DATE: January 26, 1995

TO: Office of Water Programs Staff

THROUGH: Eric H. Bartsch, P.E., Director
Office of Water Programs

FROM: Allen R. Hammer, P.E., Director
Division of Water Supply Engineering

SUBJECT: Water - Procedure - Technical Assistance Lead and Copper Rule Desktop Evaluations

Attached you will find the optimum corrosion control treatment "Desktop Evaluation" which was developed by a Lead and Copper Rule Implementation Committee subcommittee chaired by John Aulbach, District Engineer in the Lexington Field Office. This evaluation procedure will assist waterworks owners/operators in choosing an appropriate and effective corrosion control treatment for their specific waterworks.

The Desktop evaluation must be performed for all small size waterworks that exceeded an Action Level during initial monitoring as defined in the USEPA Lead and Copper Rule. The only exception will be for those waterworks who exceeded an action level and later submitted tap sample results indicating 90th percentile lead and copper concentrations that were below the Action Levels for two consecutive six-month monitoring periods. All Desktop evaluations must be completed no later than 1 March 1996.
The Desktop evaluation procedure may also be utilized for medium size waterworks or other small size waterworks that exceed an Action Level at some future date. The decision to perform the Desktop evaluation for these waterworks will be made by the respective District Engineer.

This working memo provides the Desktop Evaluation Checklist, a transmittal letter to send the results and a recommended corrosion control treatment to the waterworks, and a summary of analogous water quality data. Other resources referenced in the procedure (LCR Volume 2 Guidance Manual, RTW Model, etc,) have previously been provided to each Field Office.

Please address any questions concerning the Desktop procedure to John Aulbach or Jim Moore in the Lexington Field Office.

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1. BACKGROUND AND PURPOSE

The USEPA's Lead and Copper Rule was published in the Code of Federal Regulations on June 7, 1991. The rule established Action Levels for both lead and copper and prescribed specific treatment techniques for those waterworks exceeding an Action Level. The rule also requires all waterworks to install and operate ***optimum corrosion control treatment*** which is defined in the rule based upon the size of the waterworks and upon the results of lead and copper tap samples collected during initial monitoring.

All large size waterworks (serving > 50,000 population) are generally required to conduct corrosion control studies to clearly define optimum treatment. Medium size waterworks (serving _ 3301 and _ 50,000 population) and small size waterworks (serving _ 3300 population) exceeding either the lead or copper Action Level are required to conduct corrosion control studies only if required by the state. If such studies are not required, the waterworks are required to submit a corrosion control treatment recommendation to the state within 6 months of exceeding an Action Level.

Initially, the Lead and Copper Rule Implementation Committee made the decision ***not to require*** the small and medium size waterworks to conduct optimum corrosion control treatment studies. This decision was based primarily on economics as the USEPA estimated that a typical desk top evaluation performed by a consultant would cost approximately $2500.00. The committee felt that these resources would be better spent as capital dollars to install a corrosion control treatment technology. OWP staff would provide technical assistance to the waterworks owners in making the required treatment recommendation. As implementation of the lead and copper rule progressed, the committee re-thought the original recommendation and decided to require all small size waterworks to conduct a desk top evaluation. However, it was further decided that OWP staff would actually perform the evaluation as a service to the waterworks owners. The reason the committee reversed the original decision was twofold. First, if a corrosion control treatment study is performed, the waterworks has until January 1, 1999 to install the chosen corrosion control treatment. If a study is not conducted the waterworks must install treatment by January 1, 1998. Second, the lead and copper rule allows an 18 month period to conduct a corrosion control study (the study must be completed by July 1, 1996). This time frame will give OWP staff a longer time to evaluate various treatment options and hopefully reach a better decision/recommendation. If no study is performed OWP staff would only have 6 months to provide assistance to the nearly 400 small waterworks statewide that exceeded an Action Level.

2. DEFINITIONS

A. Alkalinity: The measure of the water's capacity to resist a change in pH.

B. Calcium Carbonate Precipitation Potential (CCPP): The theoretical quantity of calcium carbonate that can be precipitated from the waters that are super-saturated.

C. Corrosion Control Study: A desktop evaluation, static testing, or flow through testing designed to identify optimal corrosion treatment.

D. Demonstration Testing: Flow through or static testing methods used to illustrate the effectiveness of a particular corrosion control treatment.

E. Desktop Evaluation (paper study): An office study that compiles historical information and literature to assist in determining appropriate corrosion control treatment.

F. Dissolved Inorganic Carbonate (DIC): The amount of Carbonic Acid, Bicarbonate, and Carbonate held in solution.

G. Optimal Corrosion Treatment: The treatment that minimizes lead and copper concentrations at the users' taps while ensuring that the treatment does not cause the water system to violate any national drinking water regulations.

H. Passivation: A corrosion control technique which incorporates tying pipe materials into metal/hydroxide/carbonate compounds intended to protect the pipe.

I. Phosphate Inhibitor: A phosphate based chemical intended to reduce corrosion when added to water.

J. Precipitation: The shifting of chemical equilibria to cause the formation of a solid protective coating, usually calcium carbonate, on interior pipe surfaces.

K. Silicate Inhibitor: A silicate based chemical intended to reduce corrosion when added to water.

L. Hardness: A characteristic of water which represents the total concentration of the calcium and magnesium ions expressed as calcium carbonate.

3. REFERENCES

A. *Lead and Copper Rule, Guidance Manual, Volume II: Corrosion Control Treatment*, September 1992.

B. *Lead and Copper Rule, Corrosion Control Training Instructor Manual*, July 1993.

C. AWWA Satellite Teleconference, Lead and Copper Rule Compliance: *How to Conduct a Corrosion Control Study, Participant Guide*, 1993.

D. *The Rothberg, Tambarini and Winsor Model for Corrosion Control and Process Chemistry*, AWWA, 1993.

4. CHECKLIST INSTRUCTIONS

A. Completion of this form is the responsibility of the District Engineer, at his discretion the Environmental Engineers and Inspectors may complete the data gathering and entry.

B. Use the matrix to select values that fit your data. At your discretion the options and selection criteria can be weighted. Summarize the results, essentially the option with the most selections will be the recommended alternative. In the event of a tie, both should be recommended to the owner for his consideration.

C. No formal training will be offered, each office should review and coordinate with their committee representative to provide any specialized training needed.

D. At the option of each Field Office's committee representative he may elect to hold a brief training event to discuss these procedures with the staff to explain the intent and orient them to the form and process.

5. EVALUATION CHECKLIST

Desktop Evaluation Form for Small PWS Treatment Recommendations

A. PWS General Information:

1. **PWS Identification No. _____**
2. **Contact person:**
   Name _____
   Mailing Address _____
   _____

   Telephone _____ **Fax** _____

3. **Population served** _____

4. **Evaluation Prepared By:**
   Name _____**Title**_____
   Signature _____**Date**_____
   Telephone _____ **Fax** _____

5. **Evaluation Approved By:**
   Name _____ **Title**_____
   Signature _____ **Date**_____
   Telephone _____**Fax**_____

B. PWS Technical Information:

1. Existing Conditions:

Identify water source(s):

Source No. 1._____
Source No. 2._____
Source No. 3._____

Is treatment used? **Yes _____** **No _____**

Provide treatment processes and chemicals used for each source:

Source No. 1 _____
Source No. 2 _____
Source No. 3 _____

If treatment is used, is more than one source used at a time?
Yes _____ **No _____**
Is there a history of water quality complaints?
Yes _____ **No _____**

If yes, then answer the following:

Are the complaints documented? Yes _____ No _____

Mark the general category of complaints below. Use:
1 for some complaints in this category
2 for several complaints in this category
3 for severe complaints in this category

Categories of complaints:
Taste and odor _____
Color _____
Sediment _____
Other _____

2. Monitoring Results:
Sampling dates: From _____ To _____

First-Flush Tap Monitoring Results:

Lead:		**1ST RESULTS**	**2ND RESULTS**
Minimum concentration	**=**	**_____ mg/L**	**_____ mg/L**
Maximum concentration	**=**	**_____ mg/L**	**_____ mg/L**
90th percentile	**=**	**_____ mg/L**	**_____ mg/L**

Copper:			
Minimum concentration	**=**	**_____ mg/L**	**_____ mg/L**
Maximum concentration	**=**	**_____ mg/L**	**_____ mg/L**
90th percentile	**=**	**_____ mg/L**	**_____ mg/L**

COMMENTS:
_____
_____
_____
_____
_____
_____
_____

Source Monitoring Results: WQPs

	Source 1	2	3
Lead Concentration, mg/L	____	____	____
Copper Concentration, mg/L	____	____	____
pH:	____	____	____
Temperature, ^{0}C:	____	____	____
Alkalinity, mg/L as $CaCO_3$:	____	____	____
Calcium, mg/L as Ca	____	____	____
Conductivity, μmho/cm @ 25^{0}C:	____	____	____
TDS	____	____	____
Phosphate, mg/L as P:	____	____	____
Silicate, mg/L as SiO_2:	____	____	____

Water Quality Parameter Distribution System Monitoring Results:
(Indicate whether field or laboratory measurement.)

	Set 1		Set 2	
	Field	Lab	Field	Lab
pH:	_____	_____	_____	_____
Alkalinity: mg/L as $CaCO_3$	_____	_____	_____	_____
temperature: ^{0}C	_____	_____	_____	_____
calcium: mg/L as Ca	_____	_____	_____	_____
conductivity: μmho/cm @ 25^{0}C	_____	_____	_____	_____
orthophosphate: mg/L as P (if phosphate-based inhibitor is used)	_____	_____	_____	_____
silica: mg/L as SiO_2 (if silica-based inhibitor is used)	_____	_____	_____	_____

3. Distribution System:

Does the distribution system contain lead service lines? Yes _____ No _____
If the system has lead service lines, mark below the approximate number of lines which can be located from existing records.
None _____ Some _____ Most _____ All _____
Is the distribution system flushed?
None _____ Some _____ Most _____ All _____

C. Desktop Evaluation

1. Evaluation of existing Corrosion Control Treatment

None _____

Inhibitor _____ Type _____ Phosphate vs. Silicate
Date initiated _____
Present dose _____
Range in Residual in Distribution System:
Maximum _____mg/L Minimum _____ mg/L
Brand name _____

pH/alkalinity adjustment _____
pH Target _____
Alkalinity Target _____ mg/L $CaCO_3$

Calcium adjustment _____
Calcium Target _____ mg/L $CaCO_3$

2. Data Before/After Treatment WQPs (optional if untreated)

Complete the table below for typical untreated water quality data. Copy this form as necessary for additional sources. Include data for each raw water source, if surface supplies are used, and finished water quality information (point of entry) from each treatment plant. If wells are used, water quality information from each well is acceptable but not necessary if several wells have similar data. For groundwater supplies, include a water quality summary from each wellfield or grouping of wells with similar quality.

Include available data for the following:

Parameter	Untreated Supply	Treated Water (point of entry)
pH, units		
Alkalinity, mg/L as $CaCO_3$		
Conductivity, μmho/cm @25° C		
Total dissolved solids, mg/L		
Calcium, mg/L Ca		
Hardness, mg/L as $CaCO_3$		
Temperature, ° C		
Chloride, mg/L		
Sulfate, mg/L		

3. **General Comments:**

Have chemical suppliers provided any information or operating guidance?

Yes _____ No _____

Have there been any corrosion control studies?

Yes _____ No _____

If yes, please indicate:

Date(s) of study From _____ To _____
Study conducted by PWS personnel? Yes _____ No _____
Brief results of study were:

(optional) Study results attached? Yes _____ No _____
Were treatment changes recommended? Yes _____ No _____
If yes:

Were treatment changes implemented? Yes _____ No _____
Have corrosion characteristics of the treated water changed?
Yes _____ No _____
If yes, how has change been measured?

General observation _____
Coupons _____
Frequency of complaints _____
Other _____

Briefly indicate, if other:

4. **Desktop Evaluation Resources**

Were similar facilities located which are experiencing successful corrosion control?
Yes _____ No _____ (optional use if available)

If yes, identify their corrosion control treatment method.

None	_____
pH/Alkalinity adjustment	_____
Calcium adjustment	_____
Inhibitor	_____
Phosphate based	_____
Silica based	_____

5. Calculations/Determination of Alternatives

Note: Insert your independent Evaluation notes. Chapter 3 of the Guidance Manual will assist in this determination.

Use the following matrix to evaluate the treatment alternative. Additionally, the RTW model can be used, as needed, to assist in the chemical addition calculations. Appendix C contains relative informative and background excerpts from the RTW manual regarding its utilization.

CORROSION CONTROL TREATMENT SELECTION

For each of the four WQPs listed in the chart below, circle the number in the row(s) to the right that fit or approximates the raw water quality of this source:

WQP	CO_3 Passivation	Orthophosphate* Passivation	CO_3* Precipitation	Silicate
pH	9.8	7-8 optimum 7.4-7-8	na	>8.2
Calcium mg/L as Ca	na	<50	>20	<10
Alkalinity mg/L as $CaCO_3$	>20	>20	>20	>9.5
DIC mg/L as C	<15 optimum 3-5	<5	na	na

The above evaluation indicates the following treatment options are applicable to this source: (circle the options)

CO_3 Passivation Orthophosphate Passivation CO_3 Precipitation Silicate Coating

The recommended treatment option: _____
.

WQP Adjustment Required to Facilitate the Selected Treatment Option:

1. **Raise pH to _____ using Lime/Soda Ash/Caustic.**
2. **Raise alkalinity to _____ using _____ .**
3. **Lower DIC to _____ using Aerator.**

Comments:
_____
_____
_____

***These are the two most likely options. Look at precipitation first, if not adequate, look at orthophosphate addition with pH adjustment.**

6. Recommendations: (Summary of Recommended Alternatives)

Use the information from the C(5) determination and information in Appendix (A) to complete.

The corrosion control treatment method being proposed is:

pH/Alkalinity adjustment _____

Target pH is _____

Target alkalinity is _____ mg/L as $CaCO_3$

Calcium adjustment _____

Target calcium concentration is _____ mg/L Ca

Inhibitor _____

Phosphate based _____

Target dose _____ mg/L

Target residual _____ mg/L as PO_4

Silicate based _____

Target dose _____ mg/L

Target residual _____ mg/L as SiO_2

Rationale for the proposed corrosion control treatment is:

List your proposed operating guidelines:

Parameter	Operating Range

Briefly explain why these guidelines were selected.

7. Provide any additional comments that will assist in determining optimal corrosion control treatment for the PWS.

Consider advise impacts such as compliance with other regulations as operational problems.

Disclaimer

This is a recommendation only, you and your consultant will need to review this and determine the applicability to your system. Plans and specifications for the installation of a treatment alternative must be submitted for review and approval.

SUBJECT:
Water -

6. TRANSMITTAL LETTER

Date

SUBJECT:
Water -

Address

Dear :

This Department has completed an optimum corrosion control treatment "Desktop Evaluation" for your waterworks. This evaluation was conducted in accordance with requirements contained in the USEPA's Lead and Copper Rule and the Volume II Guidance Manual titled "Lead and Copper Rule Guidance Manual, Volume 2: Corrosion Control Treatment" dated September 1992. This evaluation was conducted as a service to you to provide technical assistance in selecting an effective corrosion control treatment option to reduce the concentrations of lead and/or copper in your distribution system.

A copy of the completed Desktop Evaluation is attached for your information. The evaluation includes a recommended corrosion control treatment technique which, based upon water quality parameters from your specific waterworks and evaluation methodology recommended in the Volume II Guidance Manual, should reduce the concentrations of lead and/or copper at consumers tap. You must understand, however, that installation of the recommended corrosion control treatment may not reduce lead and/or copper to concentrations which are below the established Action Levels contained in the Lead and Copper Rule. Further, you have the option of selecting a different corrosion control treatment than that recommended.

The USEPA Lead and Copper Rule and the *Waterworks Regulations* require that corrosion control treatment must be installed and in operation prior to 1 January 1999. In order to comply with this deadline you must complete the following actions:

1. **Utilize the "Desktop Evaluation" as a tool to assist in selecting an appropriate corrosion control treatment. As noted above you and/or your engineer may select a different corrosion control treatment than that recommended in the "Desktop Evaluation".**

SUBJECT:
Water -

2. **Plans and specifications must be prepared by a licensed professional engineer showing the installation of corrosion control treatment for your waterworks. Such plans and specifications must be submitted to this office for review, approval, and issuance of a waterworks construction permit.**

3. **Construction/installation of the corrosion control treatment must not begin until the construction permit has been issued.**

4. **Complete construction/installation of the chosen treatment and conduct follow-up monitoring as required by the Lead and Copper Rule. Follow-up monitoring will consist of two consecutive six-month monitoring periods beginning no later than January 1999.**

5. **A recommended schedule to ensure compliance with the Lead and Copper Rule's Corrosion Control Treatment Technique is attached for your information.**

I am committed to provide you with additional technical assistance in selecting, installing, and operating corrosion control treatment at your waterworks. Please do not hesitate to contact me if you have any questions concerning this matter.

Sincerely,

_____
District Engineer

cc: _____
_____
_____ County Health Department - Attn:
VDH - Richmond Central

SUBJECT:
Water -

**OPTIMUM CORROSION CONTROL TREATMENT
COMPLIANCE SCHEDULE FOR SMALL SIZE WATERWORKS
EXCEEDING AN ACTION LEVEL DURING INITIAL MONITORING PERIOD**

TASK	COMPLETE NO LATER THAN
OWP Completes Optimum Corrosion Control Treatment Desktop Evaluation and transmits recommendation to Owner	**1 March 1996**
Owner Submits Engineering Plans and Specification (OWP Technical Assistance per WM 1126 as Appropriate)	**1 January 1997**
OWP Reviews Plans and Issues Construction Permit	**1 May 1997**
Owner Installs Optimum Corrosion Control Treatment	**1 January 1998**
Installed Treatment is Optimized and Tested	**1 January 1999**
Owner Conducts Follow-Up Monitoring	**1 January 2000**

7. APPENDICES

APPENDIX A

APPENDIX B

APPENDIX C