APPENDIX A

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

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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		

Table 3a: Treated Water Quality Characteristics for Systems Exceeding Copper Action Level Only			
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 $CaCO_3$	# of systems: average: range:	# of systems: average: range:	# of systems: average: range:
Hardness, mg/L as $CaCO_3$	# 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 $CaCO_3$	# of systems: average: range:	# of systems: average: range:	# of systems: average: range:
Hardness, mg/L as $CaCO_3$	# 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	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:

Table 3b: Treated Water Quality Characteristics for Systems Exceeding Both Copper and Lead Action Levels			
Water quality characteristics	Large (> 50,000)	Med (3,301 - 50,000)	Small (≤ 3,300)
Alkalinity, mg/L as $CaCO_3$	# of systems: average: range:	# of systems: average: range:	# of systems: average: range:
Hardness, mg/L as $CaCO_3$	# 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 $CaCO_3$	# of systems: average: range:	# of systems: average: range:	# of systems: average: range:
Hardness, mg/L as $CaCO_3$	# 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:

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 systems *required to Install* CCT			No. of systems *installing* CCT		
Large (> 50,000)	Med (3,301- 50,000)	Small (≤ 3,300)	Large (> 50,000)	Med (3,301- 50,000)	Small (≤ 3,300)
ground water systems					
surface water systems					

Table 4b: Systems Exceeding the Copper and Lead Action Levels					
No. of systems *required to Install* CCT			No. of systems *installing* CCT		
Large (> 50,000)	Med (3,301- 50,000)	Small (≤ 3,300)	Large (> 50,000)	Med (3,301- 50,000)	Small (≤ 3,300)
ground water systems					
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:			
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 using:			
orthophosphate			
polyphosphate			
blended phosphate			
surface water systems using:			
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	Large (> 50,000)	Med (3,301 - 50,000)	Small (≤ 3,300)
ground water systems using:			
orthophosphate			
polyphosphate			
blended phosphate			
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 using:			
pH/alkalinity adjustment			
calcium hardness			
inhibitor addition			
surface water systems using:			
pH/alkalinity adjustment			
calcium hardness			
inhibitor addition			

Table 7b: Number of Systems that Met the Copper Action Level after Installing CCT (Had Exceeded Both Copper & Lead Action Levels)			
Type of CCT	Large (> 50,000)	Med (3,301 - 50,000)	Small (≤ 3,300)
ground water systems using:			
pH/alkalinity adjustment			
calcium hardness			
inhibitor addition			
surface water systems using:			
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 $CaCO_3$ (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.

EXAMPLE 1

Table 8a: Water Quality Parameters for Systems that *Met* 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 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 $CaCO_3$	Lg: Med: Sm:	Lg: Med: Sm:	Lg: Med: Sm: n= 125; ave. = 110; range = 85 - 155	Lg: Med: Sm:
Hardness, mg/L as $CaCO_3$	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 *Did Not Meet* 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 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 $CaCO_3$	Lg: Med: Sm:	Lg: Med: Sm:	Lg: Med: Sm: n= 75; ave. = 200; range = 130 - 260	Lg: Med: Sm:
Hardness, mg/L as $CaCO_3$	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:

Table 8a: Water Quality Parameters for Systems that *Met* 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
ground water systems				
pH range, in pH units	Lg: Med: Sm:	Lg: Med: Sm:	Lg: Med: Sm:	Lg: Med: Sm:
Alkalinity, mg/L as $CaCO_3$	Lg: Med: Sm:	Lg: Med: Sm:	Lg: Med: Sm:	Lg: Med: Sm:
Hardness, mg/L as $CaCO_3$	Lg: Med: Sm:	Lg: Med: Sm:	Lg: Med: Sm:	Lg: Med: Sm:
dosage of inhibitor (if used), mg/L	Lg: Med: Sm:	Lg: Med: Sm:	Lg: Med: Sm:	Lg: Med: Sm:
DIC (if known), mg/L C	Lg: Med: Sm:	Lg: Med: Sm:	Lg: Med: Sm:	Lg: Med: Sm:
Iron, mg/L	Lg: Med: Sm:	Lg: Med: Sm:	Lg: Med: Sm:	Lg: Med: Sm:
Manganese, mg/L	Lg: Med: Sm:	Lg: Med: Sm:	Lg: Med: Sm:	Lg: Med: Sm:
surface water systems				
pH range, in pH units	Lg: Med: Sm:	Lg: Med: Sm:	Lg: Med: Sm:	Lg: Med: Sm:
Alkalinity, mg/L as $CaCO_3$	Lg: Med: Sm:	Lg: Med: Sm:	Lg: Med: Sm:	Lg: Med: Sm:
Hardness, mg/L as $CaCO_3$	Lg: Med: Sm:	Lg: Med: Sm:	Lg: Med: Sm:	Lg: Med: Sm:

Table 8a: Water Quality Parameters for Systems that *Met* 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 inhibitor (if used), mg/L	Lg: Med: Sm:	Lg: Med: Sm:	Lg: Med: Sm:	Lg: Med: Sm:
DIC (if known), mg/L C	Lg: Med: Sm:	Lg: Med: Sm:	Lg: Med: Sm:	Lg: Med: Sm:
TOC (if known), mg/L C	Lg: Med: Sm:	Lg: Med: Sm:	Lg: Med: Sm:	Lg: Med: Sm:

Table 8b: Water Quality Parameters for Systems that *Did Not Meet* 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 systems				
pH range, in pH units	Lg: Med: Sm:	Lg: Med: Sm:	Lg: Med: Sm:	Lg: Med: Sm
Alkalinity, mg/L as $CaCO_3$	Lg: Med: Sm:	Lg: Med: Sm:	Lg: Med: Sm:	Lg: Med: Sm:
Hardness, mg/L as $CaCO_3$	Lg: Med: Sm:	Lg: Med: Sm:	Lg: Med: Sm:	Lg: Med: Sm:
dosage of inhibitor (if used), mg/L	Lg: Med: Sm:	Lg: Med: Sm:	Lg: Med: Sm:	Lg: Med: Sm:
DIC (if known), mg/L C	Lg: Med: Sm:	Lg: Med: Sm:	Lg: Med: Sm:	Lg: Med: Sm:
Iron, mg/L	Lg: Med: Sm:	Lg: Med: Sm:	Lg: Med: Sm:	Lg: Med: Sm:

Table 8b: Water Quality Parameters for Systems that *Did Not Meet* 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, mg/L	Lg: Med: Sm:	Lg: Med: Sm:	Lg: Med: Sm:	Lg: Med: Sm:
surface water systems				
pH range, in pH units	Lg: Med: Sm:	Lg: Med: Sm:	Lg: Med: Sm:	Lg: Med: Sm:
Alkalinity, mg/L as $CaCO_3$	Lg: Med: Sm:	Lg: Med: Sm:	Lg: Med: Sm:	Lg: Med: Sm:
Hardness, mg/L as $CaCO_3$	Lg: Med: Sm:	Lg: Med: Sm:	Lg: Med: Sm:	Lg: Med: Sm:
dosage of inhibitor (if used), mg/L	Lg: Med: Sm:	Lg: Med: Sm:	Lg: Med: Sm:	Lg: Med: Sm:
DIC (if known), mg/L C	Lg: Med: Sm:	Lg: Med: Sm:	Lg: Med: Sm:	Lg: Med: Sm:
TOC (if known), mg/L C	Lg: Med: Sm:	Lg: Med: Sm:	Lg: Med: Sm:	Lg: Med: Sm:

Table 8c: Water Quality Parameters for Systems that *Met* 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 systems				
pH range, in pH units	Lg: Med: Sm:	Lg: Med: Sm:	Lg: Med: Sm:	Lg: Med: Sm:
Alkalinity, mg/L as $CaCO_3$	Lg: Med: Sm:	Lg: Med: Sm:	Lg: Med: Sm:	Lg: Med: Sm:
Hardness, mg/L as $CaCO_3$	Lg: Med: Sm:	Lg: Med: Sm:	Lg: Med: Sm:	Lg: Med: Sm:
dosage of inhibitor (if used), mg/L	Lg: Med: Sm:	Lg: Med: Sm:	Lg: Med: Sm:	Lg: Med: Sm:
DIC (if known), mg/L C	Lg: Med: Sm:	Lg: Med: Sm:	Lg: Med: Sm:	Lg: Med: Sm:
Iron, mg/L	Lg: Med: Sm:	Lg: Med: Sm:	Lg: Med: Sm:	Lg: Med: Sm:
Manganese, mg/L	Lg: Med: Sm:	Lg: Med: Sm:	Lg: Med: Sm:	Lg: Med: Sm:
surface water systems				
pH range, in pH units	Lg: Med: Sm:	Lg: Med: Sm:	Lg: Med: Sm:	Lg: Med: Sm
Alkalinity, mg/L as $CaCO_3$	Lg: Med: Sm:	Lg: Med: Sm:	Lg: Med: Sm:	Lg: Med: Sm
Hardness, mg/L as $CaCO_3$	Lg: Med: Sm:	Lg: Med: Sm:	Lg: Med: Sm:	Lg: Med: Sm

Table 8c: Water Quality Parameters for Systems that *Met* 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: Med: Sm:	Lg: Med: Sm:	Lg: Med: Sm:	Lg: Med: Sm:
DIC (if known), mg/L C	Lg: Med: Sm:	Lg: Med: Sm:	Lg: Med: Sm:	Lg: Med: Sm:
TOC (if known), mg/L C	Lg: Med: Sm:	Lg: Med: Sm:	Lg: Med: Sm:	Lg: Med: Sm:

Table 8d: Water Quality Parameters for Systems that *Did Not Meet* 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 systems				
pH range, in pH units	Lg: Med: Sm:	Lg: Med: Sm:	Lg: Med: Sm:	Lg: Med: Sm:
Alkalinity, mg/L as $CaCO_3$	Lg: Med: Sm:	Lg: Med: Sm:	Lg: Med: Sm:	Lg: Med: Sm:
Hardness, mg/L as $CaCO_3$	Lg: Med: Sm:	Lg: Med: Sm:	Lg: Med: Sm:	Lg: Med: Sm:
dosage of inhibitor (if used), mg/L	Lg: Med: Sm:	Lg: Med: Sm:	Lg: Med: Sm:	Lg: Med: Sm:
DIC (if known), mg/L C	Lg: Med: Sm:	Lg: Med: Sm:	Lg: Med: Sm:	Lg: Med: Sm:
Iron, mg/L	Lg: Med: Sm:	Lg: Med: Sm:	Lg: Med: Sm:	Lg: Med: Sm:

Table 8d: Water Quality Parameters for Systems that *Did Not Meet* the Copper Action Level After (exceeded both action levels)				
Water quality characteristics	pH/alkalinity adjustment	Calcium hardness	Orthophosphate addition	Poly or Blended Phosphate addn
Manganese, mg/L	Lg: Med: Sm:	Lg: Med: Sm:	Lg: Med: Sm:	Lg: Med: Sm:
surface water systems				
pH range, in pH units	Lg: Med: Sm:	Lg: Med: Sm:	Lg: Med: Sm:	Lg: Med: Sm:
Alkalinity, mg/L as $CaCO_3$	Lg: Med: Sm:	Lg: Med: Sm:	Lg: Med: Sm:	Lg: Med: Sm:
Hardness, mg/L as $CaCO_3$	Lg: Med: Sm:	Lg: Med: Sm:	Lg: Med: Sm:	Lg: Med: Sm:
dosage of inhibitor (if used), mg/L	Lg: Med: Sm:	Lg: Med: Sm:	Lg: Med: Sm:	Lg: Med: Sm:
DIC (if known), mg/L C	Lg: Med: Sm:	Lg: Med: Sm:	Lg: Med:	Lg: Med: Sm:
TOC (if known), mg/L C	Lg: Med: Sm:	Lg: Med: Sm:	Lg: Med: Sm:	Lg: Med: 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

State	1 # of Systems subject to LCR #GW	2 # only exceeding Cu only #GW	2 # exceeding Pb/Cu #GW	1 # of Systems subject to LCR #SW	2 # exceeding Cu only #SW	2# exceeding Pb/Cu #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

State	1 # of Systems subject to LCR #GW	2 # only exceeding Cu only #GW	2 # exceeding Pb/Cu #GW	1 # of Systems subject to LCR #SW	2 # exceeding Cu only #SW	2# exceeding Pb/Cu #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

State	1 # of Systems subject to LCR #GW	2 # only exceeding Cu only #GW	2 # exceeding Pb/Cu #GW	1 # of Systems subject to LCR #SW	2 # only exceeding Cu only #SW	2 # exceeding Pb/Cu #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

	Groundwater % 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 GWUI

Small System Data

	Groundwater % systems exceeding		Surface Water % 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 Groundwater System Data

	pH min	pH max	pH ave	alk min	alk max	alk ave	hardness Ca min	Ca max	Ca ave	DIC min	DIC max	DIC ave	n
State													
Colorado			6.9			150			140			48	1
Kansas	6.78	8.01	7.4	117	432	244	153	738	367	40	106	65	6
Minnesota	7	8.1	7.4	160	470	280	80	550	212	54	102	66	21
Arkansas	6.18	7.9	7.11	64	403	210	2	240	56	43	100	46	9
Nebraska	7.2	7.25	7.23	227	252	242	232	270	242	63	69	67	4
Montana	no data												

Small Groundwater System Data

	pH min	pH max	pH ave	alk min	alk max	alk ave	hardness 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 ave	n		Note
State									
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 systems remove iton or manganese
Nebraska	0.015	0.06	0.04	0.19	0.27	0.2	2	med	
Kansas	0.01	5.76	0.21	0.001	1.19	0.08	30	small	
Minnesota	0.04	4.4	0.69	0.01	1.6	0.23	118	small	70% of systems remove iron or manganese
Nebraska	0.07	0.08	0.077	0.06	0.2	0.2	3	small	

3a Exceeded Copper Level

Medium Surface Water System Data

	pH min	pH max	pH ave	alk min	alk max	alk ave	hardness Ca min	Ca max	Ca ave	DIC min	DIC max	DIC ave	n
State													
Colorado	7.4	7.6	7.5	280	320	300	105	350	227	74	82	78	2
Kansas	no systems												
Minnesota	no systems												
Arkansas	5.8	8.3	6.8	57	167	122	4	67	44	40	71	42	3
Nebraska	no data												
Montana	no systems												

Small Surface Water System Data

	pH min	pH max	pH ave	alk min	alk max	alk ave	hardness Ca min	Ca max	Ca ave	DIC min	DIC max	DIC ave	n
State													
Colorado	6.8	7.5	7.2	20	188	107	20	140	90	7	49	30	8
Kansas	6.9	7.7	7.5	203	276	238	278	446	337	62	70	65	2
Minnesota	no systems												
Arkansas	5.4	7.3	6.6	1	58	26	2	26	12	3	16	10	3
Nebraska	no systems												
Montana	no data												

	TOC min	TOC max	TOC ave	n
Kansas	6	8	6.7	1

Summary of Treated Water Quality BEFORE CCT

3b Exceeded Lead and Copper Levels

Medium Groundwater System Data

State	pH min	pH max	pH ave	alk min	alk max	alk ave	hardness Ca min	Ca max	Ca ave	DIC min	DIC max	DIC ave	n
Colorado	7.3	7.36	7.33	70	180	125	100	584	342	19	48	34	2
Kansas	no systems												
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

State	pH min	pH max	pH ave	alk min	alk max	alk ave	hardness Ca min	Ca max	Ca ave	DIC min	DIC max	DIC ave	n
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												

State	Fe min	Fe max	Fe ave	Mn min	Mn max	Mn ave	n	
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

Medium Surface Water System Data

State	pH min	pH max	pH ave	alk min	alk max	alk ave	hardness Ca min	Ca max	Ca ave	DIC min	DIC max	DIC ave	n
Colorado	no systems												
Kansas	no systems												
Minnesota	no systems												
Arkansas	no systems												
Nebraska	no systems												
Montana	no data												

Small Surface Water System Data

State	pH min	pH max	pH ave	alk min	alk max	alk ave	hardness Ca min	Ca max	Ca ave	DIC min	DIC max	DIC ave	n
Colorado	5.9	7.4	6.5	6	100	38				6	26	17	7
Kansas	no systems												
Minnesota	no systems												
Arkansas	6.4	6.7	6.6	9	11	10	3	14	9	4	4	4	2
Nebraska	no systems												
Montana	no data												

Summary of Systems adding Corrosion Control

4a and 4b

Medium System Data

	Groundwater				Surface Water			
	Systems that exceeded copper require CCT	Installing CCT	Systems that exceeded Cu/Pb require CCT	Installing CCT	Systems that exceeded copper require CCT	Installing CCT	Systems that exceeded Cu/Pb require CCT	Installing CCT
State	#	#	#	#	#	#	#	#
Colorado	1	1	2	1	0	0	0	0
Kansas	6	6	0	5	0	0	0	0
Minnesota	20	20	9	9	0	0	0	0
Arkansas	6	5	3	3	4	3	0	0
Nebraska	6	0	0	0	0	0	0	0
Montana	3	2	1	1	0	0	3	2

Small System Data

	Groundwater				Surface Water			
	Systems that exceeded copper require CCT	Installing CCT	Systems that exceeded Cu/Pb require CCT	Installing CCT	Systems that exceeded copper require CCT	Installing CCT	Systems that exceeded Cu/Pb require CCT	Installing CCT
State	#	#	#	#	#	#	#	#
Colorado	34	22	12	12	10	6	10	9
Kansas	30	29	5	5	2	2	0	0
Minnesota	83	77	8	8	0	0	0	0
Arkansas	23	14	10	7	9	2	2	2
Nebraska	32	2	2	0	0	0	0	0
Montana	59	13	14	6	5	1	3	1

Summary of Systems adding Corrosion Control

5a Exceeded Copper only

Medium System Data **Type of CCT**

	Groundwater			Surface Water		
	pH/Alkalinity	calcium hardness	inhibitor addn	pH/Alkalinity	calcium hardness	inhibitor addn
State						
Colorado	0	0	1	0	0	0
Kansas	2	0	4		no systems	
Minnesota	2	0	18		no systems	
Arkansas	5	0	4	3	0	3
Nebraska	3	0	3		no data	
Montana	0	0	2		no systems	

Small System Data **Type of CCT**

	Groundwater			Surface Water		
	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	
Arkansas	12	0	5	2	0	1
Nebraska	1	0	13		no systems	
Montana	1	0	11	0	0	1

5b Exceeded Lead and Copper

Medium System Data **Type of CCT**

	Groundwater			Surface Water		
	pH/Alkalinity	calcium hardness	inhibitor addn	pH/Alkalinity	calcium hardness	inhibitor addn
State						
Colorado	2	0	0		no systems	
Kansas		no systems			no systems	
Minnesota	0	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 addn	pH/Alkalinity	calcium hardness	inhibitor addn
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
Nebraska		no data			no systems	
Montana	2	0	3	0	0	0

Summary of Phosphate Inhibitor Use by Water Systems

6a Exceeded Copper Only

Medium Systems

	Groundwater Systems				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

	Groundwater Systems				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

	Groundwater Systems				Surface Water Systems			
State	all types	orthoP	poly P	blend	all types	orthoP	poly P	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	0	0

Small Systems

	Groundwater Systems				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/Alkalinity		inhibitor addn		pH/Alkalinity		inhibitor addn	
State	chose	success	chose	success	chose	success	chose	success
Colorado	0	0	1	1	0	0	0	0
Kansas	2	2	4	3		no systems		
Minnesota	2	1	18	12		no systems		
Arkansas	5	1	4	4	3	0	3	3
Nebraska	3	0	3	0				
Montana	0	0	2	1		no systems		

Small Systems

	Groundwater Systems				Surface Water Systems			
	pH/Alkalinity		inhibitor addn		pH/Alkalinity		inhibitor addn	
State	chose	success	chose	success	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 systems		
Arkansas	12	7	5	2	2	1	1	1
Nebraska	1	1	13	0		no systems		
Montana	1	0	11	3	0	0	1	0

7b Exceeded Lead and Copper

Medium Systems

	Groundwater Systems				Surface Water Systems			
	pH/Alkalinity		inhibitor addn		pH/Alkalinity		inhibitor addn	
State	chose	success	chose	success	chose	success	chose	success
Colorado	2	1	0	0		no systems		
Kansas		no systems				no systems		
Minnesota	0	0	8	8		no systems		
Arkansas	3	1	3	3		no systems		
Nebraska		no systems				no systems		
Montana	0	0	1	0	0	0	2	1

Small Systems

	Groundwater Systems				Surface Water Systems			
	pH/Alkalinity		inhibitor addn		pH/Alkalinity		inhibitor addn	
State	chose	success	chose	success	chose	success	chose	success
Colorado	6	3	6	4	4	1	4	2
Kansas	0	0	5	2		no systems		
Minnesota	0	0	8	3		no systems		
Arkansas	7	4	2	3	2	1	1	1
Nebraska						no systems		
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

	Groundwater 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%
Arkansas	20.00%	100.00%		
Nebraska	0.00%	0.00%		
Montana		50.00%		

Small Systems

	Groundwater 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

	Groundwater 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

	Groundwater 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%		

8a Exceeded Copper originally, in compliance after CCT

Medium Groundwater System Data — pH alkalinity treatment

State	n	pH min	pH max	pH ave	alk min	alk max	alk ave	hardness Ca min	Ca max	Ca ave	DIC min	DIC max	DIC ave
Colorado													
Kansas	3	6.9	7.9	7.3	117	222	192	153	384	266	43	58	48
Minnesota	1	7.4	8.1	7.8									
Arkansas	1	7	8.6	7.8									
Nebraska	no data												
Montana	no data												

Medium Groundwater System Data — phosphate treatment

State	n	pH min	pH max	pH ave	alk min	alk max	alk ave	hardness Ca min	Ca max	Ca ave	DIC min	DIC max	DIC ave	ortho PO4	blend or total PO4
Colorado	1			7.2			190						53		0.36
Kansas	1	7.2	7.5	7.35	293	341	309	502	738	665	82	89	83	unk	
Kansas	1	7.3	8	7.6	196	432	324	295	624	396	53	106	83		unk
Minnesota	2													1.36	
Minnesota	9	7.1	7.6	7.4											1.75
Arkansas	3	6.15	7.8	7.1										1.5	
Arkansas	1				225	292	260								2
Nebraska	no data														
Montana	no data														

State	pH alkalinity treatment n	Fe min	Fe max	Fe ave	Mn min	Mn max	Mn ave	phosphate treatment n	Fe min	Fe max	Fe ave	Mn min	Mn max	Mn ave
Kansas	3	0.01	0.32	0.07	0.01	0.16	0.02							
Kansas								1	0.01	3.19	0.34	0.001	0.31	0.1
Kansas								1	0.01	6.8	0.38	0.002	1.26	0.005

8a Exceeded Copper originally, in compliance after CCT

Small Groundwater System Data — pH alkalinity treatment

State	n	pH min	pH max	pH ave	alk min	alk max	alk ave	hardness Ca min	Ca max	Ca ave	DIC min	DIC max	DIC ave
Colorado	8	7.4	8.12	7.9	75	250	155	28	140	93	20	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	no data												
Montana	no data												

Small Groundwater System Data — phosphate treatment

State	n	pH min	pH max	pH ave	alk min	alk max	alk ave	hardness Ca min	Ca max	Ca ave	DIC min	DIC max	DIC ave	ortho PO4	blend or total PO4
Colorado	5	7.2	8.5	7.8	120	240	176	140	212	181	33	57	44		0.65
Kansas	2	6.8	7.1	7.05	105	225	160	115	393	222	36	65	48	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	20	46	33				9	11	11	2.5	
Arkansas	2	7.1	7.4	7.2	0	218	109				2	58	30		3
Nebraska	no data														
Montana	no data														

State	pH alkalinity treatment n	Fe min	Fe max	Fe ave	Mn min	Mn max	Mn ave	phosphate treatment n	Fe min	Fe max	Fe ave	Mn min	Mn max	Mn ave
Kansas	7	0.01	5.8	0.59	0.01	1.2	0.1							
Kansas								2	0.01	1.6	0.24	0.001	0.006	0.002
Kansas								10	0.01	0.4	0.1	0.001	0.91	0.13

Summary of Treated Water AFTER CCT

8a Exceeded Copper originally, in compliance after CCT

Medium Surface Water System Data — pH alkalinity treatment

State	n	pH min	pH max	pH ave	alk min	alk max	alk ave	hardness Ca min	Ca max	Ca ave	DIC min	DIC max	DIC ave
Colorado	1			7.6			280						71
Kansas	no systems												
Minnesota	no systems												
Arkansas	0												
Nebraska	no systems												
Montana	no systems												

Medium Surface Water System Data — phosphate treatment

State	n	pH min	pH max	pH ave	alk min	alk max	alk ave	hardness Ca min	Ca max	Ca ave	DIC min	DIC max	DIC ave	ortho PO4	total PO4
Colorado	0														
Kansas	no systems														
Minnesota	no systems														
Arkansas	2	6.5	8.8	7.5	9	218	73				4	51	19	2	
Nebraska	no systems														
Montana	no systems														

Summary of Treated Water AFTER CCT

8a Exceeded Copper originally, in compliance after CCT

Small Surface Water System Data — pH alkalinity treatment

State	n	pH min	pH max	pH ave	alk min	alk max	alk ave	hardness 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 systems												
Arkansas	1			7			20						6
Nebraska	no data												
Montana	no data												

Small Surface Water System Data — phosphate treatment

State	n	pH min	pH max	pH ave	alk min	alk max	alk ave	hardness Ca min	Ca max	Ca ave	DIC min	DIC max	DIC ave	ortho PO4	blend or total PO4
Colorado	1			8.04			196			170			48		0.65
Kansas	1	7.4	7.6	7.5	208	276	263	278	446	337	55	71	68	unk	
Minnesota	no systems														
Arkansas	1	7.5	7.8	7.64				54	61	58				3	
Nebraska	no data														
Montana	no data														

Summary of Treated Water AFTER CCT

8b Exceeded Copper originally, NOT in compliance after CCT

Medium Groundwater System Data					pH alkalinity treatment									
								hardness						
State	n	pH min	pH max	pH ave	alk min	alk max	alk ave	Ca min	Ca max	Ca ave	DIC min	DIC max	DIC ave	
Colorado	no systems													
Kansas	no systems													
Minnesota	1	7.8	8.1	7.9										
Arkansas														
Nebraska	no systems													
Montana	no data													

Medium Groundwater System Data					phosphate treatment											
								hardness						ortho	total	
State	n	pH min	pH max	pH ave	alk min	alk max	alk ave	Ca min	Ca max	Ca ave	DIC min	DIC max	DIC ave	PO4	PO4	
Colorado	no systems															
Kansas	1	7.2	7.9	7.5	232	275	254	310	391	345	65	68	66		unk	
Minnesota	3	7.3	7.9	7.5										1.3		
Minnesota	2	7.1	7.5	7.3												1.8
Arkansas	1	6.15	7.66	6.85										2		
Nebraska	no systems															
Montana	no data															

	phosphate treatment						
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 Surface Water System Data					phosphate treatment										
								hardness						ortho	total	
State	n	pH min	pH max	pH ave	alk min	alk max	alk ave	Ca min	Ca max	Ca ave	DIC min	DIC max	DIC ave	PO4	PO4	
Arkansas	1	6.61	7.85	7.1	122	418	152				48	104	44			2

Summary of Treated Water AFTER CCT

8b Exceeded Copper originally, NOT in compliance after CCT

Small Groundwater System Data					pH alkalinity treatment									
								hardness						
State	n	pH min	pH max	pH ave	alk min	alk max	alk ave	Ca min	Ca max	Ca ave	DIC min	DIC max	DIC ave	
Colorado	no systems													
Kansas	1	6.9	7.6	7.3	182	238	211	247	270	262	57	61	58	
Minnesota	1	6.8	7.4	7.12										
Arkansas	1	6.5	6.61	6.5										
Nebraska	no data													
Montana	no data													

Small Groundwater System Data					phosphate treatment											
								hardness						ortho	total	
State	n	pH min	pH max	pH ave	alk min	alk max	alk ave	Ca min	Ca max	Ca ave	DIC min	DIC max	DIC ave	PO4	PO4	
Colorado	no systems															
Kansas	5	6.3	7.8	7.1	30	392	275	50	464	280	17	98	80		unk	
Minnesota	4	7.1	7.5	7.5										1.3		
Minnesota	13	6.4	7.7	7.3												2.1
Arkansas	no data															
Nebraska	no data															
Montana	no data															

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

Medium Groundwater System Data — pH alkalinity treatment

State	n	pH min	pH max	pH ave	alk min	alk max	alk ave	hardness Ca min	Ca max	Ca ave	DIC min	DIC max	DIC ave
Colorado	1			7.38			107						28
Kansas	no systems												
Minnesota	1	7.3	8.5	7.7									
Arkansas	2	6.1	8	7.2	10	129	61				8	32	17
Nebraska	no data												
Montana	no data												

Medium Groundwater System Data — phosphate treatment

State	n	pH min	pH max	pH ave	alk min	alk max	alk ave	hardness Ca min	Ca max	Ca ave	DIC min	DIC max	DIC ave	ortho PO4	total PO4	
Colorado	no systems															
Kansas	no systems															
Minnesota	2	7.5	7.6	7.5										1.73		
Minnesota	4	7.1	7.6	7.2												2
Arkansas	1	7.05	7.63	7.3	381	409	391							1.8		
Nebraska	no data															
Montana	no data															

Small Groundwater System Data — pH alkalinity treatment

State	n	pH min	pH max	pH ave	alk min	alk max	alk ave	hardness Ca min	Ca max	Ca ave	DIC min	DIC max	DIC ave
Colorado	3	6.9	7.7	7.3	48	222	115						
Kansas	no systems												
Minnesota	no systems												
Arkansas	3	6	8.97	7.5	120	125	123						
Nebraska	no data												
Montana	no data												

Small Groundwater System Data — phosphate treatment

State	n	pH min	pH max	pH ave	alk min	alk max	alk ave	hardness Ca min	Ca max	Ca ave	DIC min	DIC max	DIC ave	ortho PO4	total PO4	
Colorado	3	6.9	7.7	7.3	48	222	115								0.46	
Kansas	2	6.8	7.2	7.12	176	383	272	237	484	342					unk	
Minnesota	3	7.3	7.8	7.56												5
Arkansas	2	6.5	8	7.3	163	171	166							1.9		
Nebraska	no data															
Montana	no data															

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

Medium Surface Water System Data — pH alkalinity treatment

State	n	pH min	pH max	pH ave	alk min	alk max	alk ave	hardness Ca min	Ca max	Ca ave	DIC min	DIC max	DIC ave
Colorado	no systems												
Kansas	no systems												
Minnesota	no systems												
Arkansas	no systems												
Nebraska	no data												
Montana	no data												

Medium Surface Water System Data — phosphate treatment

State	n	pH min	pH max	pH ave	alk min	alk max	alk ave	hardness Ca min	Ca max	Ca ave	DIC min	DIC max	DIC ave
Colorado	no systems												
Kansas	no systems												
Minnesota	no systems												
Arkansas	no systems												
Nebraska	no data												
Montana	no data												

Small Surface Water System Data — pH alkalinity treatment

State	n	pH min	pH max	pH ave	alk min	alk max	alk ave	hardness Ca min	Ca max	Ca ave	DIC min	DIC max	DIC ave
Colorado	no systems												
Kansas	no systems												
Minnesota	no systems												
Arkansas	1	6.8	8.2	7.5	10	26	20				3	6	5
Nebraska	no data												
Montana	no data												

Small Surface Water System Data — phosphate treatment

State	n	pH min	pH max	pH ave	alk min	alk max	alk ave	hardness Ca min	Ca max	Ca ave	DIC min	DIC max	DIC ave	ortho PO4	total PO4	
Colorado	1			6.4			15							7		0.3
Kansas	no systems															
Minnesota	no systems															
Arkansas	1	6.8	7.7	7.2											2	
Nebraska	no data															
Montana	no data															

Summary of Treated Water AFTER CCT

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

Medium Groundwater System Data					pH alkalinity treatment								
								hardness					
State	n	pH min	pH max	pH ave	alk min	alk max	alk ave	Ca min	Ca max	Ca ave	DIC min	DIC max	DIC ave
Colorado	no systems												
Kansas	no systems												
Minnesota	no systems												
Arkansas	no data												
Nebraska	no systems												
Montana	no data												

Medium Groundwater System Data					phosphate treatment										
								hardness						ortho	total
State	n	pH min	pH max	pH ave	alk min	alk max	alk ave	Ca min	Ca max	Ca ave	DIC min	DIC max	DIC ave	PO4	PO4
Colorado	no systems														
Kansas	no systems														
Minnesota	1	7.3	7.7	7.5										1.5	
Minnesota	1	7.2	7.6	7.4											1.5
Arkansas	1	7.3	7.78	7.5	309	340	315				82	85	85	2	
Nebraska	no systems														
Montana	no data														

Small Groundwater System Data					pH alkalinity treatment								
								hardness					
State	n	pH min	pH max	pH ave	alk min	alk max	alk ave	Ca min	Ca max	Ca ave	DIC min	DIC max	DIC ave
Colorado	no systems												
Kansas	no systems												
Minnesota	1	7.3	7.5	7.4									
Arkansas	no data												
Nebraska	no data												
Montana	no data												

Small Groundwater System Data					phosphate treatment										
								hardness						ortho	total
State	n	pH min	pH max	pH ave	alk min	alk max	alk ave	Ca min	Ca max	Ca ave	DIC min	DIC max	DIC ave	PO4	PO4
Colorado	no systems														
Kansas	2	6.7	7.8	6.9	74	198	129	79	274	173	27	49	41		unk
Minnesota	1	7.3	7.5	7.4										0.8	
Minnesota	3	7.1	7.8	7.4											2.3
Arkansas	1	5.7	7	6.2										2	
Nebraska	no data														
Montana	no data														

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 90th 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.