filter Backwash Recycling Rule**      **Spring/Summer 2001**
- **Long Term 1 ESWTR**      **Spring/Summer 2001**
- **Ground Water Rule**      **Spring/Summer 2001**
- **Stage 2 DBPR**      **May 2002**
- **Long Term ESWTR**      **May 2002**

# Background (cont.)

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- **Large Population Potentially Exposed to DBPs**
- **Health Hazards of DBPs:**
  - **Toxicology Evidence**
  - **Epidemiological Evidence**

# Background (cont.)

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- **Improve Protection Against Risks From:**
  - **Known DBPs**
  - **Unknown DBPs**
- **Balance Risks and Benefits Of:**
  - **SWTR**
  - **IESTWR**
  - **Lead and Copper Rule**
  - **Total Coliform Rule**

# Background (cont.)

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- **140 Million People Will Have Increased Protection From DBPs**
- **24 Percent Reduction in DBP Levels (National Average)**
- **Reduction in Exposure to:**
  - **Haloacetic Acids**
  - **Bromate**
  - **Chlorite**
- **Reduced Risks From:**
  - **Cancer**
  - **Reproductive Effects**
  - **Developmental Effects**



# Rule Structure

# Rule Structure

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- **Part 141 – National Primary Drinking Water Regulations**
  - **Subpart A: §141.2 Definitions**
  - **Subpart B: §141.12 MCLs for Organic Chemicals**
  - **Subpart C: §141.30 TTHM Sampling, Analytical and Other Requirements**
  - **Subpart D: §141.32 Public Notification**
  - **Subpart F: §141.53 MCLGs and §141.54 MRDLGs**
  - **Subpart G: §141.64 MCLs and MRDLs**
  - **Subpart I: §141.89 Analytical Requirements**
  - **Subpart L: Disinfection Residuals, DBPs and DBPPs**
  - **Subpart O: §141.154 Required Health Information**
  - **Subpart P: Enhanced Filtration and Disinfection**

# Rule Structure

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- **Part 142 – National Primary Drinking Water Regulations Implementation**
  - **§142.14**            **Records Kept by States**
  - **§142.16**            **Special Primacy Requirements**

**Provisions of The Stage 1  
Disinfectants and  
Disinfection Byproducts  
Rule**

# Subpart A – General

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- **§141.2 Definitions**
  - **Enhanced Coagulation**
  - **Enhanced Softening**
  - **GAC 10**
  - **Haloacetic Acids (five) (HAA5)**
  - **Maximum Residual Disinfectant Level (MRDL)**
  - **Maximum Residual Disinfectant Level Goal (MRDLG)**
  - **Subpart H Systems**
  - **SUVA**
  - **Total Organic Carbon (TOC)**

# Subpart B

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- **Subpart B – Maximum Contaminant Levels**
  - **§141.12 MCLs for TTHMs**
    - **Phases Out the Current MCL**

# Subpart C

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- **Subpart C – Monitoring and Analytical Requirements**
  - **§141.30 TTHMs Sampling, Analytical, and Other Requirements**
    - **Changes to Citations**
    - **Designates Effective Dates**

# Subpart D

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- **Subpart D – Reporting, Public Notification, and Recordkeeping**
  - **§141.32 Public Notification**



# Subparts F and G

<b>MCLGs &amp; MCLs for Disinfection Byproducts</b>		
<b>DBP</b>	<b>MCLG (mg/L)</b>	<b>MCL (mg/L)</b>
<b>Total Trihalomethanes</b>	-	<b>0.080</b>
<b>Chloroform</b>	-	-
<b>Bromodichloromethane</b>	<b>0</b>	-
<b>Bromoform</b>	<b>0</b>	-
<b>Dibromochloromethane</b>	<b>0.06</b>	-

## Subparts F and G (cont.)

<b>MCLGs &amp; MCLs for Disinfection Byproducts</b>		
<b>DBP</b>	<b>MCLG (mg/L)</b>	<b>MCL (mg/L)</b>
<b>Five Haloacetic Acids (HAA5)</b>	-	<b>0.060</b>
<b>Monochloroacetic Acid</b>	-	-
<b>Dichloroacetic Acid</b>	<b>0</b>	-
<b>Trichloroacetic Acid</b>	<b>0.30</b>	-
<b>Monobromoacetic Acid</b>	-	-
<b>Dibromoacetic Acid</b>	-	-

## Subparts F and G (cont.)

### MCLGs & MCLs for Disinfection Byproducts

	MCLG (mg/L)	MCL (mg/L)
<b>Chlorite</b>	<b>0.80</b>	<b>1.0</b>
<b>Bromate</b>	<b>0</b>	<b>0.010</b>

## Subparts F and G (cont.)

### MRDLGs & MRDLs for Disinfectants

Disinfectant	MRDLG (mg/L)	MRDL (mg/L)
Chlorine	4	4.0
Chloramines	4	4.0
Chlorine Dioxide	0.8	0.8

## Subparts F and G (cont.)

### BAT For Disinfection Byproducts

<u>DBP</u>	<u>BAT</u>
TTHMs and HAA5	Enhanced Coagulation or GAC 10, With Cl <sub>2</sub> As Disinfectant
Chlorite	Control of Treatment To Reduce Disinfectant Demand And To Reduce Disinfectant Levels
Bromate	Control of Ozone Treatment To Reduce Production of Bromate

# Subpart L Structure

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- **Subpart L – Disinfectant Residuals, Disinfection Byproducts, and Disinfection Byproduct Precursors**
  - **§141.130: General Requirements**
  - **§141.131: Analytical Requirements**
  - **§141.132: Monitoring Requirements**
  - **§141.133: Compliance**
  - **§141.134: Reporting and Recordkeeping**
  - **§141.135: Treatment Techniques for Control of DBP Precursors**

# **§ 141.130 General Requirements**

# § 141.130 General Requirements

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- **Applicability**
  - CWSs and NTNCWSs That Add Chemical Disinfectants
  - TNCWSs That Add Chlorine Dioxide
- **Compliance Dates**
  - Subpart H Serving 10,000 or More People
    - 3 Years January 1, 2002
    - Possible Extensions
  - All Other Systems
    - 5 Years January 1, 2004
- **Qualified Personnel**



# **§ 141.131 Analytical Requirements**

# § 141.131 Analytical Requirements

- Specifies Analytical Methods
- Certified Labs for:
  - DBPs (chlorite exception)
- Parties Approved by the State for:
  - Disinfectants
  - Alkalinity
  - Bromide
  - TOC — chlorite
  - SUVA
    - DOC
    - UV254
  - pH

# **§ 141.132 Monitoring**

# § 141.132 Monitoring – General

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- **Normal Operating Conditions**
- **Multiple Wells in Same Aquifer**
  - **TTHM and HAA5**
- **Systems Must Monitor According to Plan**

# § 141.132 Monitoring—DBPs

Routine—TTHMs and HAA5			Reduced	
System Type	Frequency	Location	Conditions	Frequency
Subpart H ≥ 10,000	4/plant/qtr	25% Max. Residence Time (RT) 75% Rep.	£ 50% of MCLs TOC £ 4.0 mg/L	1/plant/qtr at Max RT
Subpart H ≥ 500 – 9,999	1/plant/qtr	Max. RT	£ 50% of MCLs TOC £ 4.0 mg/L	1/plant/year in month of warmest water temp. Max RT
Ground Water ≥ 10,000	1/plant/qtr	Max. RT	£ 50% of MCLs	1/plant/year in month of warmest water temp. Max RT
Subpart H < 500	1/plant/year in month of warmest water temp.	Max. RT	No Reduced Monitoring	
Ground Water <10,000	1/plant/year in month of warmest water temp.	Max. RT	£ 50% of MCLs (2 years) or £ 25% of MCLs (1 year)	1/plant/3 years in month of warmest water temp. Max RT

# § 141.132 Monitoring – DBP

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- **Reduced Monitoring for TTHM and HAA5 As Long As:**
  - **Quarterly Monitoring**
    - **Annual Average of Samples Is No More Than 75 Percent of Either MCL**
  - **Less Frequent Monitoring**
    - **The Result of the Sample (or Average) Is No More Than 75 Percent of Either MCL**

# § 141.132 Monitoring – DBP

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- **Chlorite**

- **Routine**

- **Daily — At Entrance to Distribution**
    - **Monthly**
      - ◆ **Near First Customer**
      - ◆ **Average Residence Time**
      - ◆ **Maximum Residence Time**
    - **Additional — If Daily Sample > MCL, Monitor the Following Day**

- **Reduced**

- **One 3-Sample Set/Quarter If No Sample > MCL for 1 Year**
    - **Revert to Routine If Any Sample > MCL**

# § 141.132 Monitoring – DBP

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- **Bromate**
  - **Routine**
    - **1 Sample/Month/Plant at Entrance**
  - **Reduced**
    - **If Average Source Water Bromide Is < 0.05 mg/l**
    - **1 Sample/Quarter/Plant at Entrance**



# § 141.132 Monitoring – Disinfectant Residuals

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- **Chlorine and Chloramines**
  - **Routine**
    - **Same Point and Time As Coliform**
    - **Subpart H Systems May Use Results of Monitoring Under Provisions of SWTR**
  - **Reduced**
    - **No Reductions**

# § 141.132 Monitoring – Disinfectant Residuals

- **Chlorine Dioxide**

- **Routine**

- **Daily Monitoring**
    - **At Entrance to Distribution System**
    - **Additional Monitoring**
    - **When Any Daily Sample > MRDL**
      - ◆ **Without Booster Chlorination**
        - » **3 Samples at > 6 Hour Intervals as Close as Possible to First Customer**
      - ◆ **With Booster Chlorination**
        - » **First Customer**
        - » **Average RT**
        - » **Maximum RT**

- **Reduced**

- **No Reductions**

# § 141.132 Monitoring – DBPP

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- **Bromide**
  - **Optional for Systems Using Ozone**
    - **Monthly Measurements**
  - **Purpose**
    - **Reduced Bromate Monitoring To:**
      - ◆ **1 Sample/Quarter/Plant at Entrance**
      - ◆ **If Average Source Water Bromide Is < 0.05 mg/L (Monthly for 1 Year)**

# § 141.132 Monitoring – DBPP

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- **“Paired Sampling”**
  - Conventional Plants
- **Routine**
  - One Paired Sample/Month
  - One Source Water Alkalinity/Month
- **Reduced**
  - One Paired Sample/Quarter
  - One Source Water Alkalinity/Quarter If:
    - Treated Water TOC < 2.0 mg/L for 2 Years Or,
    - Treated Water TOC < 1.0 mg/L for 1 Year

# **§ 141.132 Monitoring – Monitoring Plans**

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- **Each System Must Develop and Implement a Monitoring Plan**
- **Available 30 Days After Compliance Date**
- **Subpart H Systems > 3,300 Must Submit With First Report**
- **Plan Must Include:**
  - **Locations and Schedules**
  - **Compliance Calculation Methodology**
  - **Entire Distribution System**

# **§ 141.133 Compliance**

## § 141.133 Compliance – General

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- **Failure to Monitor Is Treated As a Violation for Entire 1 Year Period:**
  - MCLs
    - TTHM, HAA5, or Bromate
- **Failure to Monitor Is Treated As a Violation for Entire 1 Year Period Which Makes It Impossible to Determine Compliance for:**
  - MRDLs
    - Chlorine or Chloramine
- **All Identified Compliance Samples Must Be Included in Calculations**
- **In First Year**
  - Out of Compliance When Average > MCL

# § 141.133 Compliance – DBP

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- **TTHMs and HAA5**
  - **Systems Monitoring Quarterly**
    - Based on Running Annual Arithmetic Average
    - Computed Quarterly
    - Of Quarterly Arithmetic Averages
  - **Systems Monitoring Less Frequently**
    - If Average is  $>$  MCL, Increase Monitoring to Quarterly
    - Compliance Calculated After 1 Year of Quarterly Monitoring
  - **Systems on Reduced Monitoring**
    - When Annual Average Is  $>$  MCL
      - ◆ Revert to Routine
      - ◆ No Violation



# § 141.133 Compliance – DBP

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- **Bromate**
  - Running Annual Arithmetic Average
    - Computed Quarterly
    - Of Monthly Samples (or Averages)
- **Chlorite**
  - Arithmetic Average of Each 3-Sample Set

# § 141.133 Compliance – Disinfectant Residuals

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- **Chlorine and Chloramines**
  - **Running Annual Arithmetic Average**
    - **Computed Quarterly, of All Samples**
  - **If a System Switches Disinfectants the Results of Both Must Be Used for Compliance Calculations**
    - **MRDLs Are Identical**

# § 141.133 Compliance – Disinfectant Residuals

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- **Chlorine Dioxide**

- **Acute Violations**

- **Based on Samples Collected on Consecutive Days**

- ◆ Entrance Sample > MRDL and

- ◆ 1 or More Distribution Sample(s) > MRDL

- **Nonacute Violations**

- **Based on Consecutive Daily Samples at the Entrance**

- ◆ 2 Samples > MRDL and

- ◆ All Distribution Samples < MRDL

# **§ 141.133 Compliance – DBP Precursors**

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- **Compliance Determined As Specified by §141.135(c)**
  - **Discussed in DBPP Section (§ 141.135)**

# **§ 141.134 Reporting and Recordkeeping**

# § 141.134 Reporting and Recordkeeping – General

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- **Report to the State**
  - **Monitoring Quarterly or More Frequently**
    - **Within 10 Days of the Quarter**
  - **Monitoring Less Frequently**
    - **Within 10 Days of the Monitoring Period**

# § 141.134 Reporting and Recordkeeping – DBP

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- **TTHM and HAA5**
  - **Monitoring Quarterly or More Frequently:**
    - **Number of Samples Last Quarter**
    - **Location, Date, and Result**
    - **Arithmetic Average of Quarter's Samples**
    - **Annual Arithmetic Average of Quarterly Averages**
    - **Whether the MCL Was Exceeded**

# § 141.134 Reporting and Recordkeeping – DBP

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- **TTHM and HAA5**
  - **Monitoring at Least Annually:**
    - **Number of Samples Last Year**
    - **Location, Date and Result**
    - **Arithmetic Average of All Samples Over Year**
    - **Whether the MCL Was Exceeded**



# § 141.134 Reporting and Recordkeeping – DBP

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- **TTHM and HAA5**
  - **Monitoring Less Frequently Than Annually:**
    - **Location, Date, and Result of Last Sample**
    - **Whether the MCL Was Exceeded**

# § 141.134 Reporting and Recordkeeping – DBP

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- **Chlorite**
  - **Number of Samples Taken Each Month for Last 3 Months**
  - **Location, Date, and Result of Last Quarter's Samples**
  - **For the Quarter, Each Month's Arithmetic Average**
  - **Whether the MCL Was Exceeded and in Which Month**

# § 141.134 Reporting and Recordkeeping – DBP

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- **Bromate**
  - **Number of Samples in Quarter**
  - **Location, Date, and Result**
  - **Average of Monthly Averages Over the Past Year**
  - **Whether the MCL Was Exceeded**

# **§ 141.134 Reporting and Recordkeeping – Disinfectant Residual**

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- **Chlorine or Chloramines**
  - **Number Each Month of the Last Quarter**
  - **Average of Each of the Past 12 Months**
  - **Average of Monthly Averages Over the Past Year**
  - **Whether the MRDL Was Exceeded**

# § 141.134 Reporting and Recordkeeping – Disinfectant Residual

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- Chlorine Dioxide
  - Dates, Results, and Locations During Last Quarter
  - Whether the MRDL Was Exceeded
  - Whether the MRDL Was Exceeded in Any 2 Consecutive Daily Samples and
  - Whether the Violation Was Acute or Nonacute

# § 141.134 – Reporting and Recordkeeping

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- **For DBPP or Enhanced Coagulation or Enhanced Softening**
  - **For Subpart H Systems Using Conventional Treatment**
  - **See Slides Following §141.135**

# **§ 141.135 Treatment Technique For DBPP**

# § 141.135 Treatment Technique For DBPP

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- **Design**
  - Reduction of Known and Unknown DBPs
- **Applicability**
  - Conventional Subpart H Systems
- **Requirements**
  - Meet One of the Alternative Compliance Criteria; or
  - Achieve Required TOC Removals; or
  - Get Waiver From State



# § 141.135 Treatment Technique For DBPP

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- **Conventional plants monitor for**
  - **TOC** (Raw and Finished)
  - **Alkalinity** (Raw)
  - **SUVA** (Raw and Finished)
    - **UV<sub>254</sub>**
    - **DOC**
  - **Magnesium** **(Raw and Finished)**  
**(Softening Systems Only)**

# **§ 141.135 Treatment Technique For DBPP**

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- **To Achieve Compliance Systems Must Do One of the Following:**
  - **Meet One or More Alternative Compliance Criteria**
  - **Achieve Step 1 TOC Removal Requirements**
  - **Establish and Achieve Step 2 TOC Removal Requirements**
  - **Obtain a State Waiver of the Requirements**

# § 141.135 Treatment Technique For DBPP

- **Alternative Compliance Criteria**
  - 1. **Source Water TOC < 2.0 mg/L (Annual Average)**
  - 2. **Treated Water TOC < 2.0 mg/L (Annual Average)**
  - 3. **Source Water SUVA  $\leq$  2.0 L/mg-m (Annual Average)**
  - 4. **Treated Water SUVA  $\leq$  2.0 L/mg-m (Annual Average)**
  - 5. **Source Water TOC < 4.0 mg/L, Alkalinity > 60 mg/L and**
    - **TTHM/HAA5  $\leq$  50 Percent of MCLs; Or,**
    - **Clear and Irrevocable Financial Commitment to Technologies That Limit TTHM/HAA5 to  $\leq$  50 Percent of MCL**
      - ◆ **Technologies Operational Within 6 1/2 Years**
  - 6. **TTHM/HAA5  $\leq$  50 Percent of MCLs and Using Only Chlorine**

# § 141.135 Treatment Technique For DBPP

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- **Additional Alternative Compliance Criteria for Softening Systems**
  1. Treated Water Alkalinity < 60 mg/L
  2. Removal of 10 mg/L Mg Hardness

# § 141.135 Treatment Technique For DBPP

- **Enhanced Coagulation and Enhanced Softening**
  - **Step 1: Required Removal of TOC**

Source Water TOC (mg/L)	Source Water Alkalinity (mg/L as calcium carbonate)		
	0-60	> 60-120	> 120
> 2.0 to 4.0	35%	25%	15%
> 4.0 to 8.0	45%	35%	25%
> 8.0	50%	40%	30%

# § 141.135 Treatment Technique For DBPP

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- **Step 2 Alternative Minimum TOC Removal Requirements**
  - Application Within 3 Months of Failure
  - Bench- or Pilot-scale Testing
    - 10 mg/L Increments of Coagulant
    - Step 2 Target pH
  - Step 2 Removal
    - An Incremental Dose Achieves  $\geq 0.3$  mg/L TOC Removal
    - Point of Diminishing Return (PODR)
  - States May Make Step 2 Retroactive

# § 141.135 Treatment Technique For DBPP

- Step 2: Target pH

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

# § 141.135 Treatment Technique For DBPP

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- **Step 2 (Cont.)**
  - **When Alkalinity < 60 mg/L**
    - **pH Must Be Maintained Between 5.3 and 5.7 Until TOC Removal of 0.3 mg/L Per 10 mg/L Is Reached**
  - **Potential State Waiver**



# § 141.135 Treatment Technique For DBPP

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- **Procedure for Step 2 Bench Scale Testing**
  - **Apparatus and Reagents**
    - Jar Test Apparatus
    - pH Meter
    - Stock Solution of Coagulant
    - Stock Solution of Base
    - Sample Bottles (Alkalinity and pH)
    - Sample Bottles (TOC)
    - Pipettes and Glassware

# Coagulant Dosage Equivalents

Regular Grade Alum (Aluminum Sulfate) $\text{Al}_2(\text{SO}_4)_3^*$ 14 $\text{H}_2\text{O}$ (mg/L)	Reagent Grade Alum (Aluminum Sulfate) $\text{Al}_2(\text{SO}_4)_3^*$ 18 $\text{H}_2\text{O}$ (mg/L)	Ferric Chloride $\text{FeCl}_3^*$ 6 $\text{H}_2\text{O}$ (mg/L)	Ferric Chloride $\text{FeCl}_3$ (mg/L)	Ferric Sulfate $\text{Fe}_2(\text{SO}_4)_3^*$ 9 $\text{H}_2\text{O}$ (mg/L)	Ferrous Sulfate $\text{FeSO}_4^*$ 7 $\text{H}_2\text{O}$ (mg/L)
10	11.2	9.1	5.5	9.5	9.4
20	22	18	11	19	19
30	34	27	16	28	28
40	45	36	22	38	37
50	56	46	27	47	47
60	6	55	33	57	56
70	78	64	38	66	66
80	90	73	44	76	75
90	101	82	49	85	84
100	112	91	55	95	94

# § 141.135 Treatment Technique For DBPP

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- **Testing Protocol**
  1. **Collect Raw Water**
  2. **Measure pH and Alkalinity**
  3. **Determine Maximum Dose**
    - **Add Incremental Doses**
    - **Achieve Target pH**
  4. **Fill Required Number of Beakers**
  5. **Add Coagulant Doses**
    - **Mimic Plant With Apparatus**
  6. **Pipette Supernatant Samples for:**
    - **TOC**
    - **pH**
    - **Alkalinity**

# Example Data Sheet for Jar Tests

	Units	Raw	Jar #1	Jar #2	Jar #3	Jar #4	Jar #5	Jar #6
Coagulant Dose	mg/L							
Volume of Coag. Stock Solution	mL							
TOC	ID #							
	mg/L							
DOC	ID #							
	mg/L							
UV254	ID #							
	1/cm							
SUVA	L/mg-m							
pH								
Alkalinity	mg/L							

# Bench Scale Testing

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## Case Study 1:

- A Utility's Compliance Ratio Is 0.95
- An Average of 25 Percent TOC Removal Is Required
  - Alkalinity Between 120 and 240 mg/L
  - TOC > 4.0 to 8.0
- Bench Scale Testing
  - Determine Dose for 25 Percent Removal

# Bench Scale Testing

- Enhanced Coagulation and Enhanced Softening
  - Step 1: Required Removal of TOC

Source Water TOC (mg/L)	Source Water Alkalinity (mg/L as calcium carbonate)		
	0-60	> 60-120	> 120
> 2.0 to 4.0	35%	25%	15%
> 4.0 to 8.0	45%	35%	25%
> 8.0	50%	40%	30%

# § 141.135 Treatment Technique For DBPP

- Step 2: Target pH

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

# Case Study 1 Results of pH Titration (alkalinity 120 - 240)

Alum Dose (mg/L)	Resulting pH
0	7.95
10	7.8
20	7.7
30	7.5
40	7.4
50	7.35
60	7.25
70	7.2
80	7.15
90	7.05
100	6.9

(target pH of 7.0)



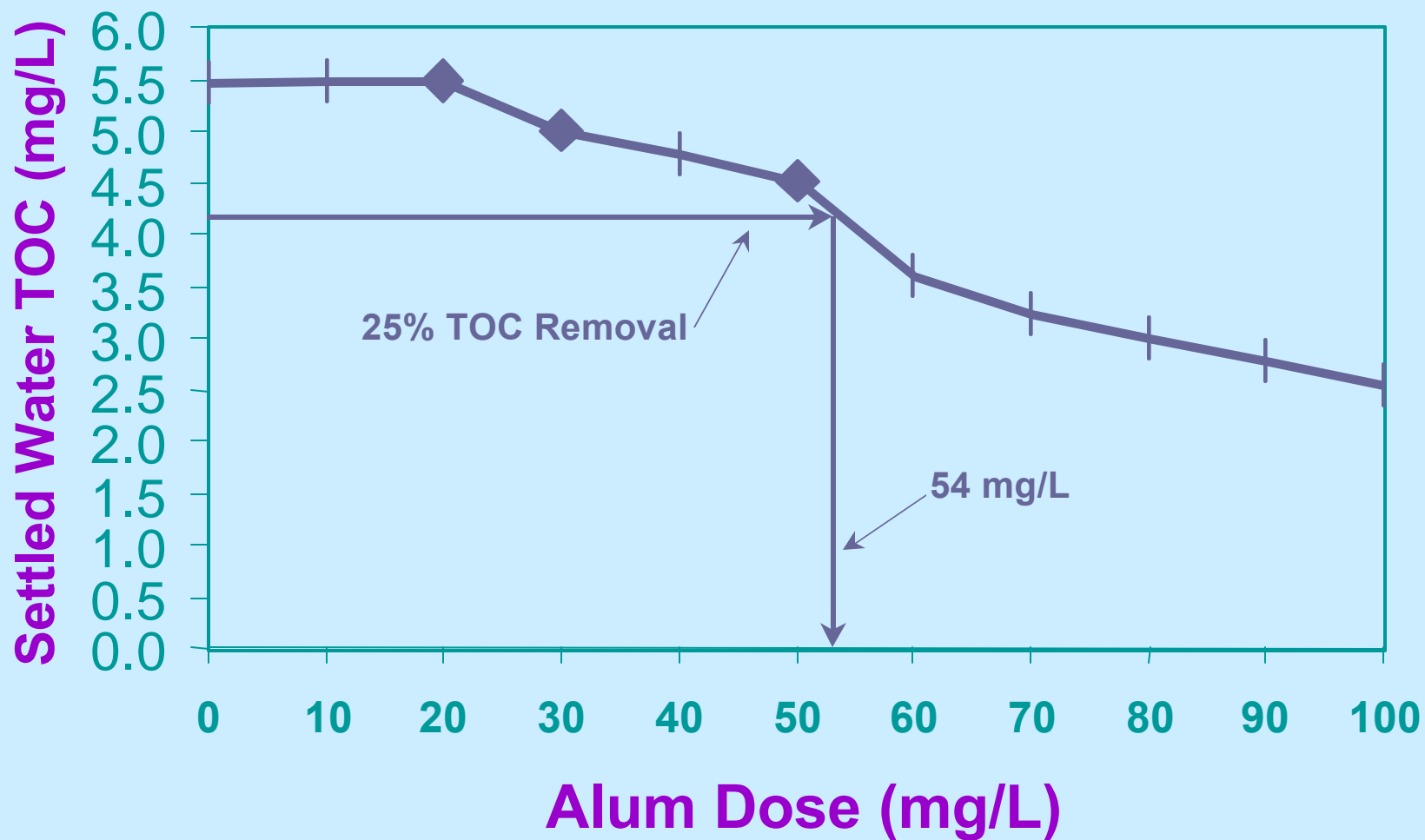
# Case Study 1 Jar Test Results

Alum Dose (mg/L)	TOC (mg/L)	TOC Removal (%)
0	5.45	
10	5.50	0
20	5.50	0
30	5.00	8
40	4.78	15
50	4.52	22
60	3.60	34
70	3.24	39
80	3.00	44
90	2.78	49
100	2.53	54

This utility's goal is 25 percent TOC removal

# Case Study 1 – Estimating Dose

## Settled Water TOC vs. Coagulant Dose



# Bench Scale Testing

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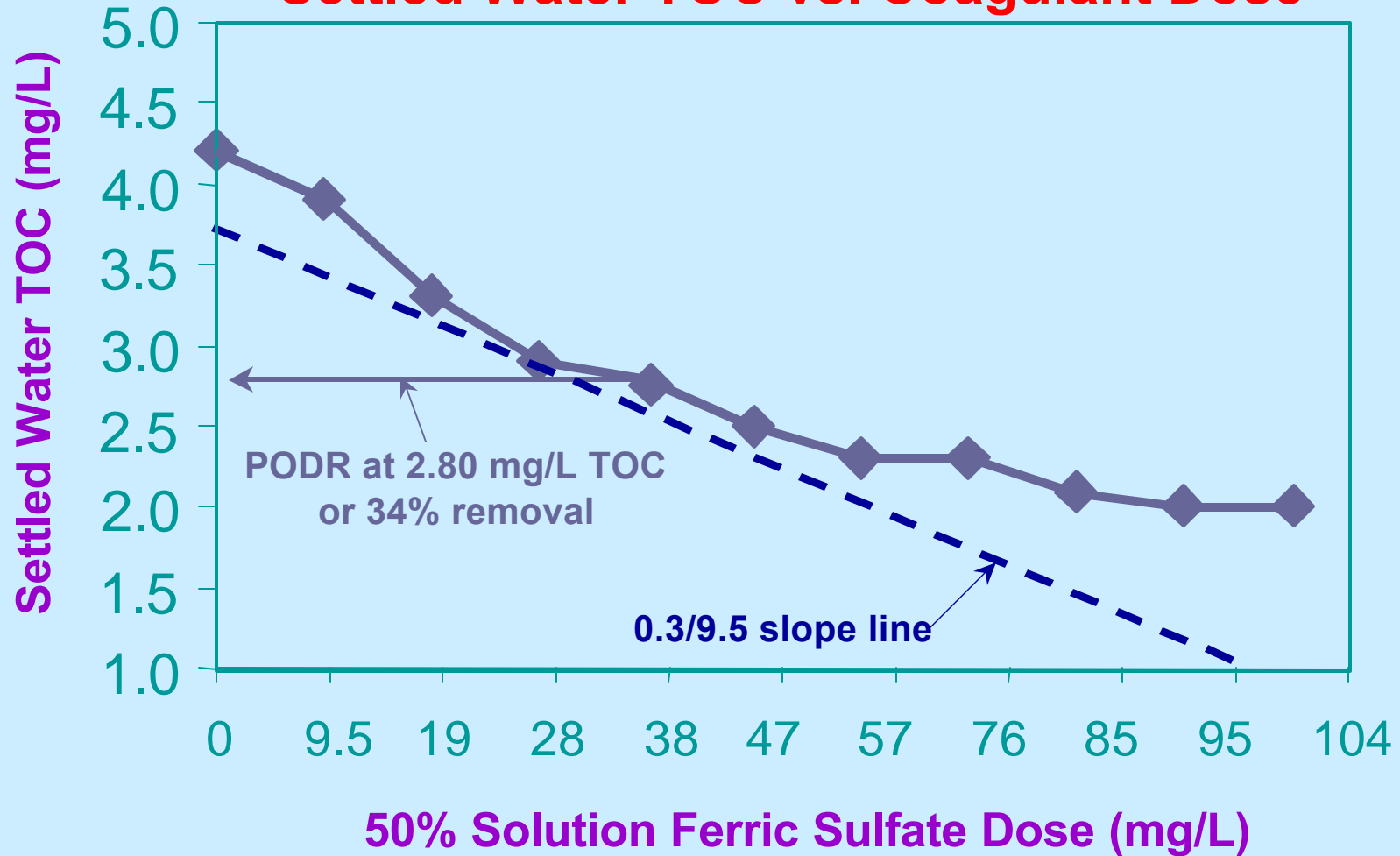
- **Case Study 2:**
  - **After 12 Months This System:**
    - **Is Unable to Meet Step 1**
    - **Does Not Meet an Alternative Compliance Criterion.**

# Case Study 2 Jar Test Results

<b>50% Ferric Sulfate Solution Dose (mg/L)</b>	<b>TOC (mg/L)</b>	<b>TOC Removed (Per Dose)</b>	<b>TOC Removal (%)</b>
0	4.2		
9.5	3.9	0.30	7
19	3.3	0.60	23
28	2.9	0.40	31
38	2.8	0.10	34
47	2.5	0.30	40
57	2.3	0.20	45
66	2.3	0.00	45
76	2.1	0.20	50
85	2.0	0.10	52
95	2.0	0.00	52

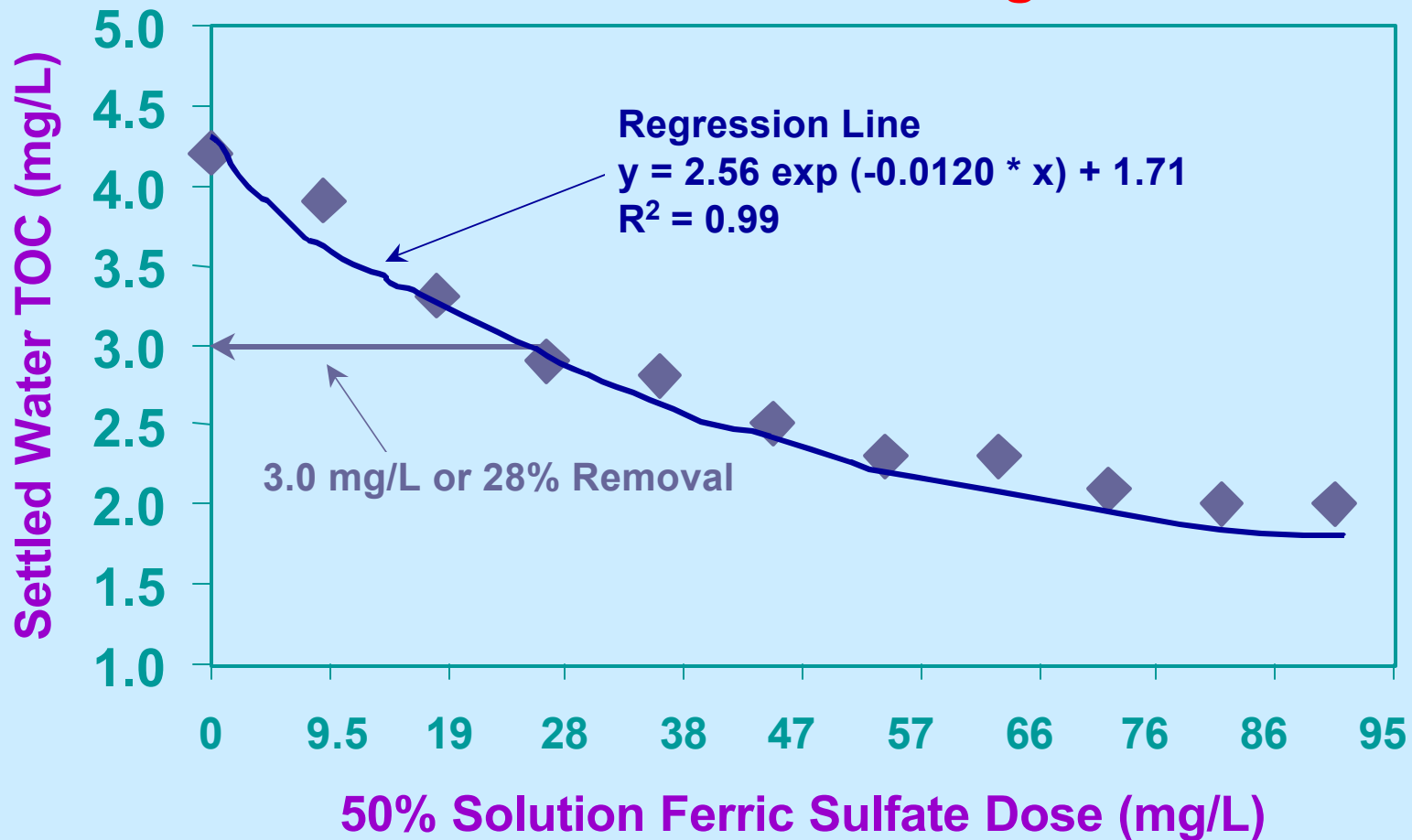
# Case Study 2 – Determining Step 2 Removal

## Settled Water TOC vs. Coagulant Dose



# Case Study 2 – Determining Step 2 Removal

## Settled Water TOC vs. Coagulant Dose



# Bench Scale Testing

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- **Case Study 3**
  - **A System With Alkalinity < 60 mg/L**
  - **Must Add Base to Maintain pH Between 5.3 and 5.7**

## Case Study 3 – Base Addition

Jar #	Ferric Dose (mg/L)	Base (NaOH) Dose (mg/L)	pH	
			Rapid Mix	Settled Water
Blank	0	0	7.2	7.2
1	9	9	6.5	6.6
2	18	18	6.2	6.6
3	27	27	5.9	6.1
4	36	36	5.5	5.7
5	46	46	5.5	5.7
6	55	55	5.5	5.6
7	64	64	5.5	5.6

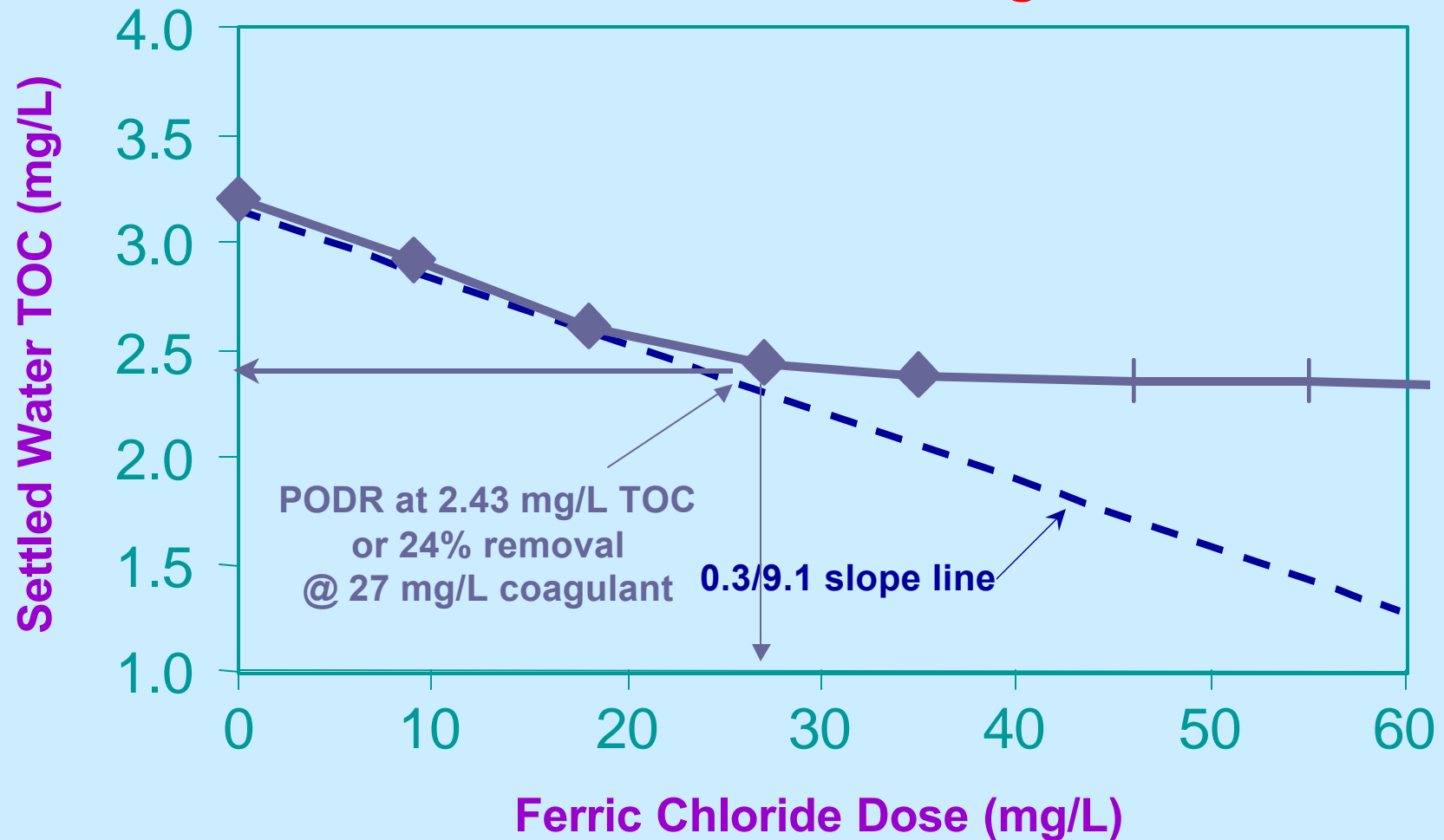


# Case Study 3 – Jar Test Results

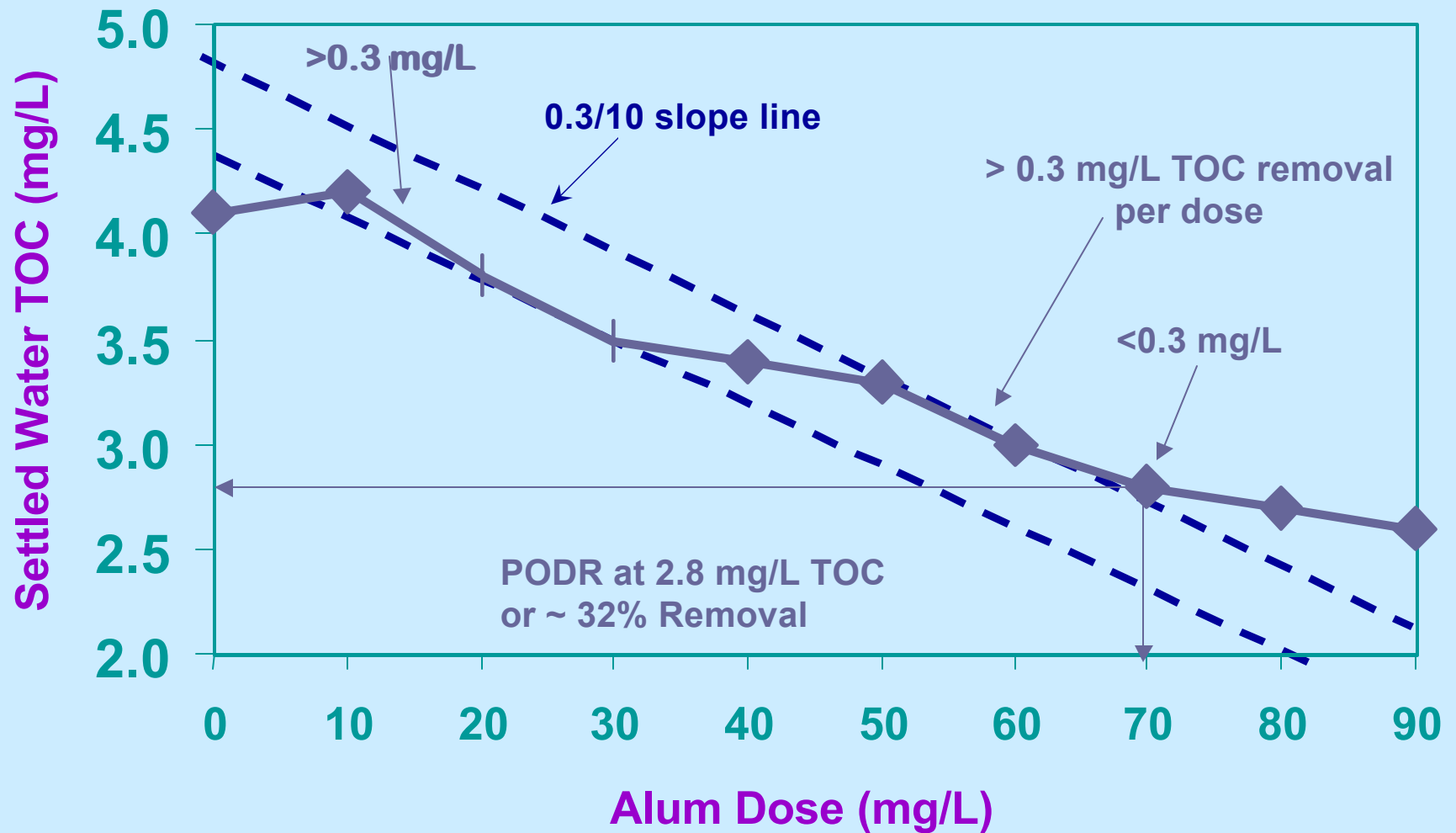
<b>Ferric Chloride Hexahydrate Dose (mg/L)</b>	<b>TOC (mg/L)</b>	<b>TOC Removed per Dose</b>	<b>TOC Removal (%)</b>
0	3.2		
9	2.92	0.28	9
18	2.60	0.32	19
<b>27</b>	<b>2.43</b>	<b>0.17</b>	<b>24</b>
35	2.38	0.05	26
46	2.35	0.03	27
55	2.35	0.00	27
64	2.35	0.00	27

# Case Study 3

## Settled Water TOC vs. Coagulant Dose



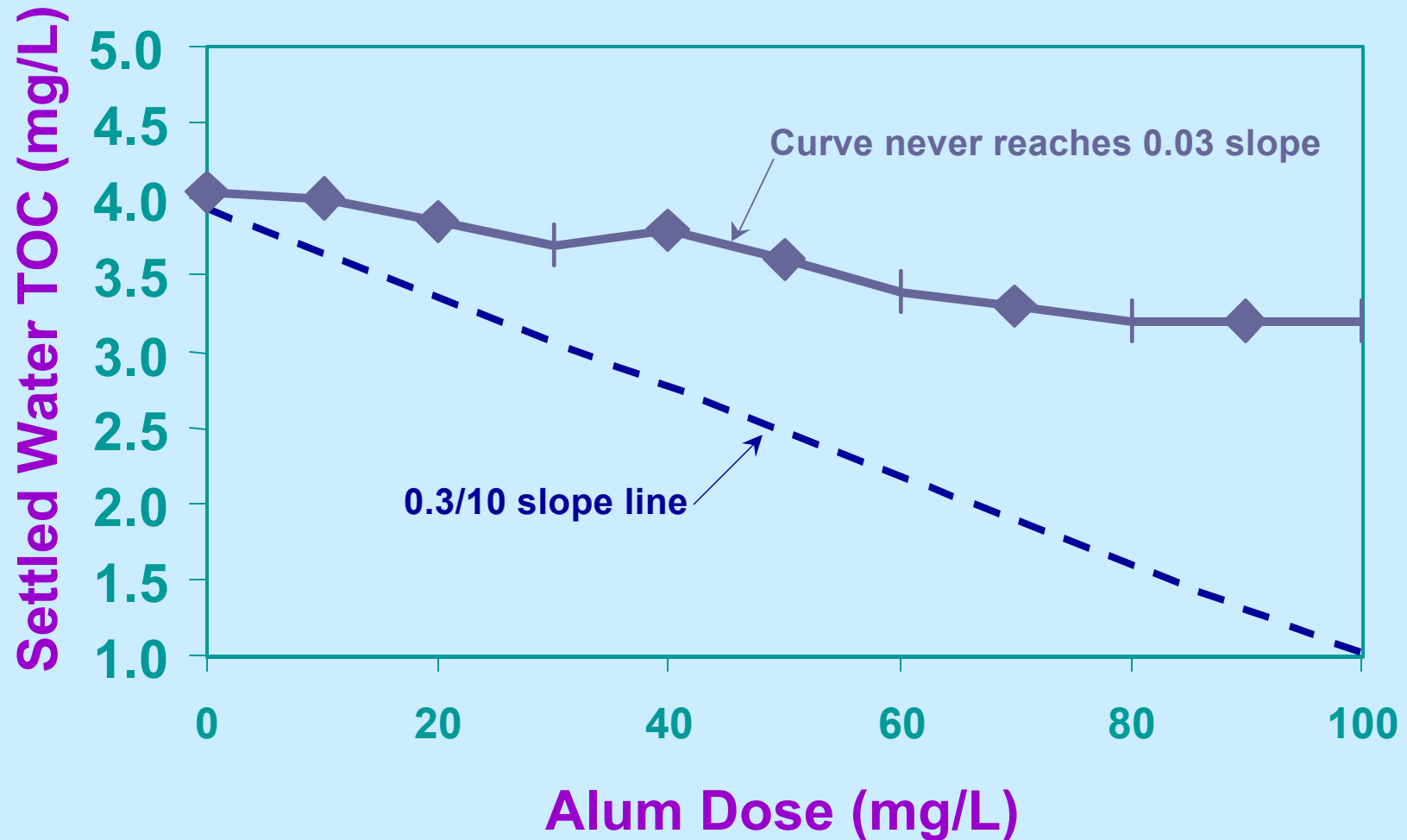
# Case Study 4 – PODR Is Met Twice



# Case Study 5 – PODR Never Reached

<b>Alum Dose (mg/L)</b>	<b>TOC (mg/L)</b>	<b>TOC Removed (per dose)</b>	<b>TOC Removal (%)</b>
0	4.05		
5	3.95	0.10	3
10	4	-0.05	1
20	3.85	0.15	5
30	3.7	0.15	9
40	3.8	-0.10	6
50	3.6	0.20	11
60	3.4	0.20	16
70	3.3	0.10	19
80	3.2	0.10	21
90	3.2	0.00	21
100	3.2	0.00	21

# Case Study 5 – PODR Is Never Reached



# Workshop

*Step 2 Bench Scale Testing*

# § 141.133 Compliance

*For DBPP*

# **§ 141.133 Compliance – DBP Precursors**

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- **Compliance Determined As Specified by § 141.135(b)**
  - **Alternative Compliance Criteria**
  - **Additional Alternative Compliance Criteria for Softening**
  - **Step 1 TOC Reductions**
  - **Step 2 TOC Reductions**
- **Early Monitoring Recommended**



# § 141.133 Compliance – DBP Precursors

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- **For Each of 12 Months**
  - Determine Actual TOC Percent Removal
  - Determine Required TOC Percent Removal
    - Divide Actual by Required
  - Add 12 Results Together
    - Divide by 12
- **Result Must Be  $\geq$  1.00 for Compliance**
  - System May Assign Monthly Value of 1.0 for Any Month One of the Alternative Compliance Criteria Is Met

# § 141.133 Compliance – DBP Precursors

- Compliance Calculations

Month	<u>A</u> Treated TOC (mg/L)	<u>B</u> Source TOC (mg/L)	<u>C</u> % removed (1-A/B) x 100	<u>D</u> Source Water Alkalinity (mg/L)	<u>E</u> Required TOC Removal (%)	<u>F</u> C/E
Jan.						1.10
Feb.						0.94
Mar.						1.03
Apr.						1.07
May						0.98
Jun.						1.24
Jul.						1.10
Aug.						1.07
Sep.						1.02
Oct.	4.6	8.2	44	70	40	1.10
Nov.	4.0	6.1	34	75	35	0.98
Dec.	4.4	6.2	29	85	35	0.83

If average is  $\approx$  1.00,  
the PWS is **in compliance**

**s (F) = 12.48**  
**12.48/12= 1.04**

# **§ 141.134 Reporting and Recordkeeping**

*For DBPP and Enhanced Coagulation or  
Enhanced Softening*

# § 141.134 Reporting and Recordkeeping – DBPP

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- **A System Required to Meet Minimum TOC Removals**
  - **Number of Paired Samples Taken During Last Quarter**
  - **Location, Date, and Result of Each**
    - **Paired Sample**
    - **Alkalinity**
  - **Each Month's**
    - **Average Percent TOC Removal**
    - **Required TOC Percent Removal**
  - **Compliance Calculations**
  - **Whether System Is in Compliance**

# § 141.134 Reporting and Recordkeeping – DBPP

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- **Systems Monitoring for DBPP Monthly or Quarterly and Meeting Alternative Compliance Criteria**
  - **Criterion Used**
  - **Number of Paired Samples in Last Quarter**
  - **Location, Date, and Result of Each**
    - **Paired Sample**
    - **Alkalinity**
  - **For Those Meeting **TOC Criteria** the Running Annual Average Of:**
    - **Source Water TOC or**
    - **Treated Water TOC**
  - **Whether the System Is in Compliance**

# § 141.134 Reporting and Recordkeeping – DBPP

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- **Systems Monitoring for DBPP Monthly or Quarterly and Meeting Alternative Compliance Criteria**
  - **Criterion Used**
  - **Number of Paired Samples in Last Quarter**
  - **Location, Date, and Result of Each**
    - **Paired Sample**
    - **Alkalinity**
  - **For Those Meeting **SUVA Criteria** the Running Annual Average Of:**
    - **Source Water SUVA or**
    - **Treated Water SUVA**
  - **Whether the System Is in Compliance**

# § 141.134 Reporting and Recordkeeping – DBPP

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- **Systems Monitoring for DBPP Monthly or Quarterly and Meeting Alternative Compliance Criteria**
  - **Criterion Used**
  - **Number of Paired Samples in Last Quarter**
  - **Location, Date, and Result of Each**
    - Paired Sample
    - Alkalinity
  - **For Those Meeting Source Water TOC, Alkalinity, and Distribution TTHM and HAA5 Criteria**
    - The Annual Average Source Water TOC
    - The Annual Average Alkalinity
    - The Annual Averages of TTHM and HAA5
  - **Whether the System Is in Compliance**

# § 141.134 Reporting and Recordkeeping – DBPP

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- **Systems Monitoring for DBPP Monthly or Quarterly and Meeting Alternative Compliance Criteria**
  - **Criterion Used**
  - **Number of Paired Samples in Last Quarter**
  - **Location, Date, and Result of Each**
    - **Paired Sample**
    - **Alkalinity**
  - **For Those Systems Using Only Chlorine and Whose TTHM and HAA5 Levels Are No More Than 50 Percent of the MCLs**
    - **The TTHM and HAA5 Running Annual Averages**
  - **Whether the System Is in Compliance**



# § 141.134 Reporting and Recordkeeping – DBPP

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- **Softening Systems Monitoring for DBPP Monthly or Quarterly and Meeting Alternative Compliance Criteria**
  - Criterion Used
  - Number of Paired Samples in Last Quarter
  - Location, Date, and Result of Each
    - Paired Sample
    - Alkalinity
  - For Softening Plants Lowering **Alkalinity to < 60 mg/L**
    - **The Running Annual Average Treated Water Alkalinity**
  - Whether the System Is in Compliance

# § 141.134 Reporting and Recordkeeping – DBPP

- **Softening Systems** Monitoring for DBPP Monthly or Quarterly and Meeting Alternative Compliance Criterion
  - Criterion Used
  - Number of Paired Samples of Last Quarter
  - Location, Date, and Result of Each
    - Paired Sample
    - Alkalinity
  - For Softening Systems **Removing at Least 10 mg/L Mg Hardness**
    - **The Running Annual Average of Mg Hardness Removal**
  - Whether the System Is in Compliance

**Code of Federal Regulations**  
**Title 40**  
**Part 142—NPDWR**  
**Implementation**

# **Subpart B—Primary Enforcement Responsibility**

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- **§142.16 Special Primacy Requirements**
  - EPA’s Regulation of States for Purpose of Awarding Primacy
- **Arrangement of Guidance**
  - IESWTR
  - Stage 1 DBPR
- **Note: Guidance Often Goes Beyond Minimum Requirements**
  - “Must”
  - “May” or “Should”

# **Stage 1 Disinfectants/ Disinfection Byproducts Rule**

*Special Primacy Requirements*

*§142.16*

# **Stage 1 DBPR §142.16 Special Primacy Requirements**

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- **(h) Requirements for States to Adopt 40 CFR Part 141, Subpart L. In Addition to the General Primacy Requirements Elsewhere in This Part, Including the Requirement That State Regulations Be at Least As Stringent As Federal Requirements, an Application for Approval of a State Program Revision That Adopts Subpart L, Must Contain**
  - **A Description of How the State Will Accomplish the Following Program Requirements...**

# Stage 1 DBPR §142.16 Special Primacy Requirements

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- **(h) A Description of How the State Will Accomplish the Following Program Requirements...**
  - **(1) Interim Treatment**
  - **(2) Qualification of Operators**
  - **(3) DPD Test Kit Approval**
  - **(4) Approval of Parties**
  - **(5) Multiple Wells/Single Aquifer**
  - **(6) Step 2 TOC Removal Requirements**

# Stage 1 DBPR §142.16(h)

---

- **(1) How the State Will Determine Any Interim Treatment Requirements for Systems Installing GAC or Membranes to Comply With DBP MCLs**
- **Satisfied By:**
  - **An Explanation of How Systems Will Qualify for an Extension, Conditions That Could Be Included in an Extension Agreement, and Interim Treatment Measures That the State May Specify.**



# Stage 1 DBPR §142.16(h)

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- **(2) How the State Will Qualify Operators Subject to the Provisions of Subpart L**
- **Satisfied By:**
  - **A Description of the State's Program for Determining the Minimum Qualifications Necessary for Operators of Systems Subject to Subpart L**
- **Options Include:**
  - **Procedures Established Under the SWTR**
  - **State Operator Certification Program Meeting EPA Guidelines**
  - **Others**

# Stage 1 DBPR §142.16(h)

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- **(3) How the State Will Approve DPD Colorimetric Test Kits for Free and Total Chlorine Measurements**
- **Satisfied By:**
  - **Providing Copies of the Rules or Other Authorities That**
    - **Allow DPD Colorimetric Test Kits or**
    - **Disallow DPD Colorimetric Test Kits**
  - **The Relevant Sections Should Be Cited**

# Stage 1 DBPR §142.16(h)

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- **(4) How the State Will Approve Parties to Conduct pH, Bromide, Alkalinity, and Residual Disinfectant Concentration Measurements**
- **Satisfied By:**
  - **The State's Process for Similar Approvals Under the SWTR or**
  - **A Description of the Process That Demonstrates It Ensures the Measurements Are Reliable and Accurate**
  - **Should Include:**
    - **Training Requirements**
    - **Laboratory Facilities (If and When Necessary)**
    - **Certification As Qualified Operator**
    - **Under Supervision of a Qualified Operator**

# Stage 1 DBPR §142.16(h)

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- **(5) How a State Will Define the Criteria to Use to Determine If Multiple Wells Are Being Drawn From a Single Aquifer**
- **Satisfied by**
  - **A Description of Criteria That Will Provide Reasonable Assurance Each Well Is Drawing From the Same Aquifer and Would Have Very Similar DBP Formation Potential**

# Stage 1 DBPR §142.16(h)

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- **Multiple Wells—Suggestions**
  - **Well Construction and Geology**
    - Locations
    - Depths
    - Well Log Information (Strata, Water Producing Zones, Screened Intervals, Grouting, Etc.)
    - Static Water Level (SWL)
    - Aquifer Studies and Maps
    - Treatment Applied
  - **Water Characteristics and Chemistry**
    - pH
    - Temperature
    - Conductivity
    - TOC
    - Common Ions

# Stage 1 DBPR §142.16(h)

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- **Multiple Wells—Suggestions (Cont.)**
  - **Use Information From USGS and State Geological Survey (Bureau of Mines and Geology)**
  - **Require an Analysis by a Professional**

# Stage 1 DBPR §142.16(h)

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- **(6) How the State Will Accomplish the Approval of Alternate Minimum TOC Removal (Step 2) Requirements**
- **Satisfied by**
  - **A Description of an Approval Process That Is Consistent With the Requirements of §141.135(b) and Maximizes TOC Removal**
- **Guidance**
  - **Enhanced Coagulation and Enhanced Softening, EPA, 1999**

# Stage 1 DBPR §141.132(f) Monitoring Plans

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- **Each Regulated System Must Develop and Implement a Monitoring Plan. It Must Be Available to the State and Public No Later Than 30 Days Following Compliance Date and Subpart H Systems Serving More Than 3,300 Must Submit a Copy to the State With First Report. The Plan Must Include:**
  - **Locations and Schedules for All Parameters**
  - **How Compliance With MRDLs, MCLs, and Treatment Techniques Will Be Calculated**
  - **If Consecutive System, or If Providing Water to a Consecutive System, Under Provisions of §141.29, the Plan Must Reflect the Entire Distribution System**



# Stage 1 DBPR §141.132(f) Monitoring Plans

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- **Suggestions**
  - **Cover Page**
  - **System Name**
  - **PWSID Number**
  - **Address**
  - **Contact Person, Number, Etc.**
  - **System Type (Community, NTNC, TNC)**
  - **Population Served**
  - **Source Information (Number, Surface/Ground)**
  - **Entry Points**
  - **Treatment Provided**

# Stage 1 DBPR §141.132(f) Monitoring Plans

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- **Suggestions**
  - **Required Subpart L Monitoring**
    - **Disinfection Byproducts**
    - **Disinfectants**
    - **Disinfection Byproduct Precursors**
  - **Schematic Drawings of Treatment Facilities**
    - **Sources**
    - **Treatment Type and Purpose**
    - **Chemicals Applied and Points of Application**
    - **Unit Processes of Each Treatment Train With Flow Rates**
    - **Sampling Points Identified and Numbered**

# Stage 1 DBPR §141.132(f) Monitoring Plans

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- **Suggestions**
  - **A Summary of Typical System Operating Characteristics, on a Seasonal Basis If Necessary**
    - **How Sources Are Used**
    - **Locations of Extended Residence Times**
  - **A Schedule for Collecting All Required Samples**
    - **Time for Collection**
    - **Site Location and ID Number**
    - **Handling/Preservation Requirements**
    - **Analysis Plan for Each Sample (On-Site, Certified Lab)**
    - **Regular Monitoring Requirement and Reduced**

# Stage 1 DBPR §141.132(f) Monitoring Plans

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- **Suggestions**
  - **For Conventional Surface Water Treatment Plants**
    - TOC Removal Requirements
    - Monitoring Locations, Frequencies, Etc.
  - **A Plan for Calculating Compliance With**
    - MCLs
    - MRDLs
    - Treatment Techniques