LEAD AND COPPER RULE

Large, Medium and Small Water Systems

Corrosion Control Guidance

Bureau of Water – Public Water Supply Section
Effective September 15, 2020

Kansas Department of Health and Environment
Bureau of Water Public Water Supply Section

Policy: The Kansas Department of Health and Environment (KDHE) staff will follow the guidance and procedures presented in this document to direct and support implementation of corrosion control treatment for all public water supply (PWS) systems that exceed either the lead or copper action levels under K.A.R. 28-15a-80. Requirements for the control of lead and copper.

Purpose: The purpose of this document is to establish a rational and reasonable basis for consultants and staff decisions in the development and review of corrosion control strategies which will promote quality, timely and consistent service to the public and regulated community.

Applicability: This guidance will apply to all large, medium and small PWS systems that exceed either the lead or copper action level (ALE).

KDHE PUBLIC WATER SUPPLY
CORROSION CONTROL TREATMENT STUDY GUIDANCE

General

The Lead and Copper Rule (LCR) requires all large, medium and small PWS systems that exceed either the lead or copper action level (AL) to prepare or update a corrosion control treatment (CCT) study for their system. Large systems (>10,000) were required to complete their original studies by June 1994. Studies for medium (3,300 -10,000) or small systems (0-3,300) must be submitted within 18 months of the date that an action level is exceeded if required by KDHE.

KDHE encourages PWS systems to initially conduct a desktop study to evaluate available treatment alternatives with emphasis on the use of data from PWS systems with successful corrosion control under similar operating conditions. This guidance document includes additional information required for a complete study. KDHE recommends PWS systems and consultants refer to the EPA Optimal Corrosion Control Treatment Evaluation Technical Recommendations for Primacy Agencies and Public Water Systems Office (update 2016) document for additional guidance. Other references are provided at the end of this document. KDHE may require additional information or testing based upon system specific conditions.

Treatment for corrosion control is intended to modify water characteristics to reduce chemical and physical reactions between the water and the pipe surface typically by formation of a protective layer on the interior pipe walls. Formation of the protective coating can be accomplished in two ways: precipitation or passivation. The precipitation method involves modifying water chemistry to form a non-reactive compound within the water which then creates a coating on the interior pipe wall. The passivation approach involves converting a portion of the pipe material to a less reactive chemical state.

Corrosion Control Study

The purpose of the Corrosion Control Treatment Study (CCTS) is to identify corrosion control priorities, evaluate viable corrosion control approaches and select the optimal corrosion control treatment (OCCT) in a simplified format.

At a minimum, the PWS system shall include the following information in a CCTS:

1. A general discussion of the PWS system water sources, infrastructure and current treatment facilities. Including chemical feeds, locations and dosages.

2. A current sample site location plan for lead and copper tap and water quality parameter monitoring.

3. A recent materials survey inventory for the distribution system.

4. A summary of all lead and copper testing results and water quality parameter monitoring testing results for last 10 years (as available). These results shall be evaluated when considering the location of sample sites within the distribution system and used as the basis for considering corrosion control treatment options.

5. The water system shall measure the following water quality parameters (WQP) in any tests conducted under this paragraph before evaluating CCT and after installation of any corrosion control treatments:

    a. Lead

    b. Copper

    c. pH

d. Alkalinity

e. Calcium

f. Conductivity

g. Orthophosphate (when an inhibitor containing a phosphate compound is already in use or proposed for use)

h. Silicate (when an inhibitor containing a silicate compound is already in use or proposed for use)

i. Water Temperature

j. Other additional WQ parameters as required to be used as part of the OCCT

6. Both the tap and entry point sampling for Water Quality Parameters (WQP) should be conducted when treatment techniques are representative of the water system's normal operating conditions. The following number of water quality parameter samples shall be collected based upon the population served by the PWS system.

System Size	Number of sites for Water Quality Parameters
>100,000	25
10,001-100,000	10
3,301-10,000	3
501-3,300	2
101-500	1
$\leq$ 100	1

7. Provide a discussion of the PWS system's water quality parameters and possible effects on corrosion control treatment including an evaluation based upon pH, Alkalinity and calculated dissolved inorganic carbon (DIC) to determine preferred CCT strategies.

8. Any PWS system submitting a Corrosion Control Treatment Recommendation shall evaluate the effectiveness of the treatment techniques listed below both as individual treatment techniques or as a combination as appropriate.

- Alkalinity and pH adjustment

- Addition of phosphate or silicate-based corrosion inhibitors at a concentration high enough to maintain residual concentrations in all test tap samples.

9. The water system shall evaluate each of the corrosion control treatments using either pipe rig/loop tests, metal coupon tests, partial-system tests, or analyses based on documented successful equivalent treatments with other systems of similar size, water chemistry and distribution system configuration. Specific successful examples for representative systems must be provided.

10. The water system shall identify all chemical and/or physical constraints limiting the system's use of a treatment technique and document such limiting factors.

11. The system must also consider the effects of the Corrosion Control Treatment Techniques on other existing water quality treatment processes in relation to compliance with the requirements of the federal drinking water regulations.

12. The water system's evaluation shall also address the proposed treatment of each source if the system has multiple sources, and the compatibility of the sources as the result of the proposed treatment.

13. Include an evaluation of possible water quality issues such as but not limited to scaling or impacts on metals contained in source water or treated water including arsenic, iron, manganese and aluminum.

14. If source water treatment is needed to achieve optimal corrosion control, the water supplier shall evaluate possible source water treatments including ion exchange, reverse osmosis, lime softening, coagulation/filtration or others. The evaluation shall recommend optimal corrosion control treatment and water quality parameter performance requirements for the selected treatment.

15. Provide an evaluation of unintended consequences that may be caused by the recommended treatment alternatives on other water quality treatment processes including an evaluation of possible effects of CCT on the receiving wastewater system's treatment processes and NPDES Permit(s). Especially if phosphate-based corrosion inhibitors are proposed.

16. A Kansas licensed engineer shall, based upon testing and other evaluations, provide a system recommendation, which constitutes the optimal corrosion control treatment option (OCCT) for that system. The following resources should be utilized to support the recommendations:

    - Comparable OCCT which was successful at a similar public water supply system
    - Loop Testing (preferred method)
    - Envelope Testing
    - CCT Jar Testing
    - Engineering Report or Consultant Study for a successful OCCT for a similar system
    - Computer Model(s)
    - Literature

    Note: KDHE considers CCT jar testing an important resource early in the evaluation that can indicate to the user whether certain ranges of water quality parameters can be obtained with the recommended chemical and at what dosages. Jar testing involves treatment of a raw water sample with the addition of the selected chemical until the desired water quality parameter range has been reached.

17. Provide a proposed schedule for completion of the remaining corrosion control treatment compliance steps including, but not limited to, CCT optimization testing, treatment design and permit application submittal, financing and construction, and initiation of operation that meet the requirements of the LCR. Systems shall conduct follow-up sampling for 2 consecutive 6-month periods following OCCT installation.

Following Completion of the Study

Water suppliers should submit the completed basic Corrosion Control Treatment Study to the KDHE Public Water Supply Section, 1000 SW Jackson Street, Suite 420, Topeka, Kansas 66612. KDHE Public Water Supply Section staff will review the study for completeness and technical merit and issue an approval upon correction of any deficiencies. KDHE may require additional demonstration testing, which usually involves bench or full-scale testing using pipe loops or metal coupons, when a thorough desktop evaluation does not provide a confident treatment recommendation.

Following study approval, the water system must submit a construction permit application including plans and specifications for the CCT design in accordance with the LCR. The facilities design should be based on the recommendations made in the CCT study. Construction permit approval gives permission for the CCT facilities to be constructed. Contact the KDHE Engineering and Permits Section for more detailed information on permit requirements.

References

Kansas Administrative Regulation K.A.R. 28-15a-80. Requirements for the control of lead and copper. The provisions of 40 C.F.R. 141.80 through 141.91, as in effect on July 1, 2015, are hereby adopted by reference, except that "subpart I" shall be replaced by "K.A.R. 28-15a-80." (Authorized by and implementing K.S.A. 65-171m; effective Oct. 1, 2004; amended June 7, 2018.) https://www.kssos.org/Pubs/pubs_kar.aspx

USEPA. Drinking Water Regulations: Maximum Contaminant Level Goals and National Primary Drinking Water Regulations for Lead and Copper, 40 CFR Parts 141 and 142.
https://www.federalregister.gov/documents/1998/04/22/98-10713/maximum-contaminant-level-goals-and-national-primary-drinking-water-regulations-for-lead-and-copper

USEPA. 1992. Lead and Copper Rule Guidance Manual - Volume 2: Corrosion Control Treatment. Office of Ground Water and Drinking Water (Washington, D.C.). EPA 811-B- 92-002.
https://www.epa.gov/sites/production/files/2015-09/documents/lcr-guidance-manual-vol-ii-cct.pdf

USEPA. Optimal Corrosion Control Treatment Evaluation Technical Recommendations for Primacy Agencies and Public Water Systems, Office of Water (4606M), EPA 816-B-16-003, March 2016 (Updated)
https://www.epa.gov/dwreginfo/optimal-corrosion-control-treatment-evaluation-technical-recommendations