NMED
New Mexico Environment Department

LEAD-COPPER RULE: SAMPLING, ACTION LEVEL EXCEEDANCE DETERMINATION, AND CORROSION CONTROL TREATMENT

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Why is the Lead-Copper Rule important?

- Lead and Copper are regulated because of possible negative health effects
- Main sources of Lead and Copper are in system & customer plumbing
- New Scrutiny following issues in Flint, Mi.

Where does Lead and Copper enter our water?

- Lead and Copper enter our water via leaching from plumbing, either in utility or residence due to water corroding plumbing
- Galvanic potential between different metals used in plumbing

Material (coating) / Screw Material (coating)	Steel (zinc plated)	Nickel/ Steel (nickel plated)	Copper/ Steel (copper plated)	Brass/ Steel (brass coated)	Aluminium	Steel (Dacromet/ Deltatone)	Stainless steel (A2/A3; A4/A5)
Steel (zinc plated)	+	-	-	-	●	+	-
Steel (nickel plated)	-	+	+	●		-	+
Steel (copper coated)	-	+	+	●	-	-	●
Steel (brass coated) Brass				+			
WIROX®	+	-	-	-	+	+	-
Aluminium		-	-		+	●	-
Steel (Dacromet/Deltatone)	+	-	-		●	+	-
Stainless steel (A2/A3 ; A4/A5)	●	+	+	●	●	●	+

- Severe contact corrosion
● No contact corrosion of any significance
+ No contact corrosion

Where does Lead and Copper enter our water?

GALVANIZED STEEL (MAGNET STICKS)

LEAD

COPPER

PLASTIC

Who does Lead and Copper ingestion affect?

- Lead ingestion causes long-term health problems
  - In Children: Can cause high blood pressure, reproductive problems, seizures, coma, and death
    - Developing fetuses and growing children are highly susceptible to lead's toxic effects
  - In Adults: Can cause high blood pressure, reproductive problems, kidney damage, hearing loss, and neurological problems.
- New Mexico Department of Health: Lead Poisoning Prevention
- https://nmhealth.org/about/erd/eheb/clppp/
- Copper ingestion can cause abdominal pain, nausea, vomiting, diarrhea, headache, cramps

General LCR Tap Sampling Requirements

- All Community Water Systems and Non-Transient/Non-Community Water systems must sample for the Lead-Copper Rule

Exhibit II-2: Minimum Number of Lead and Copper Tap Samples for Systems on Standard Monitoring

System Size	No. of Samples
> 100,000	100
10,001 - 100,000	60
3,301 - 10,000	40
501 - 3,300	20
101 – 500	10
≤ 100	5

If fewer than five tap sites are used for human consumption, the Revisions clarify that you must collect more than one sample from the same location on different days to obtain the minimum number of required samples. Alternatively, your State may allow you to collect one sample per available sample tap.

Exhibit II-3: Minimum Number of Lead and Copper Tap Samples for Systems on Reduced Monitoring

System Size	No. of Samples
> 100,000	50
10,001 - 100,00	30
3,301 - 10,000	20
501 - 3,300	10
101 – 500	5
≤ 100 [1]	5

[1] The number of samples for systems serving ≤100 people is the same under standard and reduced monitoring.

Standard Monitoring

- Sample every 6 months, (January to June, July to December)
- Standard monitoring was required at all existing CWS & NCNTWS when LCR was implemented
- All new systems must do standard monitoring
- Standard monitoring continues until 90th percentiles for Lead and Copper are below ALEs for 2 consecutive 6-month periods

Standard Monitoring

- Standard monitoring may start in either period
- On standard monitoring, sample may be collected any time during monitoring period
- Reduced monitoring frequency is based on results of standard monitoring
- Systems on reduced monitoring that exceed either the Lead or Copper AL must return to standard monitoring.

Reduced Monitoring - Annual

- Start annual sampling if 90th percentile if:
  - Lead 90th percentiles during standard monitoring was ≤ 0.015 mg/L, but > 0.05 mg/L
  - Copper 90th percentiles during standard monitoring was ≤ 1.3 mg/L, but > 0.65 mg/L
- During standard monitoring, LCR samples must be collected between June 1 and Sept 30.
- System must collect 3 consecutive years of annual data before further reduction in sampling frequency may be considered

Reduced Monitoring - Triennial

- Reduced to triennial (every 3 years) if:
  - Lead 90th percentile during standard monitoring was ≤ 0.005 mg/L, and
  - Copper 90th percentile during standard monitoring was ≤ 0.65 mg/L
- Collect samples between June 1 and Sept 30

Compliance Determination

- Action Level Exceedance (ALE) – There are no set Maximum Contaminant Levels (MCLs) for the Lead-Copper Rule
- Copper ALE – 1.3 mg/L = 1,300 µg/L
- Lead ALE – 15 mg/L = 0.015 µg/L
- 90th percentile of dataset:
  - Results are listed in order from lowest to highest concentration
  - Select or interpolate 90th percentile value

90th Percentile determination

	Lead (mg/L)	Copper (mg/L)		
	<0.0005	0.023		1
	<0.0005	0.025		2
	0.00063	0.038		3
	0.0007	0.055		4
	0.00072	0.21		5
	0.00093	0.25		6
	0.00098	0.26		7
	0.0021	0.41		8
	0.0022	1.2		9
	0.004	2.4		10
Lead 90th % (mg/L)	**0.0022**	**1.2**	**Cu 90th % (mg/L)**	
Lead 90th % (ug/L)	**2.2**	**1200**	**Cu 90th % (ug/L)**	

Sample Collection protocol

- 6-18 hour stagnation, cold water tap, tap designed for human consumption
- One liter volume
- System or residents can collect samples
- No Point of Use treatment (R.O.), water softeners

Sample Locations- Tiers

Exhibit II-7: Tiering Classification	
If you are a CWS	***If you are an NTNCWS***
Tier 1 sampling sites are single family structures: • with copper pipes with lead solder installed after 1982 *(but before the effective date of your State's lead ban)* or contain lead pipes; and/or • that are served by a lead service line. **Note:** When multiple-family residences (MFRs) comprise at least 20% of the structures served by a water system, the system may count them as Tier 1 sites.	**Tier 1** sampling sites consist of buildings: • with copper pipes with lead solder installed after 1982 *(but before the effective date of your State's lead ban)* or contain lead pipes; and/or • that are served by a lead service line.
Tier 2 sampling sites consist of buildings, including MFRs: • with copper pipes with lead solder installed after 1982 *(but before effective date of your State's lead ban)* or contain lead pipes; and/or • that are served by a lead service line.	**Tier 2** sampling sites consist of buildings with copper pipes with lead solder installed before 1983.
Tier 3 sampling sites are single family structures with copper pipes having lead solder installed before 1983.	**Tier 3**: Not applicable.
Representative Sample: If a CWS or NTNCWS cannot collect enough samples from tiered sites, it must collect them from sites where the plumbing is similar to that used at other sites served by the water system.	

N.M. Lead Ban: 1986

Historic uses of lead & copper in plumbing:

- Prior to 1986, no regulation on amount of lead in pipes
- Lead Ban 1986: lead in pipes less that 8% by weight, Lead content of plumbing solder less than 0.25% by weight
- 2011: 0.25% lead in pipes along wetted surface, 0.2% lead content of plumbing solder

What happens when results exceed action level (ALE)?

- Reduced monitoring ALE
- Standard monitoring (2x sample locations) and WQP collection
- OCCT recommendations in sampling period following 2 consecutive ALEs
- OCCT installation & treatment – 2 years allowed to install following recommendation of treatment (allows for funding, locating vendors, engineering review, etc.)

Reduced monitoring ALE Exceedance – next sampling steps

- Standard monitoring Lead-Copper tap samples
- Water Quality Parameters – 2 samples collected at Entry Point, 2 designated Lead-Copper sample sites in distribution, at X numbers of distribution locations, based on population
- Standard monitoring for LCR and WQP will continue until 90th percentile value is below ALE for 2 consecutive 6 month periods
- Systems will always collect WQPs in sampling periods following ALE
- Public education required for Lead ALE

Lead ALE public notice

- All systems are required to notify the locations sampled of their specific lead result and of the water system's 90th percentile.
- Notice must be made within 30 days of receipt of results
- Done regardless of whether or not system exceeds the Lead of Copper AL
- Copies of notices and certification for must to sent to DWB within 90 days of end of monitoring period
- Template provided by DWB to your system

Lead ALE Public Notice

IMPORTANT INFORMATION ABOUT LEAD IN YOUR DRINKING WATER

Este informe contiene informacion muy importante sobre la calidad de su agua potable. Por favor lea este informe o comuniquese con alguien que pueda traducir la informacion

[INSERT NAME OF WATER SYSTEM]_____ _____found elevated levels of lead in drinking water in some homes/buildings. Lead can cause serious health problems, especially for pregnant women and young children. Please read this information closely to see what you can do to reduce lead in your drinking water.

What are the health effects of lead?

Lead can cause serious health problems if too much enters your body from drinking water or other sources. It can cause damage to the brain and kidneys, and can interfere with the production of red blood cells that carry oxygen to all parts of your body. The greatest risk of lead exposure is to infants, young children, and pregnant women. Scientists have linked the effects of lead on the brain with lowered IQ in children. Adults with kidney problems and high blood pressure can be affected by low levels of lead more than healthy adults. Lead is stored in the bones, and it can be released later in life. During pregnancy, the child receives lead from the mother's bones, which may affect brain development.

What is lead?

Lead is a naturally occurring element found in small amounts in the earth's crust. While it has some beneficial uses, it can be toxic to humans and animals, causing health effects.

What are possible sources of lead in drinking water and how does lead enter drinking water?

Water Quality Parameters

- List of Water Quality Parameters
  - Field Parameters
    - pH
    - Temperature
    - Free/Total Chlorine Residual
  - Lab Analyses
    - Chloride
    - Sulfate
    - Conductivity
    - Total Alkalinity as $CaCO_3$
    - Calcium
    - Iron
    - Magnesium
    - Manganese
    - Hardness as $CaCO_3$
    - Sodium

Corrosivity Indices

- Aggressive Index: sometimes substituted for LSI; includes pH, calcium hardness, total alkalinity
- Modified Larson's Ratio: describes corrosivity of water towards mild steel; includes sulfate, chloride, alkalinity.
- Langlier Saturation Index (LSI): measure of solution's ability to dissolve or deposit Calcium Carbonate; includes pH, calcium hardness, total alkalinity, temperature
- Ryznar Stability Index (RSI): updated LSI to correct for mathematic model issues

Optimal Corrosion Control Treatment (OCCT) recommendation

- Optimal Corrosion Control Treatment recommendation is due no later than 180 days after end of monitoring period in which initial ALE occurred
- System can recommend no treatment, but must demonstrate a good reason why
- If system feels that Corrosion Control is necessary, the next step is to determine corrosion control

Determining Corrosion Control

- Use Revised Guidance Manual for Selecting Lead and Copper Control Strategies
- https://nepis.epa.gov/Exe/ZyPDF.cgi?Dockey=P100999U.txt

- Obtain finished water pH, alkalinity
  - Use to determine Dissolved Inorganic Carbonate (DIC)

Inhibitor – Orthophosphate

- Orthophosphate (PO_4) can combine with Lead and Copper ions in plumbing material and form compounds that do not readily dissolve.
- Orthophosphate residual preferred concentration 0.5 – 1 ppm
- Most effective at pH 7.2 – 7.8, pH adjustment may be necessary

Corrosion Control – decrease pH

- Decrease pH
  - CO_2 gas – disinfectant

Corrosion Control – Increase pH

- Increase pH
  - Baking Soda (NaHCO3): increases alkalinity with moderate increase in pH
  - Caustic Soda (NaOH or KOH): raises pH, converts excess CO2 to carbonate alkalinity species, increases alkalinity
  - Hydrated Lime (Ca(OH)2): raise pH, increase alkalinity and calcium content (hardness)
  - Soda Ash (Na2CO3) or Potash (KCO3): increase alkalinity with moderate increase in pH
  - Sodium Silicates (Na2SiO3): moderate increases in alkalinity and pH
- Why increase alkalinity?
  - Alkalinity is used to determine Dissolved Inorganic Carbon
  - Increasing alkalinity expands treatment options

Dissolved Inorganic Carbonate (DIC) determination

Table 3: Dissolved Inorganic Carbonate Determination (DIC mg C/L) for Systems with pH of 7.6 to 10.4 and Alkalinities of 0 to 100

For a Purely Carbonate+H_2O Closed System at 10°C (50°F); Ionic Strength = 0.005 (TDS @ 200 or Cond. @ 312)

Alpha H_2CO_3*	0.06	0.04	0.02	0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Alpha HCO_3-	0.94	0.96	0.97	0.98	0.98	0.98	0.97	0.95	0.93	0.90	0.84	0.77	0.68	0.58	0.46
Alpha CO_3=	0.00	0.00	0.00	0.01	0.01	0.02	0.03	0.04	0.07	0.10	0.16	0.23	0.32	0.42	0.54
pH	7.6	7.8	8	8.2	8.4	8.6	8.8	9	9.2	9.4	9.6	9.8	10	10.2	10.4
Alkalinity (as $CaCO_3$)															
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-1
5	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0
10	3	2	2	2	2	2	2	2	2	2	2	2	2	1	1
15	4	4	4	4	4	4	3	3	3	3	3	3	2	2	2
20	5	5	5	5	5	5	5	5	4	4	4	4	3	3	2
25	6	6	6	6	6	6	6	6	6	5	5	5	4	4	3
30	8	7	7	7	7	7	7	7	7	6	6	6	5	5	4
35	9	9	9	8	8	8	8	8	8	8	7	7	6	5	5
40	10	10	10	10	10	9	9	9	9	9	8	8	7	6	6
45	11	11	11	11	11	11	11	10	10	10	9	9	8	7	6
50	13	12	12	12	12	12	12	11	11	11	10	10	9	8	7
55	14	14	13	13	13	13	13	13	12	12	11	11	10	9	8
60	15	15	15	15	14	14	14	14	13	13	12	12	11	10	9
65	17	16	16	16	16	15	15	15	15	14	13	13	12	11	9
70	18	17	17	17	17	17	16	16	16	15	14	14	12	11	10
75	19	19	18	18	18	18	18	17	17	16	15	14	13	12	11
80	20	20	20	19	19	19	19	18	18	17	16	15	14	13	12
85	22	21	21	21	20	20	20	20	19	18	18	16	15	14	13
90	23	22	22	22	22	21	21	21	20	19	19	17	16	15	13
95	24	24	23	23	23	23	22	22	21	21	20	18	17	16	14
100	25	25	24	24	24	24	23	23	22	22	21	19	18	16	15

Theoretical Saturation pH for $CaCO_3$ precipitation

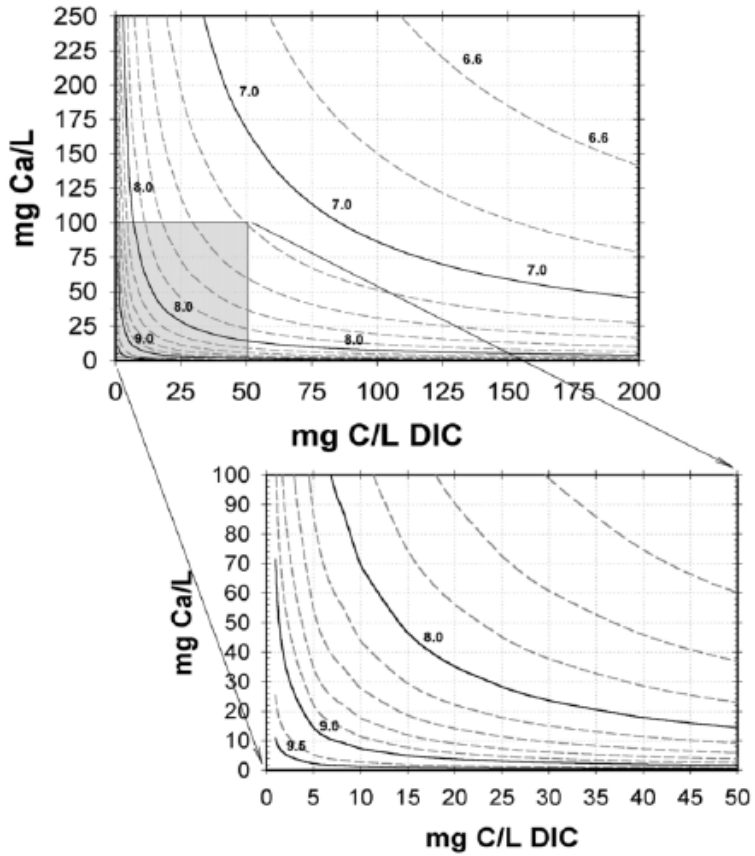


Exhibit 3.2: Theoretical Saturation pH for Calcium Carbonate Precipitation (USEPA, 2003)

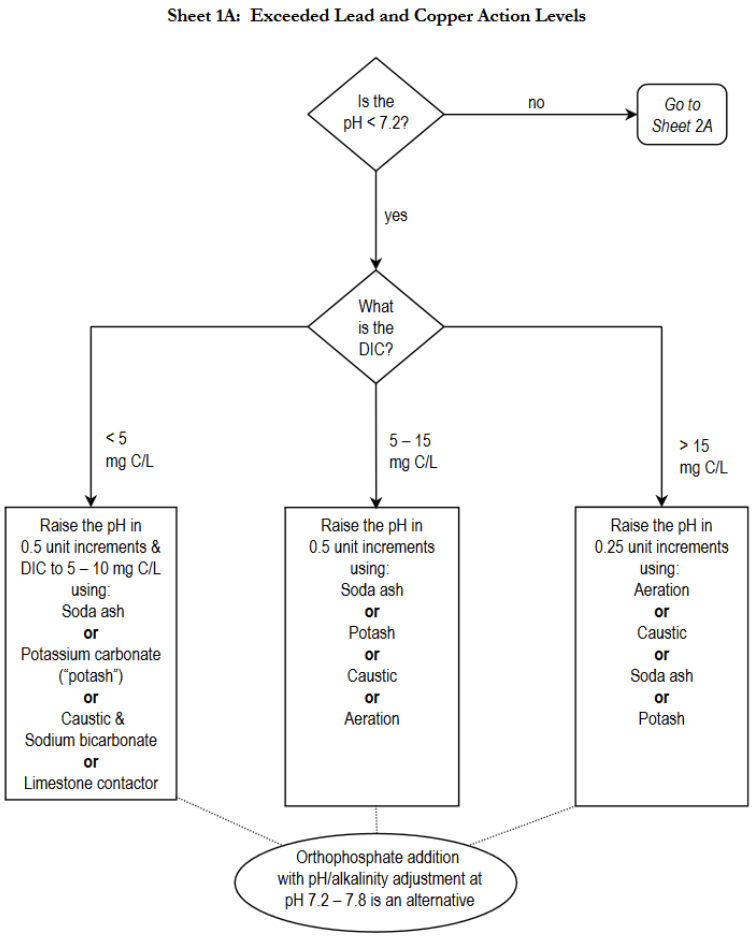
Notes:
Solid lines are pH in whole numbers. Dashed lines are pH increments of 0.2
Calcium values are in mg Ca/L. To approximate calcium concentration (in mg Ca/L) from a measured hardness (as mg/L CaCO3), divide the hardness value by 2.5.

OCCT flowcharts – determine which chart to use

- Important info:
  - Copper ALE, Lead ALE, or both?
  - DIC
  - Presence of raw water Iron/Manganese

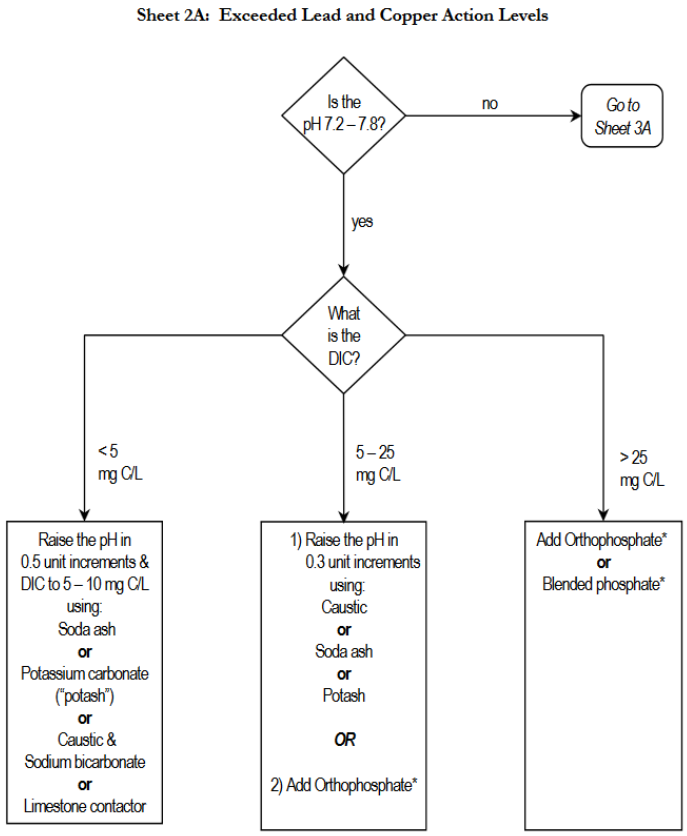
OCCT flowchart: Cu & Pb ALE

- Acidic water – requires pH adjustment prior to inhibitor additions



OCCT flowchart: Cu & Pb ALE

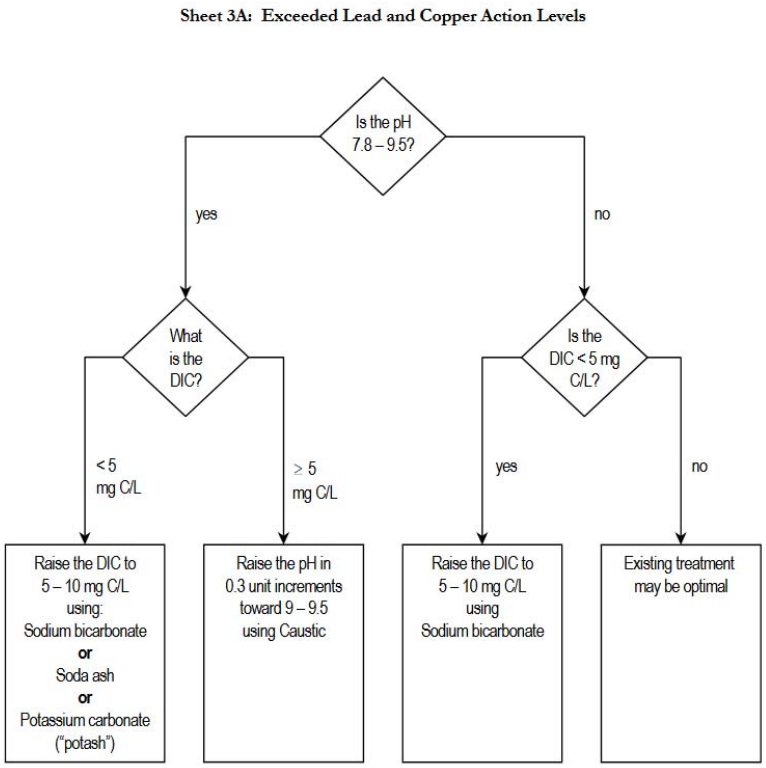
- pH 7.2 – 7.8 – optimal range for inhibitor injection.
- DIC > 25 mg C/L recommended



* Initial dose should be > 0.5 mg/L orthophosphate as P either orthophosphate or blend.

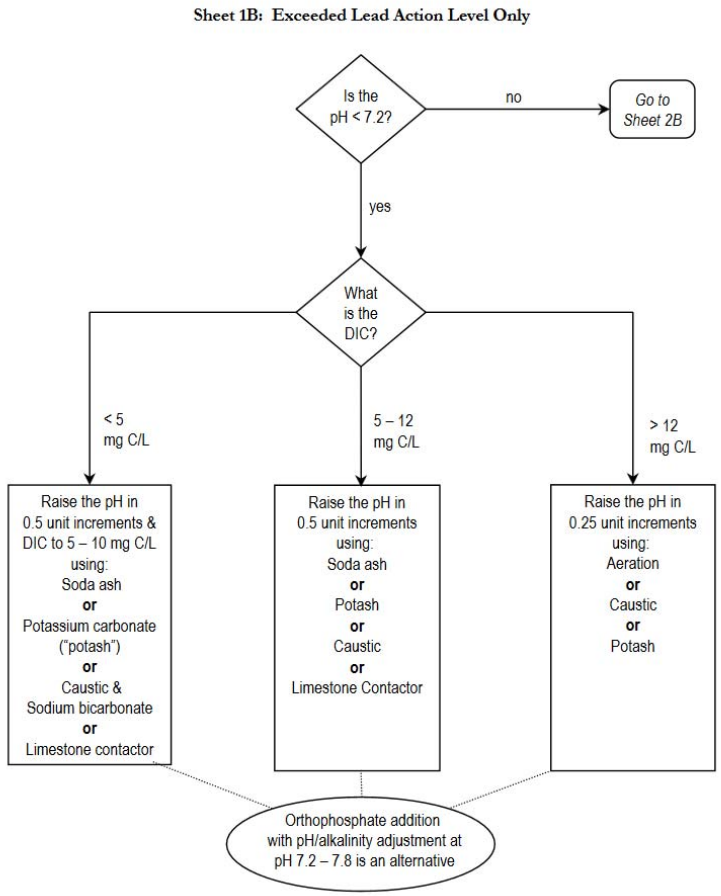
OCCT flowchart: Cu & Pb ALE

- High pH – treatment calls for increasing pH to promote calcium (hardness, alkalinity) scale on pipe walls as inhibitor



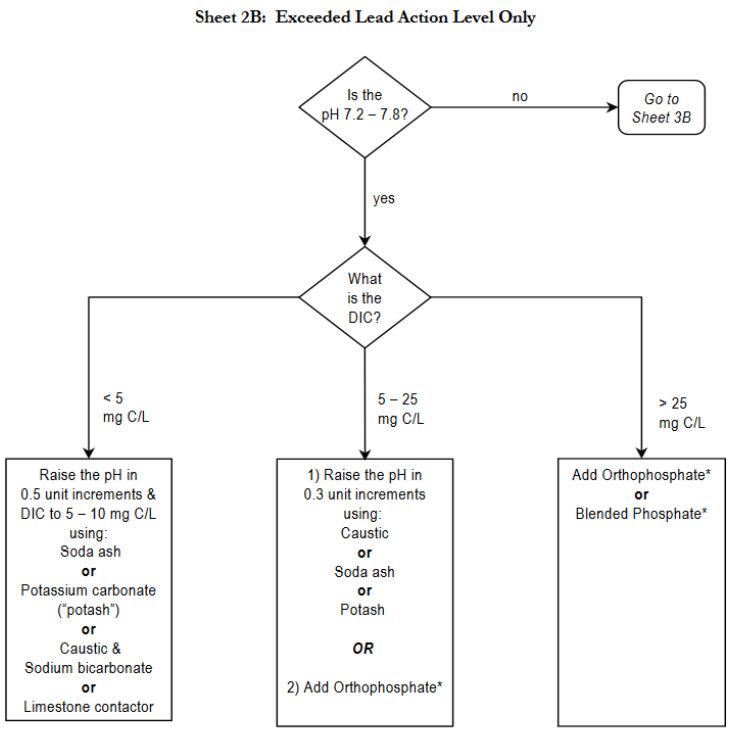
OCCT flowchart: Pb ALE

- Acidic water – requires pH adjustment prior to inhibitor additions



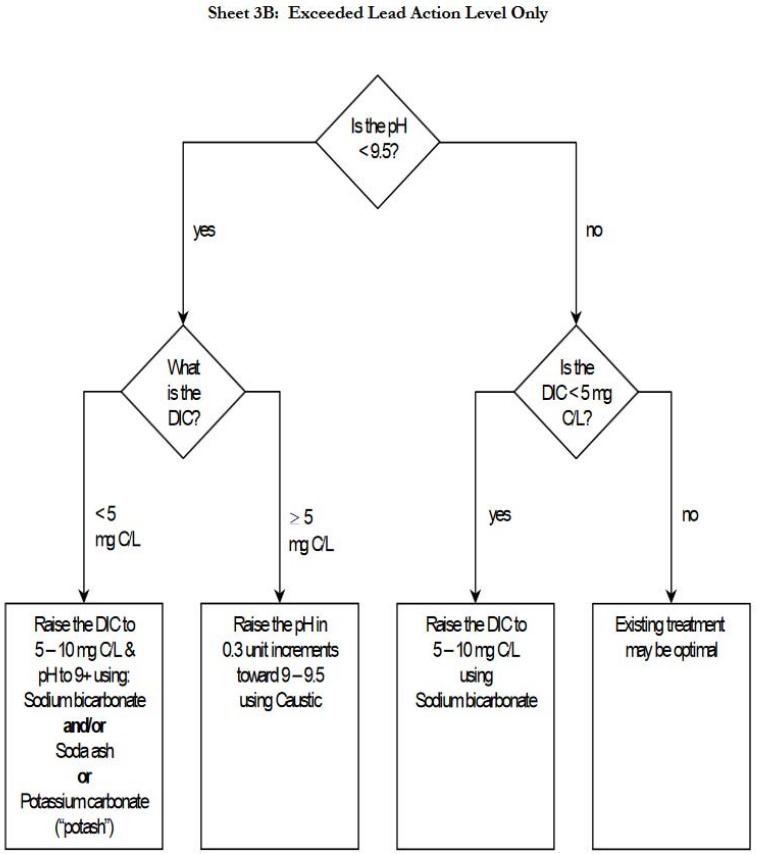
OCCT flowchart: Pb ALE

- pH 7.2 – 7.8 – optimal range for inhibitor injection.
- DIC > 25 mg C/L recommended



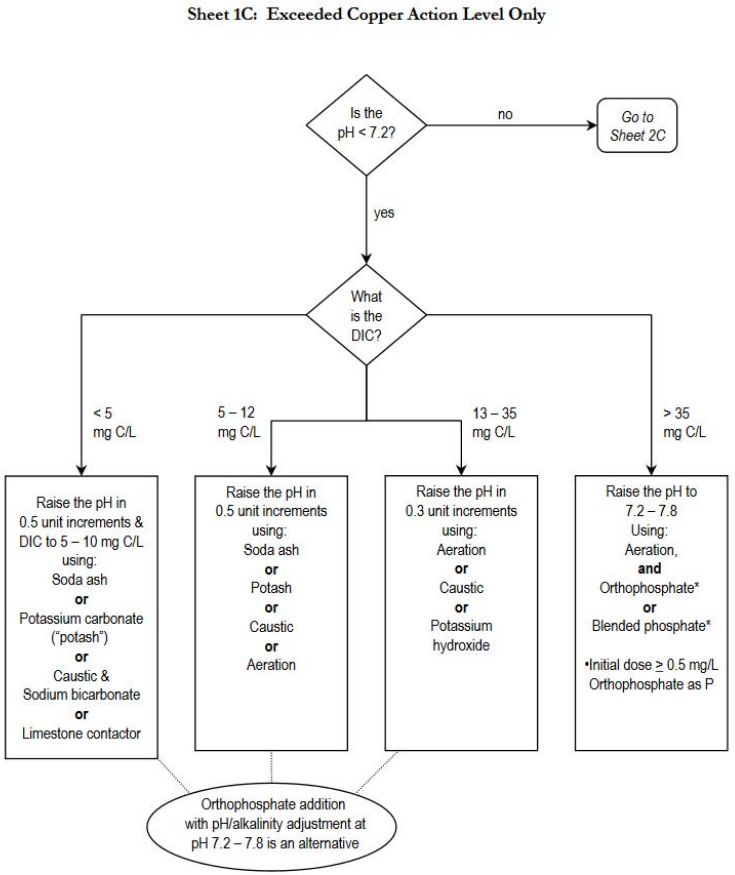
OCCT flowchart: Pb ALE

- High pH – treatment calls for increasing pH to promote calcium (hardness, alkalinity) scale on pipe walls as inhibitor,
- DIC > 5 mg C/ L recommended



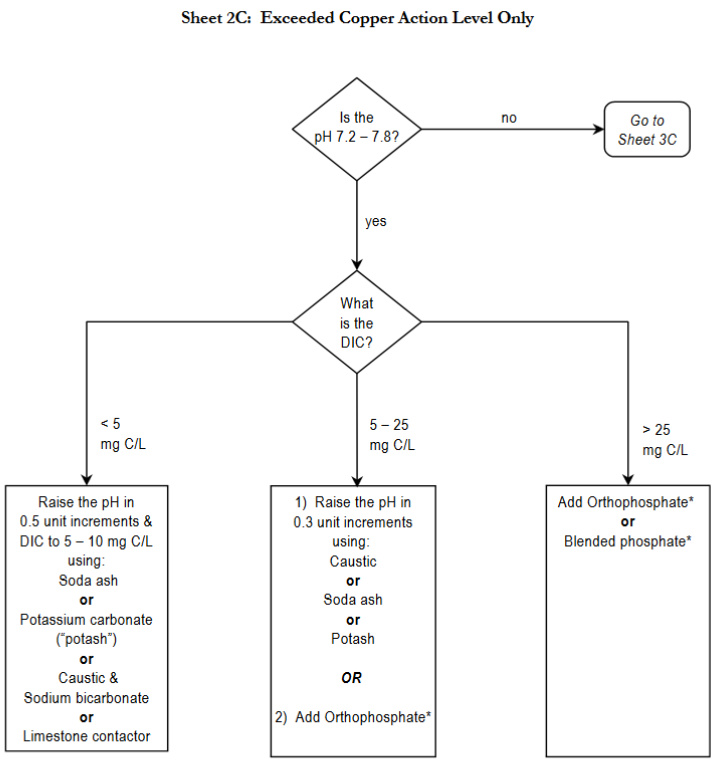
OCCT flowchart: Cu ALE

- Acidic water
- DIC < 35 mg C/L, adjust pH prior to inhibitor injection
- DIC > 35 mg C/L, orthophosphate alone may be sufficient to raise pH to operable range



OCCT flowchart: Cu ALE

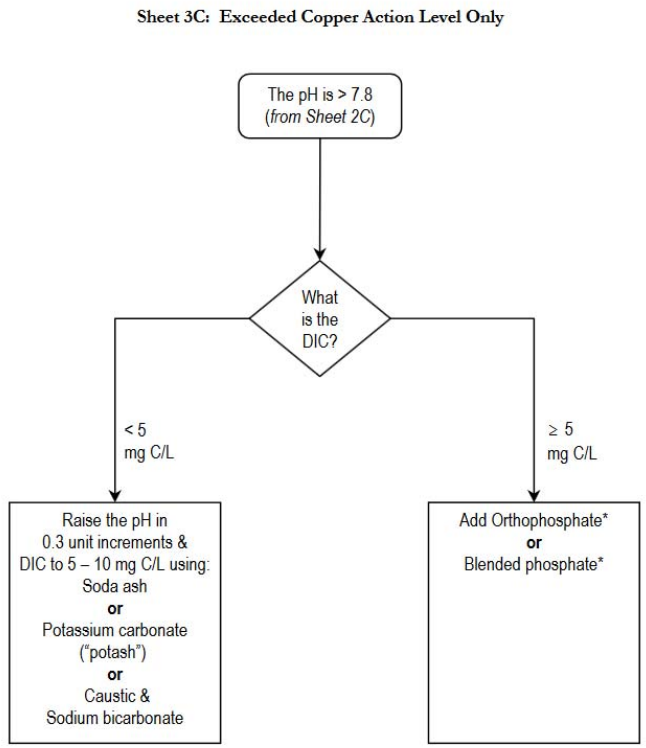
- pH 7.2 – 7.8 – optimal range for inhibitor injection.
- DIC > 25 mg C/L recommended



* Initial dose should be > 0.5 mg/L orthophosphate as P either orthophosphate or blend.

OCCT flowchart: Cu ALE

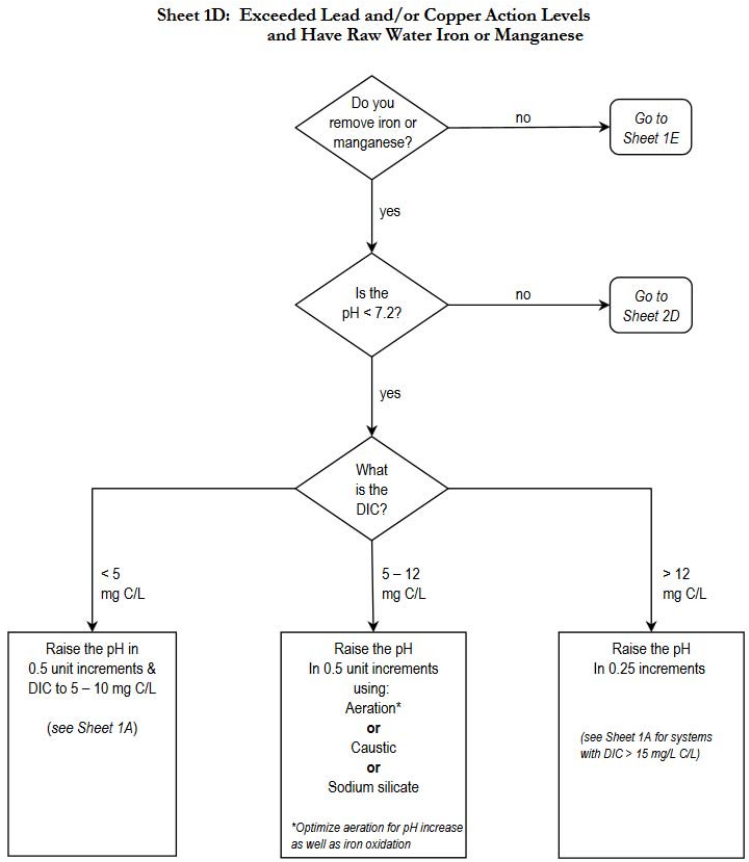
- High pH water –
  - raise DIC if less than 5 mg C/L
  - Add inhibitor if DIC > 5 mg C/L



* Initial dose should be > 0.5 mg/L orthophosphate as P either orthophosphate or blend.

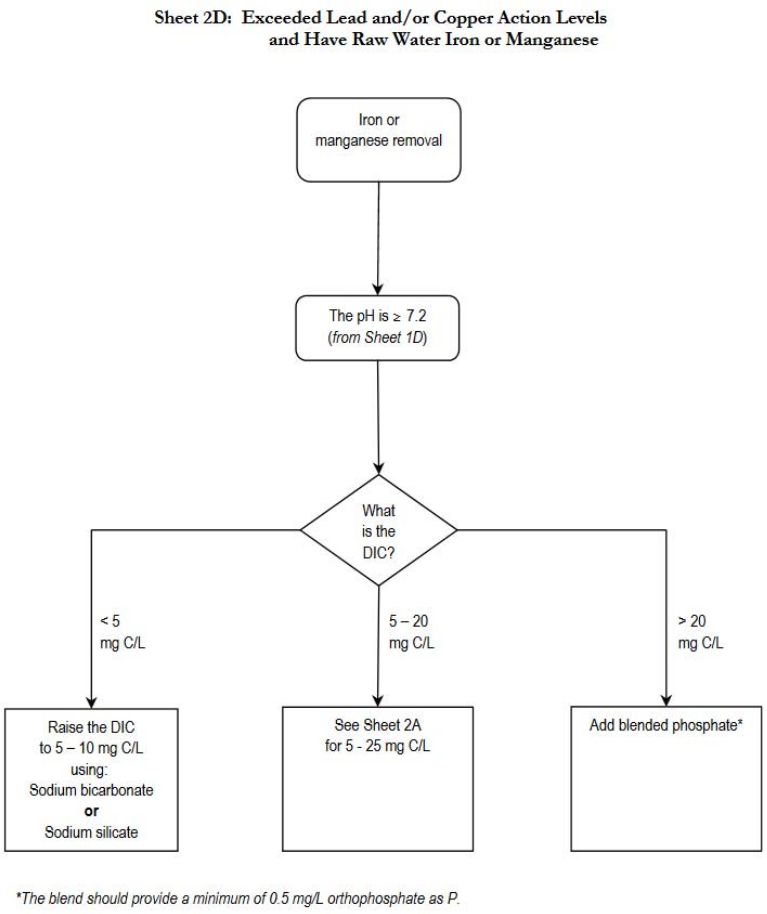
OCCT flowchart: Cu &/or Pb ALE w/ Iron & Manganese removal

- Acidic water pH < 7.2
  - Raise pH



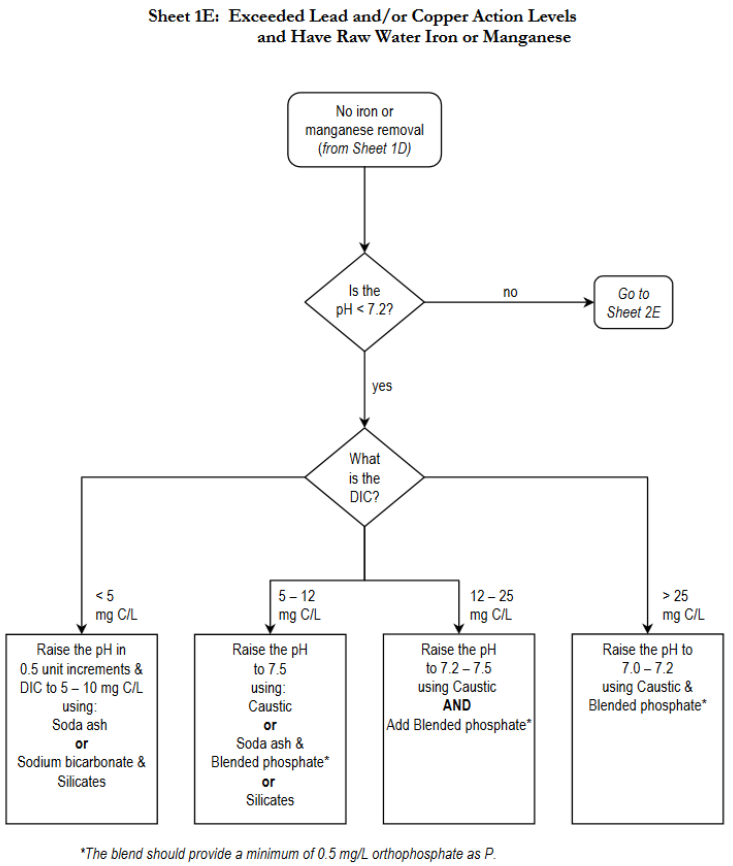
OCCT flowchart: Cu &/or Pb ALE w/ Iron & Manganese removal

- Stable water pH > 7.2
  - increase DIC if less than 5 mg C/L
  - Add inhibitor if DIC greater than 20 mg C/L



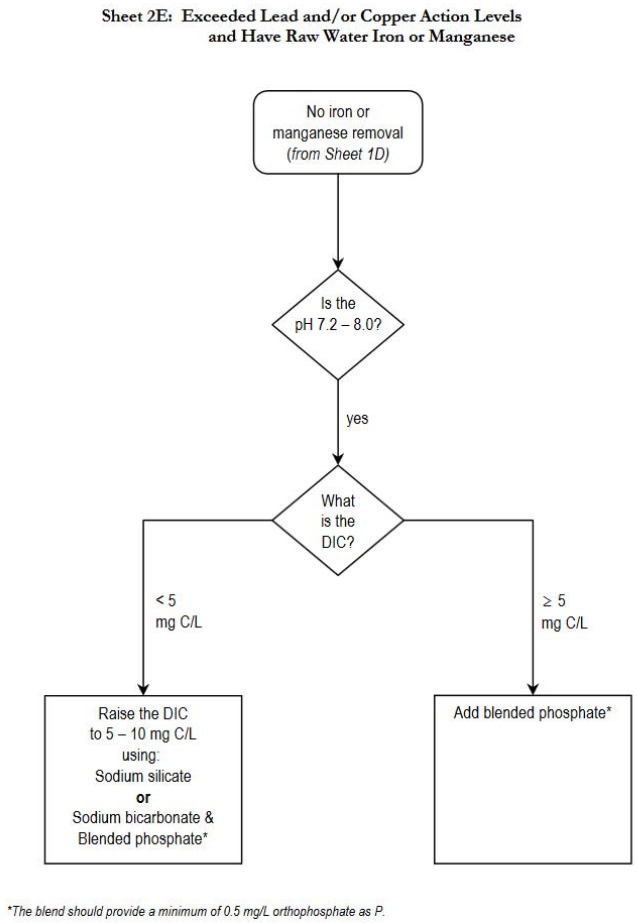
OCCT flowchart: Cu &/or Pb ALE w/ Iron & Manganese no removal

- Acidic water pH < 7.2



OCCT flowchart: Cu &/or Pb ALE w/ Iron & Manganese no removal

- Stable water pH > 7.2



Phosphate Residual testing

Phosphate Test Kit, Total Ortho-/Meta-, Model PO-24

Overview | Details | Parameter/Reagent | Downloads

» Gallery

Product #: 225001

USD Price: $184.00

Ships within 2 weeks

Quantity 1

Add to Cart

Add to Quote

» Print PDF Page

Kit provides measurement of ortho- (reactive) and meta- (condensed) phosphate (requires hot acid digestion).

- Kit provides rapid measurement of ortho- (reactive) and meta- (condensed) phosphate (requires hot acid digestion).

Hazardous Items

Items with this mark may be considered hazardous under some shipping conditions.

If necessary, we will change your selected shipping method to accomodate these items.

Inhibitor Residual testing

- Certified labs have standardized tests
- System that installs corrosion control treatment must measure WQPs every 6 months

Return to compliance

- Standard monitoring for LCR will continue until results are below ALE for 2 sampling periods
- Systems will always collect WQPs in sampling periods following ALE
- Timeframe described in letter from Lead-Copper Rule Manager
- Treatment changes must be requested and must be justified by water system (40 CFR 141.83 (b)(6))

Importance of collecting representative samples

- 6-18 hour stagnation, cold water tap, tap designed for human consumption
- One liter volume
- System or residents can collect samples
- No Point of Use treatment (R. O.), water softeners

Community assistance sampling

- DWB is developing an assistance program for populations most at risk for lead health impacts
- 2016: DWB offered additional sampling for systems that had ALEs.
  - 3 out of 37 systems participated in special sampling
    - Few samples were above ALE
    - Many systems with ALEs had sample protocol problems
  - One community sampled at daycare centers and medical facilities

2017 Community assistance to vulnerable populations

- DWB is planning to continue to offer additional free Lead-Copper testing to systems with ALEs.
- We are currently developing other initiatives to offer free testing for buildings that serve children 6 and under or pregnant women that may be at risk, such as buildings with lead plumbing.