# APPENDIX A

Questionnaire to Collect Data to Update the Guidance Manual for Selecting Lead and Copper Control Strategies This page is left intentionally blank.

# Questionnaire to Collect Data to Update the Guidance Manual for Selecting Lead and Copper Control Strategies

The purpose of the questionnaire is to obtain practical experience that has been gained by water systems in the treatment of copper using corrosion control treatment. This information will be used to update the *Guidance Manual for Selecting Lead and Copper Control Strategies*. Please note that ground water (gw) systems refer to those systems that use ground water exclusively. Surface water (sw) systems refer to those that use surface water, combined sources, or ground water under the direct influence of surface water.

Please return the questionnaire to Ms. Catherine Spencer at Black & Veatch by May 3, 2002. The contact address is 267 Hallowell Rd., Pownal, ME 04069. If you have any questions regarding this questionnaire, please contact Ms Spencer at (207) 688-4234 or spencercm@bv.com.

Name of individual completing the form:	Phone number:
Name of State Agency:	

1. Number of systems by State that are subject to the Lead and Copper Rule? Please break down the number of systems by system size and source type.

Table 1: Number of Systems Subject to the Lead and Copper Rule						
Large (> 50,000) Med (3,301 - 50,000) Small (≤ 3,300)						
gw	sw	gw	SW	gw	sw	

2. Number of systems that exceeded **only** the copper (Cu) action level (AL)? Number of systems that exceeded **both** the copper and lead (Pb) action levels? Please provide this information separately for systems with groundwater (gw) sources vs. those using surface water (sw) sources.

Table 2: Number of Systems that Exceeded the Copper Action Level						
No of Systems	Large (> 50,000) Med (3,301 - 50,000)		Small (≤ 3,300)			
	gw	SW	gw	SW	gw	sw
Exceeding Cu AL only						
Exceeding both Cu & Pb ALs						
Total						

3. Provide general treated or finished water quality characteristics of those groundwater systems in your State that exceeded the copper action level before corrosion control was implemented. Please provide general

treated or finished water quality characteristics of those surface water systems that exceeded the copper action level only (use Table 3a) and those that exceeded both the lead and copper action levels (use Table 3b) before corrosion control was implemented. Please provide information about water quality within the distribution system rather than at the point of entry.

**EXAMPLE:** 10 large ground water systems exceeded the copper action level and installed CCT. The average pH was 7.5 and range of 7.2 - 8.0. This information would be entered into the table as follows:

Water quality characteristics	Large (> 50,000)	Med (3,301 - 50,000)	Small (≤ 3,300)
ground water systems			
pH range	# of systems: 10 ave: 7.5 range: 7.2 - 8.0		

Water quality characteristics	Large (> 50,000)	Med (3,301 - 50,000)	Small (≤ 3,300)
ground water systems			
pH range in pH units	# of systems: average: range:	# of systems: average: range:	# of systems: average: range:
Alkalinity, mg/L as CaCO <sub>3</sub>	# of systems: average: range:	# of systems: average: range:	# of systems: average: range:
Hardness, mg/L as CaCO <sub>3</sub>	# of systems: average: range:	# of systems: average: range:	# of systems: average: range:
DIC (if known) mg/L C	# of systems: average: range:	# of systems: average: range:	# of systems: average: range:
Iron, mg/L	# of systems: average: range:	# of systems: average: range:	# of systems: average: range:
Manganese, mg/L	# of systems: average: range:	# of systems: average: range:	# of systems: average: range:
surface water systems			
pH range in pH units	# of systems: average: range:	# of systems: average: range:	# of systems: average: range:
Alkalinity, mg/L as CaCO <sub>3</sub>	# of systems: average: range:	# of systems: average: range:	# of systems: average: range:
Hardness, mg/L as CaCO <sub>3</sub>	# of systems: average: range:	# of systems: average: range:	# of systems: average: range:
DIC (if known), mg/L C	# of systems: average: range:	# of systems: average: range:	# of systems: average: range:
TOC (if known), mg/L C	# of systems: average: range:	# of systems: average: range:	# of systems: average: range:

Table 3b: Treated Water Quality Characteristics for Systems Exceeding Both Copper and Lead Action Levels							
Water quality characteristics							
ground water systems							
pH range, in pH units	# of systems: average: range:	# of systems: average: range:	# of systems: average: range:				

	1	Levels	
Water quality characteristics	Large (> 50,000)	Med (3,301 - 50,000)	Small (≤ 3,300)
Alkalinity, mg/L as	# of systems:	# of systems:	# of systems:
CaCO <sub>3</sub>	average:	average:	average:
	range:	range:	range:
Hardness, mg/L as	# of systems:	# of systems:	# of systems:
CaCO <sub>3</sub>	average:	average:	average:
	range:	range:	range:
DIC (if known), mg/L C	# of systems:	# of systems:	# of systems:
mg/L C	average:	average:	average:
	range:	range:	range:
Iron, mg/L	# of systems:	# of systems:	# of systems:
	average:	average:	average:
	range:	range:	range:
Manganese, mg/L	# of systems:	# of systems:	# of systems:
	average:	average:	average:
	range:	range:	range:
surface water systems		•	
oH range, in pH units	# of systems:	# of systems:	# of systems:
	average:	average:	average:
	range:	range:	range:
Alkalinity, mg/L as	# of systems:	# of systems:	# of systems:
CaCO <sub>3</sub>	average:	average:	average:
	range:	range:	range:
Hardness, mg/L as	# of systems:	# of systems:	# of systems:
CaCO <sub>3</sub>	average:	average:	average:
	range:	range:	range:
DIC (if known), mg/L C	# of systems:	# of systems:	# of systems:
ng/L C	average:	average:	average:
	range:	range:	range:
TOC (if known),	# of systems:	# of systems:	# of systems:
mg/L C	average:	average:	average:
	range:	range:	range:

4. Many of the systems that exceeded the copper action level had to implement CCT. Please indicate the number of systems in each size category that are required to implement CCT due to a copper action level exceedance AND the number of systems that actually have implemented CCT. Please provide this information separately for ground water vs. surface water systems and for those that exceeded the copper action level only (use Table 4a) vs. those that exceeded both action levels (use Table 4b).

Table 4a: Systems Exceeding the Copper Action Level Only					
No. of syste	ems required to Ir	ıstall CCT	No. of systems installing CCT		
			Small (≤ 3,300)		
ground water syste	ems				
surface water systems					

Table 4b: Systems Exceeding the Copper and Lead Action Levels					
No. of syste	ems required to Ir	istall CCT	No. of systems installing CCT		
Large         Med         Small         Large         Med           (> 50,000)         (3,301- 50,000)         (≤ 3,300)         (> 50,000)         (3,301- 50,000)		Small (≤ 3,300)			
ground water syste	ems				
surface water systems					

5. Please outline how many of the systems in each size category and source type that exceeded the copper action level and had to install corrosion control treatment opted for pH/alkalinity adjustment? Calcium hardness? Inhibitors? Please provide this information separately for those that exceeded the copper action level only (use Table 5a) vs. those that exceeded both the copper and lead action levels (use Table 5b).

Table 5a: Type of CCT Installed by Systems Exceeding the Copper Action Level Only							
Type of CCT	Large (> 50,000)	Med (3,301 - 50,000)	Small (≤ 3,300)				
ground water systems using:	ground water systems using:						
pH/alkalinity adjustment							
calcium hardness							
inhibitor addition							
surface water systems using:							
pH/alkalinity adjustment							
calcium hardness							
inhibitor addition							

Table 5b: Type of CCT Installed by Systems Exceeding Both the Copper and Lead Action Levels					
ground water systems using:					
pH/alkalinity adjustment					
calcium hardness					
inhibitor addition					
surface water systems using:					
pH/alkalinity adjustment					
calcium hardness					
inhibitor addition					

6. Please provide information on the number of large, medium, and small systems that used orthophosphate along with some breakdown according to water source (surface or groundwater). Please provide the same information for the use of polyphosphates and blended ortho/polyphosphates. Also provide this information separately for those exceeding the copper action level only (use Table 6a) and those exceeding both the copper and lead action levels (use Table 6b).

Table 6a: Use of Orthophosphate, Polyphosphate, or Blended Phosphate for Systems Exceeding the Copper Action Level Only					
Type of CCT	Large (> 50,000)	Med (3,301 - 50,000)	Small (≤ 3,300)		
ground water systems usin	ng:				
orthophosphate					
polyphosphate					
blended phosphate					
surface water systems usi	ng:				
orthophosphate					
polyphosphate					
blended phosphate					

Table 6b: Use of Orthophosphate, Polyphosphate, or Blended Phosphate for Systems Exceeding Both the Copper and Lead Action Levels						
Type of CCT	Type of CCT Large (> 50,000) Med (3,301 - 50,000)					
ground water systems u	ground water systems using:					
orthophosphate						
polyphosphate						
blended phosphate						
surface water systems u	surface water systems using:					
orthophosphate						
polyphosphate						
blended phosphate						

7. How many systems of each system size and source water type that implemented pH/alkalinity treatment subsequently met copper action levels? How many with calcium hardness treatment? How many with inhibitor treatment? Please provide this information separately for those that exceeded the copper action level only (use Table 7a) vs. those that exceeded both the copper and lead action levels (use Table 7b).

Table 7a: Number of Systems that Met the Action Level after Installing (Had Exceeded Copper Action Level Only)				
Type of CCT	Large (> 50,000)	Med (3,301 - 50,000)	Small (≤ 3,300)	
ground water systems usin	ng:			
pH/alkalinity adjustment				
calcium hardness				
inhibitor addition				
surface water systems usin	ng:	•		
pH/alkalinity adjustment				
calcium hardness				
inhibitor addition				

Table 7b: Number of Systems that Met the Copper Action Level after Installing CCT				
	(Had Exceeded Both Cop	per & Lead Action Level	s)	
Type of CCT	Large (> 50,000)	Med (3,301 - 50,000)	Small (≤ 3,300)	
ground water systems usin	ng:			
pH/alkalinity adjustment				
calcium hardness				
inhibitor addition				
surface water systems usin	ng:			
pH/alkalinity adjustment				
calcium hardness				
inhibitor addition				

- 8. Please provide information about target water quality parameters (pH, alkalinity, hardness, inhibitor dose) for the systems that met the copper action level after installing CCT *AND* for the systems that continued to exceed after installing CCT. Information about water quality within the distribution system, rather than at the entry point to the distribution system is required. Please provide the information by type of treatment implemented and separate systems that used orthophosphate from those that used polyphosphate or ortho/polyphosphate blends. Please complete the following tables:
- Tables 8a for systems that exceeded the copper action level only but no longer exceed

#### after CCT

- Table 8b for systems that exceeded the copper level only and continue to exceed after CCT
- Table 8c for systems that exceeded both action levels but no longer exceed the *copper action* level after CCT
- Table 8d for systems that exceeded both action levels but continue to exceed the *copper action* level after CCT.

**Please note:** If a system continues to exceed the lead action level after CCT but not the copper action level, place these systems in Table 8c.

#### **EXAMPLE 1**

200 small groundwater systems, of the 458 in the State, exceed the copper action level only and implemented orthophosphate addition. Of those, 125 subsequently were at or below the copper action level. The average pH of these 125 systems was 7.3 (range 7.2 - 7.8), alkalinity was 110 mg/L as CaCO<sub>3</sub> (range 85-155) and average orthophosphate dose was 1.3 mg/L with a dosage range of 0.5 mg/L to 2 mg/L.

Table	EXAMPLE 1  Table 8a: Water Quality Parameters for Systems that <i>Met</i> the Copper Action Level After CCT (exceeded copper action level only)					
Water quality characteristic	pH/alkalinity adjust	Calcium hardness	Orthophosphate addition	Poly or Blended Phosphate addition		
ground water s	systems					
pH range, in pH units	Lg: Med: Sm:	Lg: Med: Sm:	Lg: Med: Sm: n= 125; ave. = 7.3; range = 7.2 - 7.8	Lg: Med: Sm:		
Alkalinity, mg/L as CaCO <sub>3</sub>	Lg: Med: Sm:	Lg: Med: Sm:	Lg: Med: Sm: n= 125; ave. = 110; range = 85 - 155	Lg: Med: Sm:		
Hardness, mg/L as CaCO <sub>3</sub>	Lg: Med: Sm:	Lg: Med: Sm:	Lg: Med: Sm:	Lg: Med: Sm:		
dosage of inhibitor (if part of treatment), mg/L	Lg: Med: Sm:	Lg: Med: Sm:	Lg: Med: Sm: n= 125; ave. = 1.3; range = 0.5 - 2.0	Lg: Med: Sm:		

### **EXAMPLE 2**

200 small groundwater systems, of the 458 in the State, exceed the copper action level only and implemented orthophosphate addition. Of those, 75 continued to exceed the copper action level. The average pH of these 75 systems was 7.5 (range 7.3-8.1), alkalinity was 200 (range 130-260) and average orthophosphate dose was 0.8 mg/L (range 0.13 to 2 mg/L).

EXAMPLE 2  Table 8b: Water Quality Parameters for Systems that <i>Did Not Meet</i> the Copper Action Level After CCT (exceeded copper action level only)					
Water quality characteristic	pH/alkalinity adjust	Calcium hardness	Orthophosphate adjustment	Poly or Blended Phosphate addition	
ground water s	systems				
pH range, in pH units	Lg: Med: Sm:	Lg: Med: Sm:	Lg: Med: Sm: n=75; ave. = 7.5; range = 7.3 - 8.1	Lg: Med: Sm:	
Alkalinity, mg/L as CaCO <sub>3</sub>	Lg: Med: Sm:	Lg: Med: Sm:	Lg: Med: Sm: n= 75; ave. = 200; range = 130 - 260	Lg: Med: Sm:	
Hardness, mg/L as CaCO <sub>3</sub>	Lg: Med: Sm:	Lg: Med: Sm:	Lg: Med: Sm:	Lg: Med: Sm:	
dosage of inhibitor (if part of treament), mg/L	Lg: Med: Sm:	Lg: Med: Sm:	Lg: Med: Sm: n= 75; ave. = 0.8 range = 0.13 - 2.0	Lg: Med: Sm:	

(exceeded copper action level only)					
Water quality characteristic	pH/alkalinity adjustment	Calcium hardness	Orthophosphate addition	Poly or Blended Phosphate addn	
ground water sy	vstems				
pH range, in pH units	Lg:	Lg:	Lg:	Lg:	
	Med:	Med:	Med:	Med:	
	Sm:	Sm:	Sm:	Sm:	
Alkalinity,	Lg:	Lg:	Lg:	Lg:	
mg/L as	Med:	Med:	Med:	Med:	
CaCO <sub>3</sub>	Sm:	Sm:	Sm:	Sm:	
Hardness,	Lg:	Lg:	Lg:	Lg:	
mg/L as	Med:	Med:	Med:	Med:	
CaCO <sub>3</sub>	Sm:	Sm:	Sm:	Sm:	
dosage of	Lg:	Lg:	Lg:	Lg:	
inhibitor (if	Med:	Med:	Med:	Med:	
used), mg/L	Sm:	Sm:	Sm:	Sm:	
DIC (if	Lg:	Lg:	Lg:	Lg:	
known),	Med:	Med:	Med:	Med:	
mg/L C	Sm:	Sm:	Sm:	Sm:	
Iron, mg/L	Lg:	Lg:	Lg:	Lg:	
	Med:	Med:	Med:	Med:	
	Sm:	Sm:	Sm:	Sm:	
Manganese, mg/L	Lg:	Lg:	Lg:	Lg:	
	Med:	Med:	Med:	Med:	
	Sm:	Sm:	Sm:	Sm:	
surface water sy	vstems				
pH range, in pH units	Lg:	Lg:	Lg:	Lg:	
	Med:	Med:	Med:	Med:	
	Sm:	Sm:	Sm:	Sm:	
Alkalinity,	Lg:	Lg:	Lg:	Lg:	
mg/L as	Med:	Med:	Med:	Med:	
CaCO <sub>3</sub>	Sm:	Sm:	Sm:	Sm:	
Hardness,	Lg:	Lg:	Lg:	Lg:	
mg/L as	Med:	Med:	Med:	Med:	
CaCO <sub>3</sub>	Sm:	Sm:	Sm:	Sm:	

Table 8a: Water Quality Parameters for Systems that <i>Met</i> the Copper Action Level After CCT (exceeded copper action level only)					
Water quality characteristic	pH/alkalinity adjustment	Calcium hardness	Orthophosphate addition	Poly or Blended Phosphate addn	
dosage of	Lg:	Lg:	Lg:	Lg:	
inhibitor (if	Med:	Med:	Med:	Med:	
used), mg/L	Sm:	Sm:	Sm:	Sm:	
DIC (if	Lg:	Lg:	Lg:	Lg:	
known),	Med:	Med:	Med:	Med:	
mg/L C	Sm:	Sm:	Sm:	Sm:	
TOC (if known), mg/L C	Lg:	Lg:	Lg:	Lg:	
	Med:	Med:	Med:	Med:	
	Sm:	Sm:	Sm:	Sm:	

Table 8b: Water	Table 8b: Water Quality Parameters for Systems that <i>Did Not Meet</i> the Copper Action Level After CCT (exceeded copper action level only)				
Water quality characteristics	pH/alkalinity adjustment	Calcium hardness	Orthophosphate addition	Poly or Blended Phosphate addn	
ground water sy	stems				
pH range, in pH units	Lg:	Lg:	Lg:	Lg:	
	Med:	Med:	Med:	Med:	
	Sm:	Sm:	Sm:	Sm	
Alkalinity,	Lg:	Lg:	Lg:	Lg:	
mg/L as	Med:	Med:	Med:	Med:	
CaCO <sub>3</sub>	Sm:	Sm:	Sm:	Sm:	
Hardness,	Lg:	Lg:	Lg:	Lg:	
mg/L as	Med:	Med:	Med:	Med:	
CaCO <sub>3</sub>	Sm:	Sm:	Sm:	Sm:	
dosage of	Lg:	Lg:	Lg:	Lg:	
inhibitor (if	Med:	Med:	Med:	Med:	
used), mg/L	Sm:	Sm:	Sm:	Sm:	
DIC (if	Lg:	Lg:	Lg:	Lg:	
known),	Med:	Med:	Med:	Med:	
mg/L C	Sm:	Sm:	Sm:	Sm:	
Iron, mg/L	Lg:	Lg:	Lg:	Lg:	
	Med:	Med:	Med:	Med:	
	Sm:	Sm:	Sm:	Sm:	

Table 8b: Water Quality Parameters for Systems that <i>Did Not Meet</i> the Copper Action Level After CCT (exceeded copper action level only)				
Water quality characteristics	pH/alkalinity adjustment	Calcium hardness	Orthophosphate addition	Poly or Blended Phosphate addn
Manganese,	Lg:	Lg:	Lg:	Lg:
mg/L	Med:	Med:	Med:	Med:
	Sm:	Sm:	Sm:	Sm:
surface water sy	stems			
pH range, in	Lg:	Lg:	Lg:	Lg:
pH units	Med:	Med:	Med:	Med:
	Sm:	Sm:	Sm:	Sm:
Alkalinity,	Lg:	Lg:	Lg:	Lg:
mg/L as	Med:	Med:	Med:	Med:
CaCO <sub>3</sub>	Sm:	Sm:	Sm:	Sm:
Hardness,	Lg:	Lg:	Lg:	Lg:
mg/L as	Med:	Med:	Med:	Med:
CaCO <sub>3</sub>	Sm:	Sm:	Sm:	Sm:
dosage of	Lg:	Lg:	Lg:	Lg:
inhibitor (if used), mg/L	Med:	Med:	Med:	Med:
useu), mg/ E	Sm:	Sm:	Sm:	Sm:
DIC (if	Lg:	Lg:	Lg:	Lg:
known),	Med:	Med:	Med:	Med:
mg/L C	Sm:	Sm:	Sm:	Sm:
TOC (if	Lg:	Lg:	Lg:	Lg:
known),	Med:	Med:	Med:	Med:
mg/L C	Sm:	Sm:	Sm:	Sm:

Table 8c: Water Quality Parameters for Systems that <i>Met</i> the Copper Action Level After CCT (exceeded both action levels)					
Water quality characteristics	pH/alkalinity adjustment	Calcium hardness	Othophosphate addition	Poly or Blended Phosphate addition	
ground water sy	stems				
pH range, in pH units	Lg:	Lg:	Lg:	Lg:	
	Med:	Med:	Med:	Med:	
	Sm:	Sm:	Sm:	Sm:	
Alkalinity,	Lg:	Lg:	Lg:	Lg:	
mg/L as	Med:	Med:	Med:	Med:	
CaCO <sub>3</sub>	Sm:	Sm:	Sm:	Sm:	
Hardness,	Lg:	Lg:	Lg:	Lg:	
mg/L as	Med:	Med:	Med:	Med:	
CaCO <sub>3</sub>	Sm:	Sm:	Sm:	Sm:	
dosage of	Lg:	Lg:	Lg:	Lg:	
inhibitor (if	Med:	Med:	Med:	Med:	
used), mg/L	Sm:	Sm:	Sm:	Sm:	
DIC (if	Lg:	Lg:	Lg:	Lg:	
known),	Med:	Med:	Med:	Med:	
mg/L C	Sm:	Sm:	Sm:	Sm:	
Iron, mg/L	Lg:	Lg:	Lg:	Lg:	
	Med:	Med:	Med:	Med:	
	Sm:	Sm:	Sm:	Sm:	
Manganese, mg/L	Lg:	Lg:	Lg:	Lg:	
	Med:	Med:	Med:	Med:	
	Sm:	Sm:	Sm:	Sm:	
surface water sy	estems				
pH range, in pH units	Lg:	Lg:	Lg:	Lg:	
	Med:	Med:	Med:	Med:	
	Sm:	Sm:	Sm:	Sm	
Alkalinity,	Lg:	Lg:	Lg:	Lg:	
mg/L as	Med:	Med:	Med:	Med:	
CaCO <sub>3</sub>	Sm:	Sm:	Sm:	Sm	
Hardness,	Lg:	Lg:	Lg:	Lg:	
mg/L as	Med:	Med:	Med:	Med:	
CaCO <sub>3</sub>	Sm:	Sm:	Sm:	Sm	

Table 8c:	Table 8c: Water Quality Parameters for Systems that <i>Met</i> the Copper Action Level After CCT (exceeded both action levels)					
Water quality characteristics	pH/alkalinity adjustment	Calcium hardness	Othophosphate addition	Poly or Blended Phosphate addition		
dosage of inhibitor (if used), mg/L	Lg:	Lg:	Lg:	Lg:		
	Med:	Med:	Med:	Med:		
	Sm:	Sm:	Sm:	Sm:		
DIC (if	Lg:	Lg:	Lg:	Lg:		
known),	Med:	Med:	Med:	Med:		
mg/L C	Sm:	Sm:	Sm:	Sm:		
TOC (if known), mg/L C	Lg:	Lg:	Lg:	Lg:		
	Med:	Med:	Med:	Med:		
	Sm:	Sm:	Sm:	Sm:		

Table 8d: Water Quality Parameters for Systems that <i>Did Not Meet</i> the Copper Action Level After (exceeded both action levels)				
Water quality characteristics	pH/alkalinity adjustment	Calcium hardness	Orthophosphate addition	Poly or Blended Phosphate addn
ground water sy	stems			
pH range, in pH units	Lg:	Lg:	Lg:	Lg:
	Med:	Med:	Med:	Med:
	Sm:	Sm:	Sm:	Sm:
Alkalinity,	Lg:	Lg:	Lg:	Lg:
mg/L as	Med:	Med:	Med:	Med:
CaCO <sub>3</sub>	Sm:	Sm:	Sm:	Sm:
Hardness,	Lg:	Lg:	Lg:	Lg:
mg/L as	Med:	Med:	Med:	Med:
CaCO <sub>3</sub>	Sm:	Sm:	Sm:	Sm:
dosage of	Lg:	Lg:	Lg:	Lg:
inhibitor (if	Med:	Med:	Med:	Med:
used), mg/L	Sm:	Sm:	Sm:	Sm:
DIC (if	Lg:	Lg:	Lg:	Lg:
known),	Med:	Med:	Med:	Med:
mg/L C	Sm:	Sm:	Sm:	Sm:
Iron, mg/L	Lg:	Lg:	Lg:	Lg:
	Med:	Med:	Med:	Med:
	Sm:	Sm:	Sm:	Sm:

		(exceeded both action	on levels)	
Water quality characteristics	pH/alkalinity adjustment	Calcium hardness	Orthophosphate addition	Poly or Blended Phosphate addn
Manganese,	Lg:	Lg:	Lg:	Lg:
mg/L	Med:	Med:	Med:	Med:
	Sm:	Sm:	Sm:	Sm:
surface water sy	stems			
pH range, in	Lg:	Lg:	Lg:	Lg:
pH units	Med:	Med:	Med:	Med:
	Sm:	Sm:	Sm:	Sm:
Alkalinity,	Lg:	Lg:	Lg:	Lg:
mg/L as CaCO <sub>3</sub>	Med:	Med:	Med:	Med:
	Sm:	Sm:	Sm:	Sm:
Hardness,	Lg:	Lg:	Lg:	Lg:
mg/L as	Med:	Med:	Med:	Med:
CaCO <sub>3</sub>	Sm:	Sm:	Sm:	Sm:
dosage of	Lg:	Lg:	Lg:	Lg:
inhibitor (if used), mg/L	Med:	Med:	Med:	Med:
uscu), mg/L	Sm:	Sm:	Sm:	Sm:
DIC (if	Lg:	Lg:	Lg:	Lg:
known),	Med:	Med:	Med:	Med:
mg/L C	Sm:	Sm:		Sm:
TOC (if	Lg:	Lg:	Lg:	Lg:
known),	Med:	Med:	Med:	Med:
mg/L C	Sm:	Sm:	Sm:	Sm:

9. Did systems report any detrimental effects from the addition of inhibitor corrosion control treatment? Detrimental effects may be continued non-compliance with the copper action level, required implementation of phosphate removal treatment at a publicly-owned treatment works, increased customer complaints of excess hardness or decreased water quality. Please provide this information separately for those exceeding the copper action level only (use Table 9a) and those exceeding both the copper and lead action levels (use Table 9b). *See example in Table 9a*.

Table 9a: Detrimental Effects from the Addition of Inhibitor CCT for Systems with Copper Exceedances Only									
Description of Problem	No. of systems w/ problem	System Size & source type							
Example: Complaints of excess hardness	5	3 - small (2 sw; 1 gw) 1 - med (gw) 1- lg (gw)							

Table 9b: Detrimental Effects from the Addition of Inhibitor CCT for Systems with Copper and Lead Exceedances										
Description of Problem	No. of systems w/ problem	System Size & source type								

# **APPENDIX B**

**Summary of Data from Questionnaire sent to the following volunteer States:** 

Arkansas

Colorado

Kansas

Minnesota

Montana

Nebraska

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# **Summary of Survey Data**

1 and 2 Large System Data

	1 # of	2 # only	2#	1 # of	2#	2#
	Systems	exceeding	exceeding	Systems	exceeding	exceeding
	subject to LCF	Cu only	Pb/Cu	subject to LCF	Cu only	Pb/Cu
State	#GW	#GW	#GW	#SW	#SW	#SW
Colorado	0	0	0	14	0	0
Kansas	0	0	0	6	0	0
Minnesota	1	0	0	4	0	0
Arkansas	2	0	0	5	0	0
Nebraska	0	0	0	2	0	0
Montana	1	0	0	2	0	0

# **Medium System Data**

	1 # of	2 # only	2 #	1 # of	2#	2#
	Systems	exceeding	exceeding	Systems	exceeding	exceeding
	subject to LCF	Cu only	Pb/Cu	subject to LCF	Cu only	Pb/Cu
State	#GW	#GW	#GW	#SW	#SW	#SW
Colorado	24	2	2	47	2	0
Kansas	33	6	0	45	0	0
Minnesota	123	21	9	13	0	0
Arkansas	54	9	3	77	4	0
Nebraska	34	4	0	5	2	0
Montana	14	3	1	13	0	3

Nebraska systems are groundwater under the influence of surface water

# **Small System Data**

	1 # of	2 # only	2#	1 # of	2 # only	2 #
	Systems	_	exceeding	Systems	•	exceeding
	subject to LCI	Cu only	Pb/Cu	subject to LCF	Cu only	Pb/Cu
State	#GW	#GW	#GW	#SW	#SW	#SW
Colorado	631	54	19	153	22	14
Kansas	701	30	5	314	2	0
Minnesota	808	118	9	7	0	0
Arkansas	426	27	7	217	11	2
Nebraska	741	32	2	1	0	0
Montana	752	59	14	44	5	3

# Percentage of Systems with an exceedance

# Large System Data

no large systems exceeded lead or copper during initial testing in these states

# **Medium System Data**

	Groundwat % systems	exceeding	Surface Water % systems exceeding
	Cu only	Cu/Pb both	Cu only Cu/Pb both
State			
Colorado	8.33%	8.33%	4.26% 0.00%
Kansas	18.18%	0.00%	0.00% 0.00%
Minnesota	17.07%	7.32%	0.00% 0.00%
Arkansas	16.67%	5.56%	5.19% 0.00%
Nebraska	11.76%	0.00%	40.00% 0.00%
Montana	21.43%	7.14%	0.00% 23.08%
			Nebraska surface water actually

Nebraska surface water actually GWUI

# **Small System Data**

	Groundwate	er	Surface W	ater
	% systems	exceeding	% systems	exceeding
	Cu only	Cu/Pb both	Cu only	Cu/Pb both
State				
Colorado	8.56%	3.01%	14.38%	9.15%
Kansas	4.28%	0.71%	0.64%	0.00%
Minnesota	14.60%	1.11%	0.00%	0.00%
Arkansas	6.34%	1.64%	5.07%	0.92%
Nebraska	4.32%	0.27%	0.00%	0.00%
Montana	7.85%	1.86%	11.36%	6.82%

# **Summary of Treated Water Quality BEFORE CCT**

### 3a Exceeded Copper Level

Medium (	Groundwa	iter Syste	m Data				hardness						
	pH min	pH max	pH ave	alk min	alk max	alk ave	Ca min	Ca max	Ca ave	DIC min	DIC max	DIC ave	n
State													
Colorado	0.70	0.04	6.9	447	400	150	450	700	140	40	400	48	1
Kansas	6.78	8.01	7.4	117 160	432 470	244 280	153	738	367 212	40 54	106	65 66	6 21
Minnesota	7 6 10	8.1	7.4 7.11				80 2	550			102	66 46	9
Arkansas	6.18 7.2	7.9 7.25	7.11 7.23	64 227	403 252	210 242	232	240 270	56 242	43 63	100 69	46 67	4
Nebraska Montana	no data	7.25	1.23	221	232	242	232	270	242	63	09	07	4
Wioiitalia	no data												
Small Gro		-					hardness	_	_				
	pH min	pH max	pH ave	alk min	alk max	alk ave	Ca min	Ca max	Ca ave	DIC min	DIC max	DIC ave	n
State													
Colorado	5.4	7.8	6.9	18	320	143	20	140	90	52	80	66	25
Kansas	6.3	8.2	7.2	30	440	225	50	690	252	17	107	63	30
Minnesota	6.7	7.7	7.3	50	550	330	15	1000	280	14	106	77	118
Arkansas	5.7	8	6.9	6	383	138	1	64	18	9	94	44	15
Nebraska	6.8	7.19	6.88	229	254	228	258	293	260	71	78	74	11
Montana	no data												
	Fe min	Fe max	Fe ave	Mn min	Mn max	Mn avo	n		Note				
State	re iiiii	r e max	reave	IVIII IIIIII	IVIII IIIax	wiii ave	n		NOIC				
Kansas	0.01	6.8	0.16	0.001	1.26	0.03	6	med					
Minnesota	0.04	0.52	0.09	0.01	0.3	0.04	21	med	90% of sv	stems rem	ove iton or r	manganese	
Nebraska	0.015	0.06	0.04	0.19	0.27	0.2	2	med	0070 0. 0,	0.0			
Kansas	0.013	5.76	0.04	0.001	1.19	0.08	30	small					
Minnesota	0.04	4.4	0.69	0.001	1.6	0.23	118	small	70% of sv	stems rem	ove iron or i	manganese	
Nebraska	0.07	0.08	0.077	0.06	0.2	0.2	3	small	7070 OI 3y	oterno rem	0 0 0 11 011 01 1	nangancsc	•
0-	F												
3a	Exceede	d Copper I	Levei										
Medium S	Surface W	ater Svst	em Data	1			hardness						
	pH min	pH max			alk max		Ca min	Ca max	Ca ave	DIC min	DIC max	DIC ave	n
State	<b>F</b> · · · · · · · · · · · · · · · · · · ·	<b>P</b>	p										
Colorado	7.4	7.6	7.5	280	320	300	105	350	227	74	82	78	2
Kansas	no system	s											
Minnesota	no system	S											
Arkansas	5.8	8.3	6.8	57	167	122	4	67	44	40	71	42	3
Nebraska	no data												
Montana	no system	S											
Small Sur	rfaco Wat	ar Systan	n Data				hardness						
		•											n
	pH min	pH max		alk min	alk max		Ca min	Ca max	Ca ave	DIC min	DIC max	DIC ave	
State		•		alk min	alk max		Ca min	Ca max	Ca ave		DIC max	DIC ave	"
		•	pH ave	2 20	alk max	alk ave	20	140		7	49	30	8
State	pH min	pH max	pH ave	2 20		alk ave		140	90			30	
State Colorado	pH min 6.8 6.9	pH max 7.5 7.7	pH ave	2 20	188	alk ave	20	140	90	7	49	30	8
State Colorado Kansas	pH min 6.8 6.9	pH max 7.5 7.7	pH ave	2 20 203	188	alk ave 107 238	20	140 446	90 337	7 62	49	30 65	8
State Colorado Kansas Minnesota	pH min 6.8 6.9 no systems	pH max 7.5 7.7 s 7.3	pH ave 7.2 7.5	2 20 203	188 276	alk ave 107 238	20 278	140 446	90 337	7 62	49 70	30 65	8 2
State Colorado Kansas Minnesota Arkansas	pH min 6.8 6.9 no system: 5.4	pH max 7.5 7.7 s 7.3	pH ave 7.2 7.5	2 20 203	188 276	alk ave 107 238	20 278	140 446	90 337	7 62	49 70	30 65	8 2
State Colorado Kansas Minnesota Arkansas Nebraska	pH min 6.8 6.9 no system: 5.4 no system:	pH max 7.5 7.7 s 7.3	pH ave 7.2 7.5	2 20 203	188 276	alk ave 107 238	20 278	140 446	90 337	7 62	49 70	30 65	8 2
State Colorado Kansas Minnesota Arkansas Nebraska	pH min 6.8 6.9 no system 5.4 no system no data	pH max 7.5 7.7 s 7.3	pH ave 7.2 7.5 6.6	2 20 5 203 6 1	188 276	alk ave 107 238	20 278	140 446	90 337	7 62	49 70	30 65	8 2

# Summary of Treated Water Quality BEFORE CCT

#### 3b Exceeded Lead and Copper Levels

Medium C	round	water S	ystem	Data			hardnes	S					
	pH min	pH max	pH ave	alk min	alk max	alk ave	Ca min	Ca max	Ca ave I	DIC minD	IC maxE	IC ave	n
State													
Colorado	7.3	7.36	7.33	70	180	125	100	584	342	19	48	34	2
Kansas	no syste	ms											
Minnesota	6.8	7.9	7.45	250	480	345	10	310	202	69	120	90	9
Arkansas	6.3	7.4	7	64	390	250	2	26	16	36	103	76	3
Nebraska	no systems												
Montana	no data												
Small Groundwater System Data hardness													
	pH min	pH max	pH ave	alk min	alk max	alk ave	Ca min	Ca max	Ca ave [	DIC minD	IC maxE	IC ave	n
State													
Colorado	6	8.1	6.9	20	116	85	40	120	41	18	28	27	13
Kansas	6.8	7.8	7.1	74	383	222	79	485	232	25	96	64	5
Minnesota	7	7.6	7.3	190	525	316	135	350	210	53	140	85	9
Arkansas	5.5	7.4	6.23	9	186	66	4	61	25	21	49	41	7
Nebraska	no data												
Montana	no data												
	Fe min	Fe max	Fe ave	Mn min	Mn max	Mn ave	n						
State													
Minnesota	0.04	0.85	0.16	0.01	0.11	0.03	9	med					
Kansas	0.01	0.25	0.09	0.001	0.25	0.03	5	small					
Minnesota	0.04	1.6	0.51	0.02	0.14	0.05	9	small					
	3.01	1.0	3.01	3.02	3.11	3.00	Ū	JJ.					

#### **Medium Surface Water System Data**

hardness

pH min pH max pH ave alk min alk max alk ave Ca min Ca max Ca ave DIC minDIC maxDIC ave n

State

Colorado no systems
Kansas no systems
Minnesota no systems
Arkansas no systems
Nebraska no systems
Montana no data

#### **Small Surface Water System Data**

hardness

pH min pH max pH ave alk min alk max alk ave Ca min Ca max Ca ave DIC minDIC maxDIC ave n State Colorado 5.9 100 38 17 7 Kansas no systems Minnesota no systems 3 2 Arkansas 6.4 6.7 6.6 11 10 14 9 Nebraska no systems Montana no data

# **Summary of Systems adding Corrosion Control**

### 4a and 4b

# Medium System Data

		Groun	dwater		Surface Water				
	Systems th	nat	Systems t	hat	Systems t	that	Systems t	hat	
	exceeded		exceeded		exceeded		exceeded		
	copper		Cu/Pb		copper		Cu/Pb		
	require Installing		require Installing		require Installing		require	Installing	
	CCT	CCT	CCT	CCT	CCT	CCT	CCT	CCT	
State	#	#	#	#	#	#	#	#	
Colorado	1	1	2	1	(	0 (	) (	0	
Kansas	6	6	0	5	(	0 (	) (	0	
Minnesota	20	20	9	9	(	0 (	) (	0	
Arkansas	6	5	3	3	4	4 3	3 (	0	
Nebraska	6	0	0	0	(	0 (	) (	0	
Montana	3	2	1	1	(	0 (	) :	3 2	

# **Small System Data**

		Gro	und	water		Surface Water				
	Systems t	hat		Systems tl	nat	Systems	that	Systems	that	
	exceeded			exceeded		exceeded	b	exceeded		
	copper			Cu/Pb		copper		Cu/Pb		
	require	Installing		require	Installing	require	Installing	require	Installing	
	CCT	CCT		CCT	CCT	CCT	CCT	CCT	CCT	
State	#	#		#	#	#	#	#	#	
Colorado	3	4	22	12	12	. 1	0 6	5 1	9	
Kansas	3	0	29	5	5		2 2	2	0 0	
Minnesota	8	3	77	8	8		0 (	)	0 0	
Arkansas	2	:3	14	10	7		9 2	2	2 2	
Nebraska	3	2	2	2	0		0 (	)	0 0	
Montana	5	9	13	14	6		5 1	:	3 1	

# **Summary of Systems adding Corrosion Control**

# 5a Exceeded Copper only

PH/Alkalinity   Calcium hardness   Inhibitor addn   PH/Alkalinity   Calcium hardness   Inhibitor addn   Colorado   Colo	Medium S	System Data		ССТ			
State			Groundwater			Surface Water	
Colorado		pH/Alkalinity	calcium hardness	inhibitor addn	pH/Alkalinity	calcium hardness	inhibitor addr
Kansas         2         0         4         no systems no systems no systems         Arkansas no systems         Arkansas         3         0         3         Arkansas         5         0         4         3         0         3         Arkansas         5         0         4         3         0         3         Arkansas         1         0         3         0         3         0         3         0         3         0         3         0         3         0         3         0         3         0         3         0         3         0         3         0         3         0         3         0         3         0         3         0         3         0         3         0         3         0         0         0         0         0         0         0         0         0         0         0         0         0         0         1         0         1         0         1         0         1         0         1         0         1         0         1         0         1         0         1         0         0         1         0         0         1         0         0         1         0<							
Minnesota Arkansas         2					0		0
Arkansas         5         0         4         3         0         3           Nebraska         3         0         3         no data         no data           Montana         0         0         2         no systems           Small System Data         Type of CCT           Groundwater pH/Alkalinity         Calcium hardness         Surface Water pH/Alkalinity           Folia         15         0         16         7         0         1						•	
Nebraska Montana         3 0 0 0 2 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0					_	•	_
Small System Data         Type of CCT           Groundwater pH/Alkalinity         Groundwater calcium hardness         Surface Water inhibitor addn         Surface Water of pH/Alkalinity calcium hardness         Inhibitor addn           State Colorado         15         0         16         7         0         1           Kansas         9         0         20         1         0         1           Minnesota         5*         0         79         no systems         1           Arkansas         12         0         5         2         0         1           Nebraska         1         0         13         no systems         1           Montana         1         0         11         0         0         1           Exceeded Lead and Copper           Type of CCT         Surface Water pH/Alkalinity calcium hardness         Inhibitor addn         PH/Alkalinity calcium hardness         Inhibitor addn           State         Colorado         2         0         0         no systems         no systems           Montana         0         0         3         no systems         no systems           Nebraska         no systems<				=	3		3
Small System Data         Type of CCT           Groundwater or pH/Alkalinity         Calcium hardness         inhibitor addn         pH/Alkalinity         Calcium hardness         inhibitor addn           State         Colorado         15         0         16         7         0         1           Kansas         9         0         20         1         0         1           Minnesota         5*         0         79         no systems         1           Arkansas         12         0         5         2         0         1           Nebraska         1         0         13         no systems         1           Montana         1         0         11         0         0         1           5b         Exceeded Lead and Copper         Surface Water Systems All System Data         Type of CT           Groundwater PH/Alkalinity         calcium hardness         inhibitor addn         pH/Alkalinity         calcium hardness         inhibitor addn           Kansas         no systems         no systems         no systems         no systems           Minnesota         0         0         0         no systems           Nebraska <td< th=""><th></th><th></th><th>*</th><th></th><th></th><th></th><th></th></td<>			*				
Capacidade   Papil/Alkalinity   Calcium hardness   Inhibitor addn   Papil/Alkalinity   Papil/A	Montana	0	0	2		no systems	
Capacidade   Papil/Alkalinity   Calcium hardness   Inhibitor addn   Papil/Alkalinity   Papil/A	Small Sys	stem Data	Type of	ССТ			
State Colorado State Colorado State Colorado Manage Colorado Colorado (15 0 16 7 0 1 1 1 0 1 1 1 0 0 1 1 1 1 0 0 1 1 1 1 0 0 1 1 1 1 0 0 1 1 1 1 0 0 1 1 1 1 0 0 0 1 1 1 1 0 0 0 1 1 1 1 0 0 0 1 1 1 1 0 0 0 1 1 1 1 0 0 0 1 1 1 1 0 0 1 1 1 1 0 0 1 1 1 1 0 1 1 1 0 1 1 1 1 0 1	,					Surface Water	
State		pH/Alkalinity		inhibitor addn	pH/Alkalinity		inhibitor addr
Colorado Kansas         15         0         16         7         0         1           Kansas         9         0         20         1         0         1           Minnesota Arkansas         12         0         55         2         0         1           Nebraska Montana         1         0         13         no systems         1           Montana         1         0         11         0         0         1           Steeded Lead and Copper           Medium System Data         Type of CCT           Groundwater pH/Alkalinity         Calcium hardness         Surface Water ph/Alkalinity         Calcium hardness         inhibitor addn         ph/Alkalinity         calcium hardness         inhibitor addn         ph/Alkalinity         calcium hardness         inhibitor addn         ph/Alkalinity         calcium hardness         inhibitor addn	State	p			p		
Kansas         9         0         20         1         0         1           Minnesota         5*         0         79         no systems         1           Arkansas         12         0         5         2         0         1           Nebraska         1         0         13         no systems           Montana         1         0         11         0         0         1           Steeeded Lead and Copper           Fixeeeded Lead and Copper           Groundwater pH/Alkalinity calcium hardness         Surface Water calcium hardness         National pH/Alkalinity calcium hardness         Surface Water no systems         National pH/Alkalinity no systems         No sy		15	0	16	7	0	1
Arkansas         12         0         5         2         0         1           Nebraska         1         0         13         no systems           Montana         1         0         11         0         0         1           Sb         Exceeded Lead and Copper           Groundwater pH/Alkalimity system Data         Type of CCT           Groundwater pH/Alkalinity calcium hardness         Inhibitor addn           State           Colorado         2         0         0         no systems         no systems           Minnesota Arkansas         3         0         3         no systems         no systems           Nebraska Montana         0         0         1         0         0         2           Small System Data         Type of CCT           Groundwater pH/Alkalinity         calcium hardness         ph/Alkalinity         calcium hardness         inhibitor addr           State         0         6         4         0         4           Colorado         6         0         6         4         0         4           Colorado         6		9		20			
Arkansas         12         0         5         2         0         1           Nebraska         1         0         13         no systems         1           Montana         1         0         11         0         0         1           Sb         Exceeded Lead and Copper           Groundwater pH/Alkalimity system Data         Type of CCT           Groundwater pH/Alkalinity calcium hardness         Inhibitor addn           State           Colorado         2         0         0         pH/Alkalinity         calcium hardness         inhibitor addr           Kansas         no systems         no systems         no systems         no systems         no systems           Montana         0         0         1         0         0         2           Small System Data         Type of CCT           Groundwater pH/Alkalinity         calcium hardness         ph/Alkalinity         calcium hardness         inhibitor addr           State         Colorado         6         4         0         4           Colorado         6         0         6         4         0         4	Minnesota	5*	0	79		no systems	
Montana         1         0         1         0         0         1           5b         Exceeded Lead and Copper           Medium System Data         Type of CCT           Groundwater pH/Alkalinity calcium hardness         Surface Water pH/Alkalinity calcium hardness           State Colorado 2 0 0 0 0 no systems Minnesota 0 0 0 8 no systems no systems Arkansas 3 0 3 no systems no systems Nebraska no systems No systems Montana 0 0 0 1 0 0 0 0 2           Small System Data PH/Alkalinity Calcium hardness         Type of CCT Groundwater Inhibitor addn pH/Alkalinity Calcium hardness         Surface Water Inhibitor addn pH/Alkalinity Calcium hardness         Surface Water Inhibitor addn pH/Alkalinity Calcium hardness         Inhibitor addr Inhibitor addn pH/Alkalinity Calcium hardness         Inhibitor addr Inhibitor addn ph/Alkalinity Calcium hardness         Inhibitor addr Inhibitor addr Inhibitor addn ph/Alkalinity Calcium hardness         Inhibitor addr Inhibitor	Arkansas	12	0	5	2	•	1
Montana         1         0         1         0         0         1           5b         Exceeded Lead and Copper           Medium System Data         Type of CCT           Groundwater pH/Alkalinity calcium hardness         Surface Water pH/Alkalinity calcium hardness           State Colorado 2 0 0 0 0 no systems Minnesota 0 0 0 8 no systems no systems Arkansas 3 0 3 no systems no systems Nebraska no systems No systems Montana 0 0 0 1 0 0 0 0 2           Small System Data PH/Alkalinity Calcium hardness         Type of CCT Groundwater Inhibitor addn pH/Alkalinity Calcium hardness         Surface Water Inhibitor addn pH/Alkalinity Calcium hardness         Surface Water Inhibitor addn pH/Alkalinity Calcium hardness         Inhibitor addr Inhibitor addn pH/Alkalinity Calcium hardness         Inhibitor addr Inhibitor addn ph/Alkalinity Calcium hardness         Inhibitor addr Inhibitor addr Inhibitor addn ph/Alkalinity Calcium hardness         Inhibitor addr Inhibitor	Nebraska	1	0	13		no systems	
Medium System Data         Type of CCT           Groundwater pH/Alkalinity         Groundwater calcium hardness         Inhibitor addn         pH/Alkalinity         Surface Water calcium hardness         inhibitor addn           State         Colorado         2         0         0         no systems         no systems           Kansas         no systems         no systems         no systems         no systems           Minnesota         0         0         8         no systems           Arkansas         3         0         3         no systems           Nebraska         no systems         no systems         no systems           Montana         0         0         1         0         0         2           Groundwater         Surface Water         inhibitor add         surface Water         inhibitor add           State         pH/Alkalinity         calcium hardness         inhibitor add         pH/Alkalinity         calcium hardness         inhibitor add           Colorado         6         0         4         0         4           Kansas         0         0         5         no systems           Minnesota         0         8         no systems	Montana	1	0	11	0		1
State	5b	Exceeded L	ead and Copper				
State         Colorado         2         0         0         no systems no systems no systems no systems         no systems no systems no systems no systems no systems no systems no systems no systems no systems no systems no systems no systems           Minnesota Arkansas         3         0         8         no systems no systems no systems no systems           Nebraska         no systems         1         0         0         2           Small System Data         Type of CCT           Groundwater         Groundwater         Surface Water pH/Alkalinity         inhibitor addr           State         PH/Alkalinity         calcium hardness         inhibitor addr           Colorado         6         4         0         4           Kansas         0         6         4         0         4           Kansas         0         0         5         no systems no systems no systems no systems         no systems           Minnesota         0         6         4         0         4           Arkansas         7         0         8         no systems         1	Medium S	System Data	Type of	ССТ			
State         Colorado         2         0         0         no systems           Kansas         no systems         no systems         no systems           Minnesota         0         0         8         no systems           Arkansas         3         0         3         no systems           Nebraska         no systems         no systems         no systems           Montana         0         0         1         0         0         2           Small System Data         Type of CCT           Groundwater         Surface Water           Butter         PH/Alkalinity         calcium hardness         inhibitor addr           State         Colorado         6         4         0         4           Kansas         0         0         5         no systems         no systems           Minnesota         0         8         no systems         no systems           Arkansas         7         0         2         2         0         1			Groundwater			Surface Water	
Colorado         2         0         0         no systems         Nebraska         no systems         To systems         no systems         no systems         no systems         no systems         Inhibitor address         Surface Water         Surface Water         Inhibitor address         Surface Water         Inhibitor address         Inhibito		pH/Alkalinity	calcium hardness	inhibitor addn	pH/Alkalinity	calcium hardness	inhibitor addr
Kansas         no systems         no systems           Minnesota Arkansas         0         8         no systems           Arkansas         3         0         3         no systems           Nebraska         no systems         no systems           Montana         0         0         1         0         0         2           Small System Data         Type of CCT           Groundwater         Surface Water           pH/Alkalinity         calcium hardness         inhibitor addr           State           Colorado         6         4         0         4           Kansas         0         0         5         no systems           Minnesota         0         8         no systems           Arkansas         7         0         2         2         0         1							
Minnesota Arkansas         0         0         8         no systems no systems no systems           Nebraska         no systems         no systems         no systems           Montana         0         0         1         0         0         2           Small System Data         Type of CCT         Surface Water         Surface Water         Surface Water         Colorado Water         Surface Water         PH/Alkalinity Calcium hardness		2		0		•	
Arkansas         3         0         3         no systems           Nebraska         no systems         no systems           Montana         0         0         1         0         0         2           Small System Data         Type of CCT           Groundwater         Surface Water           pH/Alkalinity         calcium hardness         inhibitor addn         pH/Alkalinity         calcium hardness         inhibitor addr           State         Colorado         6         4         0         4           Kansas         0         0         5         no systems           Minnesota         0         0         8         no systems           Arkansas         7         0         2         2         0         1				_		•	
Nebraska Montana         no systems         no systems           Montana         0         0         1         0         0         2           Small System Data         Type of CCT           Groundwater         Surface Water           pH/Alkalinity         calcium hardness         inhibitor addn           State         Colorado         6         4         0         4           Kansas         0         0         5         no systems           Minnesota         0         0         8         no systems           Arkansas         7         0         2         2         0         1						•	
Montana         0         0         1         0         0         2           Small System Data         Type of CCT           Groundwater         Surface Water           Groundwater         Surface Water           pH/Alkalinity         calcium hardness         inhibitor addr           State         Colorado         6         4         0         4           Kansas         0         0         5         no systems         no systems           Minnesota         0         8         no systems         no systems           Arkansas         7         0         2         2         0         1		3		3		•	
Small System Data         Type of CCT           Groundwater         Surface Water           pH/Alkalinity         calcium hardness         inhibitor addn         pH/Alkalinity         calcium hardness         inhibitor addr           State         Colorado         6         4         0         4           Kansas         0         0         5         no systems           Minnesota         0         8         no systems           Arkansas         7         0         2         2         0         1	Nebraska						
Groundwater   pH/Alkalinity   calcium hardness   inhibitor addn   calcium hardness   inhibitor addn   data   calcium hardness   calcium ha	Montana	0	0	1	0	0	2
Groundwater   pH/Alkalinity   calcium hardness   inhibitor addn   calcium hardness   inhibitor addn   data   calcium hardness   calcium ha	Small Sys	stem Data	Type of	ССТ			
StateColorado6404Kansas005no systemsMinnesota70220	_					Surface Water	
State         Colorado         6         0         6         4         0         4           Kansas         0         0         5         no systems           Minnesota         0         0         8         no systems           Arkansas         7         0         2         2         0         1		pH/Alkalinity		inhibitor addn	pH/Alkalinity	calcium hardness	inhibitor addr
Colorado         6         0         6         4         0         4           Kansas         0         0         5         no systems           Minnesota         0         0         8         no systems           Arkansas         7         0         2         2         0         1	State	F :	2		F	2	
Kansas       0       0       5       no systems         Minnesota       0       0       8       no systems         Arkansas       7       0       2       2       0       1		6	0	6	4	0	4
Minnesota         0         0         8         no systems           Arkansas         7         0         2         2         0         1					-		-
<b>Arkansas</b> 7 0 2 2 0 1	Minnesota	0	0			-	
Nebraska no data no systems		7	0	2	2	•	1
	Nebraska		no data			no systems	
<b>Montana</b> 2 0 3 0 0	Montana	2	0	3	0		0

# **Summary of Phosphate Inhibitor Use by Water Systems**

# 6a Exceeded Copper Only

# **Medium Systems**

	Groun	idwater Sy	/stems		Surface Water Systems			
State	all types	orthoP	poly P	blend	all types	orthoP	poly P	blend
Colorado	1	0	0	0	0	0	0	0
Kansas	4	0	3	1				
Minnesota	18	5	1	11				
Arkansas	4	4	0	0	3	3	0	0
Nebraska	3	0	0	3				
Montana	2	1	0	1				

### **Small Systems**

	Groun	ıdwater Sy	Surface Water Systems					
State	all types	orthoP	poly P	blend	all types	orthoP	poly P	blend
Colorado	16	0	0	13	1	0	0	1
Kansas	20	1	16	3	1	1	0	0
Minnesota	79	18	23	31				
Arkansas	5	5	0	2	1	1	0	0
Nebraska	13	5	1	6				
Montana	11	5	2	3	1	1	0	0

### 6b Exceeded lead and Copper

# **Medium Systems**

	Ground	dwater Sys	Surface Water Systems						
State	all types	orthoP	poly P	blend	all types	orthoP	poly F	כ	blend
Colorado	0	0	0	0					
Kansas									
Minnesota	8	3	1	5					
Arkansas	3	3	0	0					
Nebraska									
Montana	1	0	1	0	2	2	2	0	0

### **Small Systems**

	Ground	dwater Sys	stems		Surface Water Systems			
State	all types	orthoP	poly P	blend	all types	orthoP	poly P	blend
Colorado	6	0	0	5	4	0	0	4
Kansas	5	0	4	0				
Minnesota	8	1	3	3				
Arkansas	2	2	0	0	1	0	0	0
Nebraska								
Montana	3	0	2	1	0	0	0	0

A blank space indicates that there are no systems in this category while 0 indicates that no systems use this treatment

# **Systems that met Copper Action Level after Installing CCT**

# 7a Exceeded Copper Only

# **Medium Systems**

	Groundwater Systems				Surface Water Systems			
	pH/Alkali	nity	y inhibitor addn		pH/Alkalinity		inhibitor addn	
State	chose	success	chose	succes	s chose	success	chose	success
Colorado	0	0	1	1	0	0	0	0
Kansas	2	2	4	3		no sy	stems	
Minnesota	2	1	18	12		no sy	stems	
Arkansas	5	1	4	4	3	0	3	3
Nebraska	3	0	3	0				
Montana	0	0	2	1		no sy	stems	

# Small Systems

	Groun	dwater	Systems		Surface Water Systems			
	pH/Alkal	inity	inhibitor addn		pH/Alkali	pH/Alkalinity		addn
State	chose	succes	s chose	succes	ss chose	success	chose	success
Colorado	15	10	16	7	7	3	1	1
Kansas	9	6	20	12	1	1	1	1
Minnesota	5*	4	79	54		no sy	stems	
Arkansas	12	7	5	2	2	1	1	1
Nebraska	1	1	13	0		no sy	stems	
Montana	1	0	11	3	0	0	1	0

# 7b Exceeded Lead and Copper

### **Medium Systems**

	<b>Groundwater Systems</b>				Surface Water Systems			
	pH/Alkalinity inhibitor ad		addn	ddn pH/Alkalinity		inhibitor addn		
State	chose	succe	ss chose	succes	ss chose	success	chose	success
Colorado	2	1	0	0		no sy	stems	
Kansas		no s	systems			no sy	stems	
Minnesota	0	0	8	8		no sy	stems	
Arkansas	3	1	3	3		no sy	stems	
Nebraska		no s	systems			no sy	stems	
Montana	0	0	1	0	0	0	2	1

# Small Systems

	Groun	dwater S	Systems		Surface Water Systems			
	pH/Alkal	inity	inhibitor addn		pH/Alkalinity		inhibitor addn	
State	chose	success	chose	succes	ss chose	success	chose	success
Colorado	6	3	6	4	4	1	4	2
Kansas	0	0	5	2		no sy	stems	
Minnesota	0	0	8	3		no sy	stems	
Arkansas	7	4	2	3	2	1	1	1
Nebraska						no sy	stems	
Montana	2	0	3	1	0	0	0	0

# **Systems that met Copper Action Level after Installing CCT**

# 7a Exceeded Copper Only % successful treatment

# **Medium Systems**

	Groundwate	r Systems	Surface Water Systems			
	pH/Alkalinity	inhibitor addn	pH/Alkalinity	inhibitor addn		
State						
Colorado		100.00%				
Kansas	100.00%	75.00%				
Minnesota	50.00%	66.67%	0.00%	100.00%		
<b>Arkansas</b>	20.00%	100.00%				
Nebraska	0.00%	0.00%				
Montana		50.00%				

# **Small Systems**

_	Groundwate	r Systems	Surface Water Systems		
	pH/Alkalinity	inhibitor addn	pH/Alkalinity	inhibitor addn	
State					
Colorado	66.67%	43.75%	42.86%	100.00%	
Kansas	66.67%	60.00%	100.00%	100.00%	
Minnesota	80.00%	68.35%			
Arkansas	58.33%	40.00%	50.00%	100.00%	
Nebraska	100.00%	0.00%			
Montana	0.00%	27.27%		0.00%	

# 7b Exceeded Lead and Copper

# **Medium Systems**

•	Groundwate	er Systems	Surface Water Systems		
	pH/Alkalinity	inhibitor addn	pH/Alkalinity	inhibitor addn	
State	•				
Colorado	50.00%				
Kansas					
Minnesota		100.00%			
Arkansas	33.33%	100.00%			
Nebraska					
Montana		0.00%		50.00%	

### **Small Systems**

•	Groundwate	r Systems	Surface Water Systems					
	pH/Alkalinity	inhibitor addn	pH/Alkalinity	inhibitor addn				
State								
Colorado	50.00%	66.67%	25.00%	50.00%				
Kansas		40.00%						
Minnesota		37.50%						
Arkansas	57.14%	100.00%	50.00%	100.00%				
Nebraska								
Montana	0.00%	33.33%						

Appendix B

#### 8a Exceeded Copper originally, in compliance after CCT

State Colorado Kansas Minnesota Arkansas Nebraska Montana	H min 6.9 7.4 7	pH max 7.9 8.1	pH ave 7.3 7.8 7.8	alk min		alk ave		Ca max			DIC max E	DIC ave	
Medium Gro State Colorado Kansas Kansas Minnesota Arkansas Arkansas Nebraska Montana	7.2 7.3 7.1 6.15	pH max 7.5 8	pH ave 7.2 7.35 7.6 7.4 7.1	alk min 293 196	3 341 5 432	alk ave 190 309 324	502	Ca max	665	82	DIC max E 89 106		blend or total PO4 0.36 unk .36 1.75 1.5
State  Kansas  Kansas  Kansas		Fe max 0.32			Mn max 0.16		n	phate trea Fe min 0.01 0.01	Fe max 3.19	0.34	Mn min N 0.001 0.002		ve 0.1 005

### 8a Exceeded Copper originally, in compliance after CCT

Small Grour	ndw	ater S	ystem	n Data		pH alkali	nity treatr	nent								
									hardness							
State	n	p⊦	l min	pH max	pH ave	alk min	alk max	alk ave	Ca min	Ca max	Ca ave	DIC min	DIC max	DIC ave		
Colorado		8	7.4	8.12	7.9	75		155					61	38		
Kansas		7	6.3	8.2	7.03	30	376	212	50	482	192	17	91	64		
Minnesota		4	7	7.55	7.18											
Arkansas		5	5.8	7.5	6.9	17	104	47				15	27	21		
Nebraska		data														
Montana	no	data														
Small Groun	ndw	ater S	ystem	n Data		phospha	te treatme	ent								blend or
									hardness						ortho	total
State	n						alk max			Ca max		DIC min			PO4	PO4
Colorado		5	7.2	8.5	7.8								57	44		0.65
Kansas		2	6.8	7.1	7.05	105		160					65		unk	
Kansas		10	6.8	7.7	7.2	66	440	212	110	691	284	23	111	59		unk
Minnesota		13													0.76	
Minnesota		32														3.3
Arkansas		5	6.3	8.8	7.3							9	11	11	2.5	
Arkansas		2	7.1	7.4	7.2	0	218	109				2	58	30		3
Nebraska		data														
Montana	no	data														
04-4-				linity trea		Mariania		Ma		phate trea		E	<b>N 4</b>			ı
State	n	FE	rriin	re max	re ave	ıvırı min	Mn max	iviri ave	n	re min	Fe max	re ave	iviri min	ivin max	iviri ave	
Kansas		7	0.01	5.8	0.59	0.01	1.2	0.1								
Kansas		•	3.01	0.0	0.00	0.01	1.2	5.1	2	0.01	1.6	0.24	0.001	0.006	0.002	2
Kansas									10	0.01	0.4		0.001	0.91	0.13	
										0.01	0.1	0.1	0.001	0.01	0.10	•

#### 8a Exceeded Copper originally, in compliance after CCT

Medium Su	rface Water Sy	stem Data		pH alkal	inity treat	ment	hardnes	s						
State Colorado Kansas Minnesota Arkansas Nebraska Montana	1 no systems	pH max	pH ave 7.6		alk max	alk ave 280	Ca min		Ca ave	DIC min	DIC max	DIC ave 71		
Medium Su	rface Water Sy	stem Data		phospha	ate treatm	ent	hardnes	s					ortho	total
State Colorado Kansas Minnesota Arkansas Nebraska Montana	0 no systems	pH max	pH ave 7.5				Ca min	-	Ca ave	DIC min		DIC ave		PO4

#### Summary of Treated Water AFTER CCT

### 8a Exceeded Copper originally, in compliance after CCT

Small Surfa	ice W	/ater	Syste	m Data		pH alkal	inity treat	ment							
									hardness	3					
State	n	рŀ	H min	pH max	pH ave	alk min	alk max	alk ave	Ca min	Ca max	Ca ave	DIC min	DIC max DIC	ave	
Colorado		3	7.4	8.9	7.9	60	290	175				16	68	43	
Kansas		1	6.9	7.7	7.32	203	223	213	321	383	352	56	65	58	
Minnesota	no s	syste	ems												
Arkansas		1			7			20						6	
Nebraska	no o	data													
Montana	no o	data													
Small Surfa			•		-11		ite treatm		hardness		0	DICi-	DIC DIC	ortho	blend or total
State	nce W		•					alk ave	Ca min				DIC max DIC	ave PO4	total PO4
State Colorado			-l min	pH max	8.04	alk min	alk max	alk ave 196	Ca min	Ca max	170			ave PO4 48	total
State Colorado Kansas	n	pl 1 1	7 H min 7.4	pH max	8.04	alk min	alk max	alk ave 196	Ca min	Ca max	170			ave PO4	total PO4
State Colorado Kansas Minnesota	n		d min 7.4 ems	pH max 7.6	8.04 7.5	alk min	alk max	alk ave 196	Ca min 278	Ca max 446	170 337	55		ave PO4 48	total PO4 0.65
State Colorado Kansas Minnesota Arkansas	n no s	pl 1 1 syste 1	7.4 7.4 ems 7.5	pH max 7.6	8.04 7.5	alk min	alk max	alk ave 196	Ca min	Ca max 446	170 337	55		ave PO4 48	total PO4
State Colorado Kansas Minnesota	n no s	pl 1 1	H min 7.4 ems 7.5	pH max 7.6	8.04 7.5	alk min	alk max	alk ave 196	Ca min 278	Ca max 446	170 337	55		ave PO4 48	total PO4 0.65

### 8b Exceeded Copper originally, NOT in compliance after CCT

8b Exceed	led Copper o	riginally,	NOT in	compli	ance afte	er CCT								
Medium Gro	oundwater Syst	em Data		pH alkali	inity treatr	ment	hardness							
State Colorado Kansas Minnesota Arkansas Nebraska	n pH min no systems no systems 1 7.8		pH ave 7.9		alk max	alk ave			Ca ave	DIC min [	DIC max D	IC ave		
Montana	no data													
Medium Gro	oundwater Syst	em Data		phospha	ite treatme	ent	hardness					ortho	blend total	or
State		pH max	pH ave	alk min	alk max	alk ave			Ca ave	DIC min [	DIC max D	IC ave PO4	PO4	
Colorado Kansas	no systems 1 7.2		7.5		2 275	254	310	391	345	65	68	66	unk	
Minnesota Minnesota Arkansas	3 7.3 2 7.1 1 6.15	7.5	7.5 7.3 6.85										1.3	1.8
Nebraska Montana	no systems no data													
		phate treat												
State	Fe min	Fe max	Fe ave	Mn min	Mn max	Mn ave								
Kansas	1 0.01	0.03	0.02	0.01	0.05	0.008								
Medium Sur	face Water Sy	stem Data		phospha	ite treatme	ent	hardness					ortho	total	
State Arkansas	n pH min 1 6.61	pH max I 7.85	pH ave 7.1						Ca ave	DIC min I 48	DIC max D 104	IC ave PO4	PO4	2
Summary o	of Treated Wa	ter AFTEI	R CCT											
8b Exceed	led Copper o	riginally,	NOT in	compli	ance afte	er CCT								
Small Groun	ndwater System			•	inity treatr		hardness							
State Colorado	n pH min no systems	pH max	pH ave	alk min	alk max	alk ave	Ca min	Ca max	Ca ave	DIC min [	DIC max D	IC ave		
Kansas Minnesota Arkansas	1 6.9 1 6.8 1 6.5	7.4	7.3 7.12 6.5		2 238	211	247	270	) 262	57	61	58		
Nebraska Montana	no data no data													
Small Groun	ndwater System	n Data		phospha	ite treatme	ent	hardness	:				ortho	total	
State Colorado	no systems	pH max					Ca min	Ca max				IC ave PO4	PO4	
Kansas Minnesota Minnesota Arkansas Nebraska Montana	5 6.3 4 7.1 13 6.4 no data no data no data	7.5	7.1 7.5 7.3		) 392	275	50	464	280	17	98	80	unk 1.3	2.1

#### 8c Exceeded Lead and Copper originally, in compliance with Copper after CCT

Medium Gro	oundwater Syst	em Data	pH alkalinity tre	eatment	hardness			
State Colorado Kansas	n pH min 1 no systems	pH max pH ave		ax alk ave 107	Ca min Ca max	Ca ave	DIC min DIC max DIC ave	
Minnesota Arkansas Nebraska Montana	1 7.3 2 6.1 no data no data			29 61			8 32 17	
Medium Gro	oundwater Syste	em Data	phosphate trea	tment	hardness			ortho total
State Colorado	no systems	pH max pH ave	alk min alk m	ax alk ave		Ca ave	DIC min DIC max DIC ave	
Kansas Minnesota Minnesota		7.6 7.	2					1.73
Arkansas Nebraska Montana	1 7.05 no data no data	5 7.63 7.	3 381 4	09 391				1.8
Small Grou	ndwater System	n Data	pH alkalinity tre	eatment				
State Colorado Kansas	n pH min 3 6.9 no systems	pH max pH ave	alk min alk m			Ca ave	DIC min DIC max DIC ave	
State Colorado	n pH min 3 6.9 no systems	pH max pH ave	alk min alk m 3 48 2	ax alk ave	Ca min Ca max	Ca ave	DIC min DIC max DIC ave	
State Colorado Kansas Minnesota Arkansas Nebraska Montana	n pH min 3 6.9 no systems no systems 3 6 no data	pH max pH ave	alk min alk m 3 48 2	ax alk ave 22 115 25 123	Ca min Ca max	Ca ave	DIC min DIC max DIC ave	ortho total

### 8c Exceeded Lead and Copper originally, in compliance with Copper after CCT

Medium Su	rface Water System Data	pH alkalinity treatment	hardness	
State Colorado Kansas Minnesota Arkansas Nebraska Montana	n pH min pH max pH ave no systems no systems no systems no systems no data no data	alk min alk max alk ave		DIC min DIC max DIC ave
Medium Su	rface Water System Data	phosphate treatment	hardness	
State Colorado Kansas Minnesota Arkansas Nebraska Montana	no systems no systems no systems no systems	e alk min alk max alk ave		DIC min DIC max DIC ave
Small Surfa	ce Water System Data	pH alkalinity treatment	hardness	
State Colorado Kansas	•	alk min alk max alk ave		DIC min DIC max DIC ave
State Colorado Kansas Minnesota	n pH min pH max pH ave no systems no systems no systems	alk min alk max alk ave	Ca min Ca max Ca ave	
State Colorado Kansas Minnesota Arkansas Nebraska Montana	n pH min pH max pH aveno systems no systems no systems 1 6.8 8.2 7. no data	alk min alk max alk ave	Ca min Ca max Ca ave	3 6 5
State Colorado Kansas Minnesota Arkansas Nebraska Montana Small Surfa State Colorado Kansas	n pH min pH max pH aveno systems no systems no systems 1 6.8 8.2 7. no data no data ce Water System Data	e alk min alk max alk ave  5 10 26 20  phosphate treatment  alk min alk max alk ave	Ca min Ca max Ca ave hardness Ca min Ca max Ca ave	

#### 8d Exceeded Lead and Copper originally, NOT in compliance with Copper after CCT

Medium Gro	oundwater Syst	em Data		pH alkal	inity treat	ment	hardnes	e						
State Colorado Kansas Minnesota Arkansas Nebraska Montana	n pH min no systems no systems no systems no data no systems no data	pH max p	H ave	alk min	alk max	alk ave			Ca ave	DIC min DIC	C max DIC	ave		
Medium Gro	oundwater Syst	em Data		phospha	te treatm	ent	hardnes	•				ortho	total	
State Colorado Kansas Minnesota	n pH min no systems no systems 1 7.3		H ave	alk min	alk max	alk ave			Ca ave	DIC min DIC	C max DIC	ave PO4	PO4	
Minnesota	1 7.2		7.4											1.5
Arkansas Nebraska Montana	1 7.3 no systems no data	3 7.78	7.5	309	340	315				82	85	85	2	
Small Grou	ndwater Systen	n Data		pH alkal	inity treat	ment	hardnes	•						
State Colorado Kansas Minnesota Arkansas Nebraska	no systems no systems 1 7.3 no data no data		H ave	alk min	alk max	alk ave			Ca ave	DIC min DIC	C max DIC	ave		
Colorado Kansas Minnesota Arkansas	no systems no systems 1 7.3 no data			alk min	alk max	alk ave			Ca ave	DIC min DIC	C max DIC	ave		
Colorado Kansas Minnesota Arkansas Nebraska Montana	no systems no systems 1 7.3 no data no data	3 7.5	7.4		alk max		Ca min	Ca max	Ca ave	DIC min DIC	C max DIC		total	
Colorado Kansas Minnesota Arkansas Nebraska Montana	no systems no systems 1 7.3 no data no data no data no data	3 7.5 n Data	7.4	phospha	te treatm	ent	Ca min	Ca max		DIC min DIC		ortho	total PO4	

### Comments from States for Question 9a.

#### Kansas – none

#### Minnesota –

- Sloughing and rusty water reported after systems initiated polyphosphate or orthophosphate treatment.
- Wastewater discharge limit, if set, in Minnesota is either 4 ppm (rare) or 1 ppm as phosphorus. Since there are more than 10,000 lakes in Minnesota, wastewater discharge is a big issue. Most system are receptive toward adding up to 1.5 mg/L total phosphate (0.5 mg/L as phosphorus), but at this feed rate the copper 90<sup>th</sup> percentile level is between 1 and 2 mg/L. This is the primary reason that systems do not meet the copper action level after CCT.
- Small systems tend to rely on poly or blended phosphate for iron/manganese sequestration. Depending on the age and quality of the product, the polyphosphates have reverted to an appreciable amount of orthophosphate which helps with the

- corrosion control. However, a new batch of product will have little orthophosphate so the systems bounce between compliance and non-compliance.
- Selection of corrosion control products is mostly driven by cost. Systems often select the low bid product without knowing the exact composition or ortho/poly ratio of the product. Selection is also limited by the variety of products that a regional sales vendor carries.

Montana – none

Nebraska – none

Arkansas – sited continued non-compliance for some of their systems

Colorado -

• In general, silicate type inhibitors have not proven effective for lead and copper corrosion control in Colorado.