Ohio Environmental Protection Agency

Corrosion Control Treatment Recommendation
PWS Information

Please complete this form using the directions located at: https://epa.ohio.gov/ddagw/pws/leadandcopper#185385292-water-quality-parameters-and-corrosion-control		For Ohio EPA Use Only
PWS NAME:		**DRINKING WATER PROGRAM**
PWS ID:	**OH**	**COMPLIANCE NOTIFICATION**
COUNTY:		**CORROSION CONTROL RECOMENDATIONS**
SYSTEM TYPE:	☐ **Community** ☐ **Nontransient Noncommunity**	**PACKAGE ID:**

PWS CONTACT INFORMATION	
OWNER NAME	
PREPARER NAME/TITLE	
MAILING ADDRESSS	
TELEPHONE NUMBER	
EMAIL ADDRESS	
POPULATION SERVED	
AVERAGE DAILY USAGE	
NOTES	

Exhibit D.1 Water Quality Data - Raw Source[1]														
Source Name (if more than one source, copy this section and complete for each source)														
Source ID														
Source Type (Ground Water, Purchased, Surface Water, etc.)														
Sample Point ID														
Sample Collection Date	**Lead** (mg/L)	**Copper** (mg/L)	**pH**[2]	**Temperature**[2] (°C)	**Alkalinity** (mg/L as $CaCO_3$)	**Calcium** (mg/L as Ca)	**Total Dissolved Solids**[3] (mg/L)	**Conductivity**[3] (as µmho/cm @ 25 °C)	**Hardness** (mg/L as $CaCO_3$)	**Chloride** (mg/L)	**Sulfate** (mg/L)	**Iron** (mg/L)	**Manganese** (mg/L)	**Total Phosphorus**[4] (mg/L)
Maximum Value														
Minimum Value														
Average Value														

1 - Raw water monitoring is not required unless your PWS is adding a new source. Raw water monitoring may also be required if your PWS has had an action level exceedance or is proposing a treatment change. Include any source water raw water data available. **Copy sheet for multiple sources.**
2 - Conduct analysis in the field.
3 - Either total dissolved solids or conductivity can be measured.
4 - Only include total phosphorus if you are a surface water system.

Exhibit D.2 Water Quality Data - Entry Point[5]																			
WTP Name (if more than one plant, complete a separate form for each plant)																			
WTP ID																			
Source Name																			
Sample Point ID																			
Sample Collection Date	**Required for all Systems**											**Additional Parameters Required (See Instructions)**							
	pH[2]	**Temperature[2]** (°C)	**Alkalinity** (mg/L as $CaCO_3$)	**Calcium** (mg/L as Ca)	**Total Dissolved Solids[3]** (mg/L)	**Conductivity[3]** (as µmho/cm @ 25 °C)	**Hardness** (mg/L as $CaCO_3$)	**Chloride** (mg/L)	**Sulfate** (mg/L)	**Iron** (mg/L)	**Manganese** (mg/L)								
Maximum Value																			
Minimum Value																			
Average Value																			

2 - Conduct analysis in the field.
3 - Either total dissolved solids or conductivity can be measured.
5 - Enter data for each entry point. **Copy sheet for multiple entry points.**

Exhibit D.3 Water Quality Data - Distribution System																		
Distribution System Service Area																		
Distribution ID																		
Number of Sample Locations																		
Sample Location	**Sample Collection Date**	**Required for all Systems**							**Additional Parameters Required (See Instructions)**									
		pH[2]	**Temperature**[2] (°C)	**Alkalinity** (mg/L as $CaCO_3$)	**Calcium** (mg/L as Ca)	**Total Dissolved Solids**[3] (mg/L)	**Conductivity**[3] (as µmho/cm @ 25 °C)	**Hardness** (mg/L as $CaCO_3$)										
Maximum Value																		
Minimum Value																		
Average Value																		

2 - Conduct analysis in the field.
3 - Either total dissolved solids or conductivity can be measured.

Exhibit D.4 Lead and Copper Rule (LCR) Data Summary							
Lead Results (mg/L)							
Last 5 Monitoring Periods	**Sample Period Start Date**	**Sample Period End Date**	**No. of Samples**	**90th Percentile**	**Minimum Value**	**Maximum Value**	**# Samples > 0.015 mg/L**
1							
2							
3							
4							
5							
Copper Results (mg/L)							
Last 5 Monitoring Periods	**Sample Period Start Date**	**Sample Period End Date**	**No. of Samples**	**90th Percentile**	**Minimum Value**	**Maximum Value**	**# Samples > 1.3 mg/L**
1							
2							
3							
4							
5							

Exhibit D.5 Treatment Process Information									
WTP Name (if more than one plant, copy this section and complete for each plant)									
WTP ID									
Source Type									
Treatment Process[6]	**Current Treatment**					**Planned Future Treatment**			
	Mark an 'X' if applicable	**Chemical Used and Dosage (if applicable)**	**Average Concentration at EP**	**Date installed**	**Notes/Comments**	**Mark an 'X' if applicable**	**Chemical Planned and Dosage (if applicable)**	**Estimated Implementation Date (mm/yyyy)**	**Notes/Comments**
Disinfection[7]									
Filtration									
Softening[8]									
Phosphate addition (mg/L as PO_4)[9]									
pH Adjustment									
Other Processes (surface water treatment, GAC, aeration, lime softening, etc.)									
Other Processes (surface water treatment, GAC, aeration, lime softening, etc.)									
Other Chemical Addition[10]									
Chemical Name #1									
Chemical Name #2									

6 - If treatment is more substantial than this table allows, please include a treatment schematic with chemical dosage, concentration, and installation date for each chemical.
7 - Include concentration of residual chlorine in Note/Comments field.
8 - Include hardness in Notes/Comments field.
9 - Include percentage of the blend that is orthophosphate in Notes/Comments field.
10 - Include treatment objective in Notes/Comments for all other chemicals.

Exhibit D.6a Lead Service Line Information	
Question	**Response**
Does your system have **ANY** full[11] or partial[12] lead service lines (YES or NO)?	
If **YES**, approximately how many full lead service lines are in place?	
If **YES**, approximately how many partial lead service lines are in place?	
What was the approximate range of years the lead service lines were installed (YYYY to YYYY)?	

11 - A full lead service line refers to the pipe from the water main to the residence being lead pipe, see illustration below (Source: Sandvig et al., 2008).

12- A partial lead service line refers to only a portion of the pipe from the main to the residence being lead pipe. This could be the portion of the pipe that is under the control of the utility or the portion of the pipe that is under the control of the property owner, see illustration below (Source: Sandvig et al., 2008).

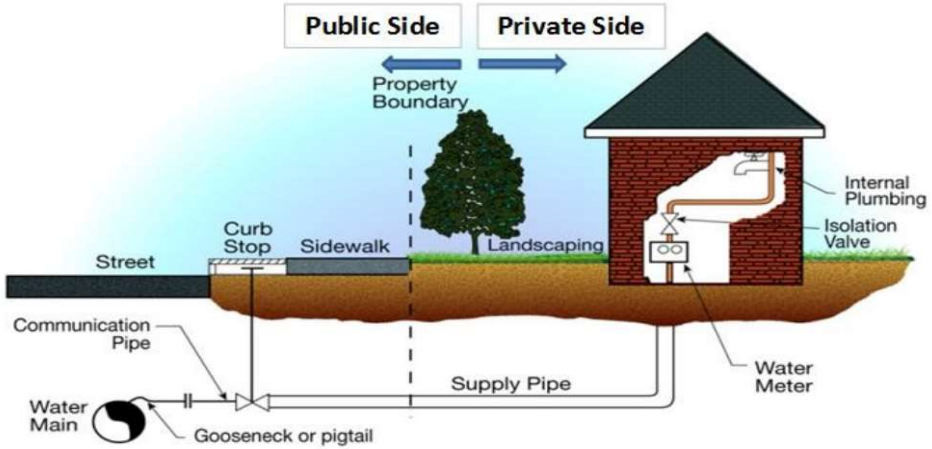

Exhibit D.7a Distribution System Materials and Operation	
Question	**Response**
When was your lead map last updated?	
What percentage of water mains are unlined cast iron? What is the approximate total length of unlined cast iron mains (feet)?	
Provide any additional comments on distribution system materials (e.g., list all types).	
Do you flush your system (YES or NO)?	
If **YES**, how often do you flush your system?	
Do you have dead-ends in your system that have experienced water quality problems (YES or NO)?	
If you chloraminate, do you use free chlorine periodically during the year (YES or NO)?	
If **YES,** approximately how often do you use free chlorine and at what dose?	
If **YES**, approximately how long is free chlorine used? (i.e. one week, one month, etc.…)	

Do you have red water complaints (YES or NO)?			
If **YES,** how often do they occur? Rarely (a few times a year), Sometimes (monthly), Regularly (weekly)			
Are there signs or history of copper pitting in the distribution system (YES or NO)?			
If **YES,** how has the issue been addressed?			
Does your system purchase any water (YES or NO)?			
If **YES**, how much? If it varies by month please list an average per month.			
What is the source of the purchased water?			
Do you have plans to change your source water or purchase water from another system (YES or NO)?			
If **YES**, please describe.			
If applicable, do you have plans to change your coagulant in the near future (i.e. in the next 1-3 years) (YES or NO)?			
	Current Coagulant	Future Coagulant	
If **YES**, please list your current coagulant and the coagulant you plan to use. Please include the planned implementation date.			
		Planned Install Date:	

Has the system completed any corrosion control studies? (YES or NO)		
If **YES**, attach the study results and complete the following rows:	Date(s) of the study:	
	Who completed the study:	
	Brief summary of the results:	
	Were treatment changes recommended?	
	Were treatment changes implemented?	
	Have corrosion characteristics of the treated water changed?	
	If yes, how has the change been measured? (i.e. general observation, coupon studies, frequency of complaints, etc.)	
	Is treatment still in use? If not, explain.	

Exhibit E.1 Identification of Options		
Exhibit E.1a Identification of Primary Recommended Optimized Corrosion Control Treatment Option		
Primary Corrosion Control Treatment Options	**Put an X next to the option(s) that were evaluated**	**Identify possible treatment chemicals (chemical formula or common name), processes, approaches for the options identified**
pH Adjustment		
Alkalinity Adjustment		
Add or modify phosphate inhibitor		

Exhibit E.1b Identification of Supplemental Corrosion Control Options		
Supplemental Corrosion Control Options	**Put an X next to any options that are proposed for supplemental treatment**	**Identify possible treatment chemicals (chemical formula or common name), processes, approaches for the options identified**
Chloride to Sulfate Mass Ratio Adjustment		
Oxidation/Reduction Potential Adjustment		
Calcium carbonate stabilization		
Water age management/ distribution flushing program		
Other:		

Exhibit E.1c: No Installation of Optimal Corrosion Control Treatment		
Options	**Put an X next to option**	**Identify rationale for option**
Fixture Replacement/Complete Distribution System Replacement **(NTNC Only)**		
No Change (i.e. Corrosion Control Treatment is already installed or Proposed source or treatment change will not effect water quality) **Not applicable for ALE systems**		

Exhibit E.2 Evaluation of Secondary Impacts[1] - Utilize Appendix B to complete this section.					
WTP Name (if more than one WTP, copy this section and complete for each WTP)					
WTP ID					
CONSTRAINTS	**pH/Alkalinity Adjustment**	**Orthophosphate**	**Blended Phosphate**	**Supplemental Corrosion Control**	**Complete Distribution System Replacement**
A. Regulatory					
SOC/IOCs					
SWTR: Turbidity					
Total Coliforms					
SWTR/GWR: Disinfection					
Disinfection Byproducts					
Lead and Copper Rule					
Radionuclides					
Harmful Algal Bloom Rule					
Iron and Manganese					
B. Functional					
Taste & Odor					
Operational Issues					
Wastewater Permit					
Aesthetics					
Chemical Availability					
Cost					
Operator ability to use chemical and operate treatment					
Potential for excessive scaling (See OCCT Manual Exhibit 3-2)					
Additional Notes/Comments					

[1] Complete for each corrosion control treatment option identified in Exhibit E.1

Exhibit E.2 Documentation of Recommendation		
Exhibit E.3a Documentation of Recommended Approach		
WTP Name		
WTP ID		
Identify Recommended Approach	**Put an X next to approach**	**Summarize rationale for selected approach or provide details in Exhibit E.3b**
Install Primary Treatment		Provide details in Exhibit E.3b
Install Primary Treatment and Supplemental Treatment		Provide details in Exhibit E.3b
Fixture Replacement/ Complete Distribution System Replacement (NTNC Only)		
No Change		Provide details in Exhibit E.3b and/or Appendix 1

Exhibit E.3b Documentation of CCT Recommendation (fill as applicable)							
Identify Recommended Treatment Approach	**Adjust pH**	**Adjust Alkalinity**	**Add Blended or Orthophosphate[2]**			**Supplemental Treatment**	
Recommended Chemical or Process					pH adjustment included (Y/N):		
Approximate Dosage					%Orthophosphate in blend:		
Recommended Levels at the Entry Point	**pH**	**Alkalinity (mg/L as $CaCO_3$)**	**pH**	**Orthophosphate (mg/L as P)[3]**	**Total Phosphorus (mg/L as P)**	*e.g. CSMR, ORP*	
Minimum							
Maximum							
Average							
Recommended Levels in the Distribution System	**pH**	**Alkalinity (mg/L as $CaCO_3$)**	**pH**	**Orthophosphate (mg/L as P)[3]**	**Total Phosphorus (mg/L as P)**	*e.g. CSMR, ORP*	
Minimum							
Maximum							
Average							
Does the recommended OCCT require the installation of new equipment or the use of a new chemical? If so, describe:							
Please provide any additional comments that will assist in determining OCCT for your PWS.							

2 - If pH will also be adjusted as part of a phosphate based treatment approach, include the chemical that will be used for pH adjustment. Please note, target pH values are still required for phosphate treatment regardless of whether pH is adjusted.
3- If an orthophosphate concentration is given in units of "mg/L as PO4" or "mg/L as orthophosphate," the value must be divided by 3 to convert to "mg/L as P".

By signing this document, I am confirming that I acknowledge and warrant the truthfulness of the information provided in this document. I hereby certify that the recommendation submmited will be implemented in accordance with Ohio Administrative Code Rules 3745-81-81 and 3745-81-82.

PRINTED NAME and Signature of Party Preparing this Recommendation

Date

PRINTED NAME and Signature of Responsible Party from Public Water System

Date

Appendix A.1: Proposed Water Quality Data - Entry Point[1]			
WTP Name (if more than one plant, copy this section and complete for each plant)			
WTP ID			
Source Name			
Sample Point ID			
	Proposed Water Quality Parameter Targets		
	Maximum	**Minimum**	**Average**
Lead[2] (mg/L)			
Copper[2] (mg/L)			
pH[3]			
Temperature[3] (˚C)			
Alkalinity (mg/L as $CaCO_3$)			
Calcium (mg/L as Ca)			
Total Dissolved Solids[4] (mg/L)			
Conductivity[4] (as µmho/cm @ 25 ˚C)			
Hardness (mg/L as $CaCO_3$)			
Chloride[5] (mg/L)			
Sulfate[5] (mg/L)			
Iron[5] (mg/L)			
Manganese[5] (mg/L)			
Total Phosphorus[6] (mg/L)			
Orthophosphate[6] (mg/L as P)			
Silica[6] (mg/L as SiO2)			
Total Chlorine[7] (mg/L as Cl_2)			
Free Chlorine[7] (mg/L as Cl_2)			
Aluminum[5] (mg/L)			
Dissolved Oxygen (DO)			
Dissolved Inorganic Carbon (DIC)			
Stability			

1 - Enter water quality targets for each entry point. Copy sheet for multiple entry points. Estimate finished water quality as determined by bench scale testing, piloting, modeling, full scale operational data, or similar. The same parameters reported in Exhibit D.2 must be reported here.
2 - Entry point lead and copper are required if your PWS has had an action level exceedance, otherwise, include if data is available.
3 - Conduct analysis in the field.
4 - Either total dissolved solids or conductivity can be measured.
5 - As required by Ohio EPA. See instructions.
6 - Required when any phosphate compound or silica-based inhibitor is used.
7 - Required when disinfection is present.

Appendix A.2: Proposed Water Quality Data - Distribution System[1]			
Distribution System Service Area			
Distribution ID			
	Proposed Water Quality Parameter Targets		
	Maximum	**Minimum**	**Average**
pH[3]			
Temperature[3] (˚C)			
Alkalinity (mg/L as $CaCO_3$)			
Calcium (mg/L as Ca)			
Total Dissolved Solids[4] (mg/L)			
Conductivity[4] (as µmho/cm @ 25 ˚C)			
Hardness (mg/L as $CaCO_3$)			
Chloride[5] (mg/L)			
Sulfate[5] (mg/L)			
Iron[5] (mg/L)			
Manganese[5] (mg/L)			
Total Phosphorus[6] (mg/L)			
Orthophosphate[6] (mg/L as P)			
Silica[6] (mg/L as SiO2)			
Total Chlorine[7] (mg/L as Cl_2)			
Free Chlorine[7] (mg/L as Cl_2)			
Aluminum[5] (mg/L)			
Dissolved Oxygen (DO)			
Dissolved Inorganic Carbon (DIC)			
Stability			

1 - Enter water quality targets for the distribution system. Estimate finished water quality as determined by bench scale testing, piloting, modeling, full scale operational data, or similar. The same parameters reported in Exhibit D.3 must be reported here.
3 - Conduct analysis in the field.
4 - Either total dissolved solids or conductivity can be measured.
5 - As required by Ohio EPA. See instructions.
6 - Required when any phosphate compound or silica-based inhibitor is used.
7 - Required when disinfection is present.

Appendix B: Constraints Worksheet					
Systems who exceed the AL must review all constraints limiting the availability of CCT alternatives considered and address constraints which cause a treatment alternative to adversely impact other water treatment processes or to be ineffective for the PWS. This appendix contains potential constraints for the treatment alternatives in E.1. This worksheet lists both regulatory constraints and functional constraints which may cause a CCT alternative to be undesirable or infeasible. Use this information to complete Exhibit E.2: Evaluation of Secondary Impacts.					
CONSTRAINTS	**pH/Alkalinity Adjustment**	**Orthophosphate**	**Blended Phosphate**	**Supplemental Corrosion Control**	**Complete Distribution System Replacement**
A. Regulatory					
SOC/IOCs					
SWTR: Turbidity	Reduces inactivation effectiveness of free chlorine if pH adjusted before disinfection.* Potential for interference with dissolved ozone measurements. May increase turbidity from post-filtration precipitation of lime, aluminum, iron or manganese.	The addition of phosphate-based inhibitors can cause an increase in turbidity. Therefore, phosphate-based inhibitors should be installed downstream of the compliance sampling location for turbidity for surface water treatment plants.	The addition of phosphate-based inhibitors can cause an increase in turbidity. Therefore, phosphate-based inhibitors should be installed downstream of the compliance sampling location for turbidity for surface water treatment plants.		
Total Coliforms	Potential for higher total plate counts, confluent growth, or presence of total coliforms when chlorination is practiced.	If corrosion byproducts are released after the application of inhibitors, coliforms may be detected more frequently, and confluent growth is more likely.	If corrosion byproducts are released after the application of inhibitors, coliforms may be detected more frequently, and confluent growth is more likely.		
SWTR/GWR: Disinfection	Reduces inactivation effectiveness of free chlorine if pH adjusted before disinfection.* Potential for interference with dissolved ozone measurements.	The application of phosphate-based inhibitors to systems with existing corrosion byproducts can result in the depletion of disinfectant residuals within the distribution system. Additionally, under certain conditions phosphate-based inhibitors may stimulate biofilms in the distribution system.	The application of phosphate-based inhibitors to systems with existing corrosion byproducts can result in the depletion of disinfectant residuals within the distribution system. Additionally, under certain conditions phosphate-based inhibitors may stimulate biofilms in the distribution system.		
Disinfection Byproducts	Higher TTHM concentrations from chlorination if pH adjusted before disinfection.* Reduced effectiveness of some coagulants for precursor removal if pH adjusted before coagulation.*	No apparent effects.	No apparent effects.		
Lead and Copper Rule	pH/Alkalinity adjustment may be an effective OCCT method. Refer to the OCCT Manual for more information.	Orthophosphate is generally an effective OCCT method for lead. Refer to the OCCT Manual for more information.	Blended phosphates are not as effective as 100% orthophosphate in reducing lead levels.	The only methods for acceptable OCCT include pH/alkalinity adjustment and use of a phosphate-based inhibitor. Supplemental methods will not effectively lower lead or copper levels.	Removal of the source of lead or copper is an effective way of reducing levels at the tap.
Radionuclides	In-plant adjustments may affect removal of radioactive particles if precipitation techniques are used for coagulation or softening. Removal of radionuclides during softening may be linked to the degree of softening. Modifying softening practices to achieve corrosion control could interfere with removals.	No apparent effects.	No apparent effects.		
Harmful Algal Bloom Rule	Increase in pH may affect chlorination destruction in the clearwell.	Phosphate based inhibitors can increase phosporous in surface waters which can lead to an increase in harmful algal blooms.	Phosphate based inhibitors can increase phosporous in surface waters which can lead to an increase in harmful algal blooms.		
Iron and Manganese	Increased potential for post-filter precipitation may give undesirable levels of aluminum, iron or manganese.				

*Unless operating restraints dictate otherwise, the optimum location for pH adjustment is after disinfection and near entrance to the distribution system. If quicklime is used to adjust pH, for example, it needs to be added prior to filtration so inert material does not accumulate in the clearwell or enter the distribution system.

Appendix B: Constraints Worksheet					
Systems who exceed the AL must review all constraints limiting the availability of CCT alternatives considered and address constraints which cause a treatment alternative to adversely impact other water treatment processes or to be ineffective for the PWS. This appendix contains potential constraints for the treatment alternatives in E.1. This worksheet lists both regulatory constraints and functional constraints which may cause a CCT alternative to be undesirable or infeasible. Use this information to complete Exhibit E.2: Evaluation of Secondary Impacts.					
CONSTRAINTS	**pH/Alkalinity Adjustment**	**Orthophosphate**	**Blended Phosphate**	**Supplemental Corrosion Control**	**Complete Distribution System Replacement**
B. Functional					
Taste & Odor		Consumer complaints regarding red water, dirty water, color, and sediment may result from the action of the inhibitor or existing corrosion byproducts within the distribution system. Public ooutreach should be conducted prior to initiation of treatment. Distribution system should be prepared prior to initation of treatment (e.g. unidirectional flushing).	Consumer complaints regarding red water, dirty water, color, and sediment may result from the action of the inhibitor or existing corrosion byproducts within the distribution system. Public ooutreach should be conducted prior to initiation of treatment. Distribution system should be prepared prior to initation of treatment (e.g. unidirectional flushing).		
Operational Issues	Process optimization is essential. Additional controls, chemical feed equipment and operator attention may be required. Multiple entry points will require pH/Alkalinity adjustment at each entry location. Differing water qualities from multiple sources will require adjusting chemical doses to match the source.	Potential post-filtration precipitation of aluminum. Multiple entry points will require multiple chemical feed systems.	Potential post-filtration precipitation of aluminum. Multiple entry points will require multiple chemical feed systems.	It may be difficult to produce an acceptable coating of calcium carbonate on interior piping for large distribution systems. High CCPP levels may eventually lead to reduced hydraulic capacities in transmission lines near the treatment facility while low CCPP values may not provide adequate corrosion protection in the extremities of the distribution system.	
Wastewater Permit		The use of orthophosphate may present problems for wastewater facilities with NPDES permits (e.g. zinc, phosphorus).	The use of orthophosphate may present problems for wastewater facilities with NPDES permits (e.g. zinc, phosphorus).		
Aesthetics	The use of sodium-based chemicals for alkalinity or pH adjustments should be evaluated with regard to the total sodium levels acceptable in the finished water.	The use of sodium-based inhibitors should be evaluated with regard to the total sodium levels acceptable in finished water.	The use of sodium-based inhibitors should be evaluated with regard to the total sodium levels acceptable in finished water.		
Chemical Availability	Consider multiple suppliers in the event a chosen vendor is unable to meet demand.	Consider multiple suppliers in the event a chosen vendor is unable to meet demand.	Consider multiple suppliers in the event a chosen vendor is unable to meet demand.	Consider multiple suppliers in the event a chosen vendor is unable to meet demand.	
Cost	Consider installation, operations, and maitenace cost.	Consider installation, operations, and maitenace cost.	Consider installation, operations, and maitenace cost.	Consider installation, operations, and maitenace cost.	Consider installation, operations, and maitenace cost.
Operators ability to use chemical and operate treatment					
Potential for excessive scaling (See OCCT Manual Exhibit 3-2)	Use the OCCT Manual to evaluate whether the proposed target pH and alkalinity could potentially cause excessive scaling.	Raised turbidity and precipitation may occur in water high in calcium or aluminum or aluminum or if calcium is added during treatment (lime).	Raised turbidity and precipitation may occur in water high in calcium or aluminum or if calcium is added during treatment (lime).	Excessive calcium carbonate precipitation may produce “white water” problems in portions of the distribution system.	