COOLING TOWER MAINTENANCE PROGRAM AND PLAN TEMPLATE

VERSION: 1.0

NEW YORK STATE DEPARTMENT OF HEALTH
Bureau of Water Supply Protection

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INTRODUCTION

This document is designed as a guide to the development of a maintenance program and plan for a cooling tower. The sections included in this template represent a survey of procedures currently used in the field and aim to capture the essential building blocks required for a comprehensive program document. The sections included serve as guidance and are therefore not specified by Subpart 4-1 of the New York State Sanitary Code.

The complete text of the regulation can be found here: https://regs.health.ny.gov/content/part-4-protection-against-legionella.

DISCLAIMER

This is a suggested template for a maintenance program and plan required by Subpart 4-1 of the New York State Sanitary Code. The examples provided should not be considered as recommendations from the New York State Department of Health for treatment options. This material should be considered the minimum suggested information used to define the maintenance program and plan; each cooling tower and situation is unique and an expansion of elements on a case by case basis may be required.

COOLING TOWER MAINTENANCE PROGRAM AND PLAN TEMPLATE

PREPARED FOR:

PREPARED BY:

EFFECTIVE DATE:

CONTENTS

SECTION 1. FACILITY INFORMATION

[This section includes a description of the facility's information.]

1.1 COOLING TOWER LOCATION

[Provide information on the cooling tower location.]

Owner name	
Point of contact name	
Point of contact phone	
Street address	
Building name (if applicable)	
City, town, or village	
County	
Latitude-longitude (if available)	

1.2 DEVELOPER OF MAINTENANCE PLAN (COMPANY)

[Provide information on the developer of the maintenance plan.]

Company name	
Point of contact name	
Point of contact title	
Point of contact phone (office)	
Point of contact phone (mobile)	
Email address	
Street address	
City, state, ZIP code	

1.3 EFFECTIVE DATE OF MAINTENANCE PLAN

[Record the date the maintenance plan goes into effect.]

Date	

1.4 COOLING TOWER INFORMATION

[The following information is typically available from the design drawings, operation information and/or on the tower itself.]

Manufacturer of cooling tower	
Model number of cooling tower	
Serial number of cooling tower	
Registration number from New York State Registry	
Year commissioned	
Thermal cooling capacity of cooling tower	
Cooling tower type (e.g. cooling tower, evaporative cooler, evaporative condenser, etc.)	

Description of the process from which heat is being removed	
Water source (e.g., municipal water company, onsite)	
Water disposal method (sanitary sewer company, onsite disposal, discharge by permit to the environment, etc.)	

1.5 ADDITIONAL NARRATIVE:

[Add any additional narrative that may be used to augment the information that was recorded in Section 1.1 above.]

SECTION 2. PROCESS DESCRIPTION

[This section includes the mechanical and quantitative description of the cooling tower process.]

2.1 TOWER SYSTEM DESCRIPTION

[Provide a description of the tower system]

Tower type and design	
Configuration	
Purpose	
Component the tower is attached to	
Operational period type (e.g. seasonal, year long, as needed, etc.)	
Typical operational season (start date to end date)	
Number of days per week tower is used	
Number of weeks per year the tower is used	
Total system water volume (both basin and the water that is contained in the piping)	
Cooling capacity (Tons, BTU/hr, etc.)	
Circulation rate (either from basin to the spray deck or from basin and to the heat exchanger and to the spray deck, gpm)	
Filtration used (yes/no)	

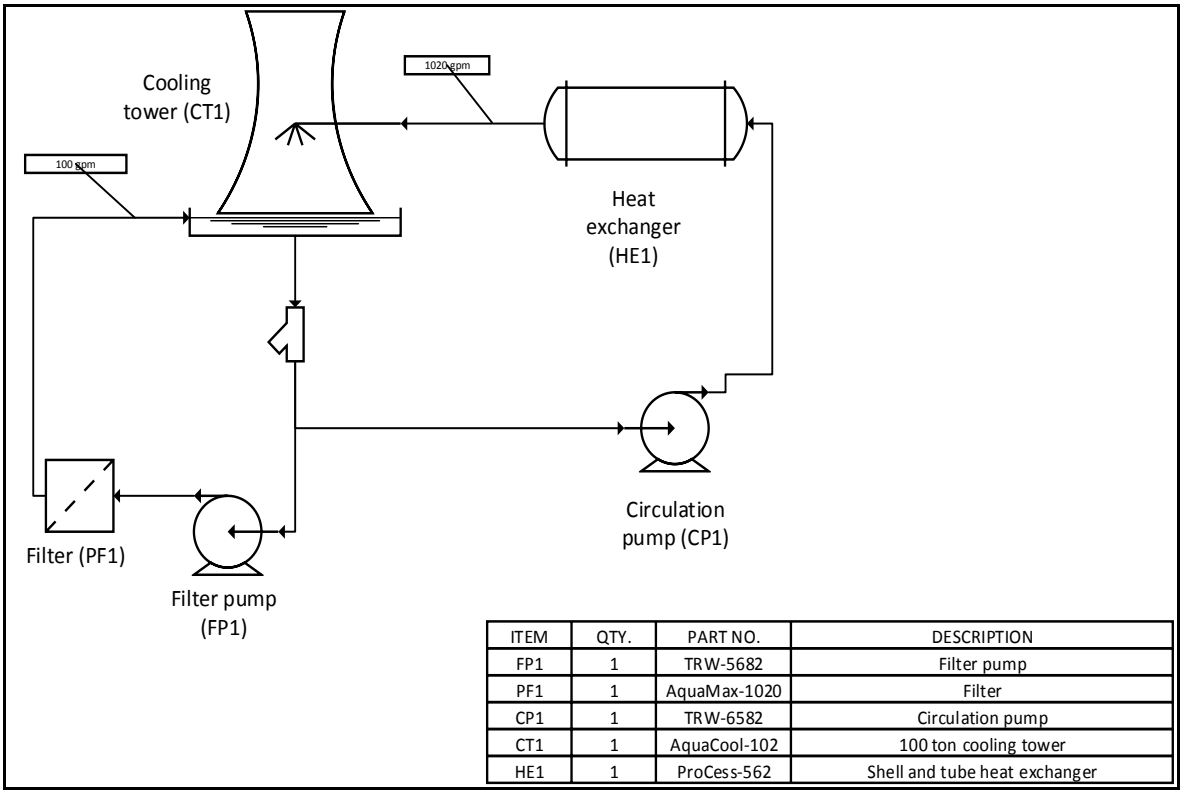
2.1.1 FILTER INFORMATION (IF USED)

Filter flow rate	
Filter manufacturer	
Filter model	
Filter pump model	
Filter pump maximum flow rate	
Filter pump power (single or three phase)	
Filter pump flow rate determined by flow controller or un controlled	
Filter cleaning method (e.g. backwash, cartridge cleaning, bag replacement, etc.)	
Pressure drop at which filter should be backwashed/cleaned etc.	

2.2 PROCESS SCHEMATIC

[Provide a schematic that contains sufficient information to provide a means of understanding the entire process and its mechanical components.]

Process Schematic Example



ITEM	QTY.	PART NO.	DESCRIPTION
FP1	1	TRW-5682	Filter pump
PF1	1	AquaMax-1020	Filter
CP1	1	TRW-6582	Circulation pump
CT1	1	AquaCool-102	100 ton cooling tower
HE1	1	ProCess-562	Shell and tube heat exchanger

2.3 HEAT SOURCE DESCRIPTION

[Provide descriptions of: a) the source of the heat that is removed by the cooling tower; and b) how the loss of cooling equipment will be addressed by backup processes or methods.]

2.4 CONTROL ELEMENTS

[Designate the location and function of the control locations (or elements) that are used to maintain the operating variables of a cooling tower. Use the table below as the location for these data.]

Control element designation examples

Control element	Control sensor	Purpose
Bleed valve located on the bottom of the basin piping	Conductivity sensor located in control room. Solenoid valve is opened by signal from central control system	Allow water containing excessively high dissolved solids concentrations to be removed from the system to be replaced by fresh water.
Sand filter	Turbidity sensor used during maintenance visits	The sand filter is operated continuously on a circulation to filtration ratio that is established manually by valving and is checked periodically to ensure water turbidity is maintained.
Biocide pumps (halogen)	ORP sensor located in mechanical control room	On-line disinfection is maintained using ORP as the process variable to ensure there is adequate disinfectant maintained in the system.
Biocide pumps (non-halogen)	Periodic dip slide tests performed for feedback data	Bacteria counts are used as a means of measuring the effectiveness of the biocide process.
pH chemical feed pump	pH sensor located in mechanical control room	The pH of the water is used to protect the cooling tower components from corrosion. The pH of the water is maintained by the addition of xyz solution.
Antiscalant/corrosion inhibitor chemical feed pump	Chemical testing performed during periodic maintenance visits	The chemical feed pump dosing is adjusted based on test data during site visits.

SECTION 3. PERSONNEL ROLES AND RESPONSIBILITIES

[This section includes the information of the of the personnel involved in the maintenance and operation of a cooling tower and the specific actions/activities to be performed by those personnel.]

3.1 PERSONNEL

[Record the information of the personnel involved in the maintenance and operation of a cooling tower.]

Maintenance program administrator

Name	
Title	
Employer or company	
Address	
Phone number	
Email address	

Licensed pesticide applicator

Name	
Pesticide applicator New York State DEC license number (7G)	
Employer or company	
Address	
Phone number	
Email address	

Maintenance personnel (provide information for each individual)

Name	
Title	
Employer or company	
Address	
Phone number	
Email address	

Maintenance program validator

Name	
Title	
Employer or company	
Address	
Phone number	
Email address	

3.2 RESPONSIBILITIES AND ROLES

[This section outlines actions/activities to be performed in accordance with 10NYCRR 4-1.]

Responsibility/Role	Frequency Performed	Person/Company
Cooling tower registration[1]	Once when commissioned.	
Reporting[2]	Intervals of no more than 90 days.	
Development and updating of required maintenance program and plan[3]	As needed.	
Bacteriological culture sampling[4]	Intervals not to exceed 30 days while the cooling tower is in use, and that requires additional bacteriological culture sampling and analysis, as needed, to validate process adjustments.	
Legionella culture analysis[5]	Within two weeks after startup and after maintenance shutdown and at intervals not to exceed 90 days while the cooling tower is in use.	
Immediate and appropriate actions specified by Appendix 4-A[6]	Immediate and appropriate actions that are in response to bacteriological and *Legionella* culture analysis.	
Notification[7]	In response to a *Legionella* result that exceeds 1,000 CFU/mL.	
Disinfection[8]	In response to a Legionella result that exceeds $\geq$ 20 CFU/mL.	
Inspection[9]	Inspection is required prior to seasonal start-up and at intervals not exceeding every 90 days while in use. Year-round towers are required to be inspected at intervals not exceeding every 90 days and prior to start-up following a maintenance procedure.	

[1] Registration is required by 10NYCRR 4-1.3(a)

[2] Reporting of various test data and operations schedule is required by 10NYCRR Section 4-1.3(b).

[3] The maintenance program and plan are required to be developed and implemented by September 1, 2016 by 10NYCRR Section 4-1.4(a).

[4] Bacteriological culture sampling is required by 10NYCRR Section 4-1.4 (b)(1).

[5] *Legionella* culture sampling is required by 10NYCRR Section 4-1.4 (b)(2).

[6] 10NYCRR Section 4-1.4 (b)(4) requires immediate and appropriate actions in response to bacteriological and *Legionella* culture analyses that exceed values that are stipulated in Appendix 4-1-A. See Appendix 4-1-A for more details of appropriate actions.

[7] Notification of the local health department within 24 hours of receipt of a Legionella culture sample result that exceeds 1,000 colony forming units (CFU) per milliliter is required by 10NYCRR Section 4-1.6 (a). Notification of the public may also be required as determined by the local health department (10NYCRR Section 4-1.6 (b)).

[8] Disinfection is required by 10NYCRR Section 4-1.7 (a) to be performed by a pesticide applicator who is certified in accordance with the requirements of Article 33 of the Environmental Conservation Law and 6 NYCRR Part 325, or a pesticide apprentice under the supervision of a certified applicator.

[9] Inspection is required by 10NYCRR Section 4-1.9.

Certification[10]	Annual certification is required by November 1 of each year. The certification document should attest that the cooling tower has a maintenance program and plan, and that all activities within that plan or required by the regulation were implemented.	
Recordkeeping[11]	Records of all sampling and analyses, disinfection schedules and applications, inspection finding, deficiencies, and corrective actions and certifications are required to be maintained for three years.	
Checking chemistry levels in the tower	Frequency to be determined by the water treatment professional.	
Checking the inventory of chemicals used to treat the tower water	Frequency to be determined by the water treatment professional.	

[10] Certification are required by 10NYCRR Section 4-1.9.
[11] Record keeping is required by 10NYCRR Section 4-1.9.

SECTION 4. PROGRAM VALIDATION

[Program validation should be performed by an individual who has management responsibilities for the proper implementation of the maintenance program and plan to ensure all required activities are being properly executed. This section should identify the items to be examined and the frequency of the review.

The program validation procedure is performed by reviewing the data and maintenance logs to ensure: 1) the maintenance program is being executed as documented; 2) the maintenance program is effective at reaching its goals; and 3) deficiencies or unneeded components of the maintenance program are identified for correction in future revisions of the plan.]

Items and materials used for process validation

Item examined	Purpose	Frequency

SECTION 5. PROGRAM IMPLEMENTATION

[A treatment program consists of the implementation of chemicals, testing/sampling systems and administration equipment. The following sections specify appropriate information. For example:

- *Chemical(s) used for corrosion control*
- *Chemical(s) used for microbiological control*
- *Chemical(s) used for pH adjustment/maintenance*
- *Chemical(s) used for dispersants/penetrants*
- *Chemical(s) used for antiscalants*

The information included in these sections should corroborate the process information in Section 2.4]

5.1 PROGRAM CHEMISTRY

[Provide information on program corrosion inhibitors, biocides/disinfectants, and dispersants/ detergents]

5.1.1 CORROSION INHIBITORS

Product	Manufacturer	NYS DEC Registration Number	Setpoint Range

5.1.2 BIOCIDES/DISINFECTANTS

Product	Manufacturer	NYS DEC Registration Number	Setpoint Range

5.1.3 DISPERSANTS/DETERGENTS

Product	Manufacturer	NYS DEC Registration Number	Setpoint Range

5.2 PROGRAM MATERIALS

[Provide a list of those items and materials that are used in the water treatment program execution.]

Item 1	
Item 2	
Item 3	

5.3 PROGRAM TESTING/SAMPLING DEVICES

[Provide information on program chemical testing and bacterial culture devices.]

5.3.1 PROGRAM CHEMICAL TESTING

Product/Instrument	Manufacturer	Chemical Tested	Model Number

5.3.2 PROGRAM BACTERIAL CULTURE DEVICES (E.G. DIPSLIDES)

Product	Manufacturer	Model Number

5.4 PROGRAM ADMINISTRATION EQUIPMENT

[The program and plan administration requires measuring water parameters such as conductivity, pH, oxidation-reduction potential (ORP) and other items vital to maintain the chemistry of the system.]

5.4.1 DATA GENERATION/SAMPLING & CONTROL

[Input the data generation/sampling and control equipment used to maintain the chemistry levels required by the program and plan.]

Model	Quantity Measured	Sensor Manufacturer	Controller
	Conductivity		
	ORP		
	pH		

5.4.2 CONTROL ELEMENTS

[Process variables may be maintained by electronic feedback loop or manual adjustment based on a test result. The following table captures the data that specify how variables are controlled.]

Quantity Controlled	Element	Manufacturer	Model
Conductivity	Bleed valve		
ORP	Chemical feed pump		
Anti-scalant/corrosion inhibitor	Chemical feed pump		
pH	Chemical feed pump		

SECTION 6. ONSITE MONITORING PROCEDURES

[Onsite monitoring is required to maintain the automated process monitoring and control systems, to check the effectiveness of the current set points and to adjust (if necessary) the open-loop control systems.]

6.1 MONITORING SCHEDULE

[List the monitoring schedule.]

Operating variable	Monitoring activity	Frequency performed

6.2 MONITORING METHODS AND PROCEDURES

[Document the variables or parameters that are monitored and the procedure used to obtain process data. This section must be consistent with the information in Section 5.4.1.]

Monitored variable	Procedure
Cooling tower water conductivity measurement	
Cooling tower influent temperature	
Cooling tower effluent temperature	
Disinfectant test procedure	
pH test procedure	
Cooling tower bacteria sampling protocol	
Cooling tower legionella sampling protocol	
Disinfectants	
Corrosion inhibitor/antiscaling agent	
pH adjustment chemical	
Pump operation validation	

6.3 MONITORING RESPONSE PROTOCOLS

[List the responses to the results that are a result of the cooling tower measurements.]

Variable	Acceptable range or limiting value	Procedure to address out-of-specification values
Conductivity		
pH		
Biocide		
Bacteria		
Legionella		
Temperature		
Air flow rate		

6.4 MONITORING LOG

[Include the cooling tower monitoring sheets. The log must be consistent with the Maintenance Program and Plan that is developed by the cooling tower operator. The log sheets are therefore customized to the specifications of the program and plan.]

SECTION 7. ONSITE MAINTENANCE OPERATIONS

[Document the maintenance procedures that are required to be performed as a matter of routine operation of the cooling tower. Examples of routine procedures include calibration and cleaning of conductivity, pH and ORP probes, cleaning of the basin to maintain proper flow of water, water strainer cleaning and more.]

Procedure name	Description of method
Sensor calibration	
Basin cleaning	
Filling chemical feed reservoirs	
Additional regular maintenance	

SECTION 8. COOLING TOWER OPERATION PROCEDURES

8.1 SEASON STARTUP PROCEDURE

[Outline the tower startup procedure and specify all chemicals and/or cleaning agents used during the startup process.]

8.2 SEASON SHUTDOWN PROCEDURE

[Outline the tower shutdown procedure and specify any and all chemicals and/or materials used for tower shutdown procedures.]

8.3 NON-LOAD OPERATION/PROCEDURE

[Outline any and all differences in the operational procedure for running a cooling tower without any heat load.]

8.4 TEMPORARY SHUTDOWN AND STARTUP FOR MAINTENANCE OPERATIONS

[Outline the shutdown and startup procedures that are associated with short term (temporary) conditions that are often associated with maintenance operations.]

8.5 COOLING TOWER CLEANING PROCEDURE

[Describe procedure]

8.6 COOLING TOWER ONLINE DISINFECTION PROCEDURE

[Describe procedure]

8.7 COOLING TOWER EMERGENCY DISINFECTION PROCEDURE

[Describe procedure]

8.8 COOLING TOWER CLEANING PROCEDURES

[Describe procedures]

8.9 COMMISSIONING GUIDELINES FOR NEW COOLING TOWER SYSTEMS

[List guidelines]

8.10 CONTINGENCY COOLING FOR PLANNED OR UNPLANNED TOWER INTERRUPTIONS

[Describe contingency]

8.11 CONTINGENCY RESPONSE PLAN, SYSTEM INTERRUPTIONS

[Describe contingency]

8.12 SIDE STREAM FILTER MAINTENANCE AND DISINFECTION PROCEDURES

[Describe procedures]

8.13 CIRCULATION PROCEDURE FOR OFF LINE/IDLE

[Describe procedure]

SECTION 9. BIOLOGICAL SAMPLING PLAN

[The following outline lists the minimum required sampling that must be performed to satisfy the requirements of Section 4-1.4.]

Frequency of Routine Biological Sampling:

- Bacteriological culture sampling
  - Not to exceed 30 days
- *Legionella* culture sampling
  - Within two weeks after the tower startup
  - Intervals not to exceed every 90 days while operational
  - Note: year-round operation requires sampling every 90 days as well as a sample within two weeks after start-up following maintenance

Biological Sampling Required Due to Operational Issues or Epidemiological Concerns:

- *Legionella* culture sampling and analysis
  - Power failure of sufficient duration to allow for the growth of bacteria
  - Loss of biocide treatment of sufficient duration to allow for the growth of bacteria
  - Failure of conductivity control, or any other control methods, to maintain proper cycles of concentration
  - Determination by the State Department of Health or the local health department that one or more cases of legionellosis is or may be associate with the cooling tower
  - Any other conditions specified by the Department or local health department

SECTION 10. MAINTENANCE RESPONSES TO TESTING

[The following table summarizes the requirements of Subpart 4-1 Appendix 4-A. Log the operational changes in response to non-compliant testing results.]

10.1 INTERPRETATION OF *LEGIONELLA* CULTURE RESULTS FROM COOLING TOWERS

Interpretation of *Legionella* Culture Results from Cooling Towers	
Legionella Test Results in CFU/mL[1]	Approach
No detection (< 20 CFU/mL)	Maintain treatment program and *Legionella* monitoring in accordance with the maintenance program and plan.
For levels at ≥ 20 CFL/mL but < 1,000 CFL/mL perform the following:	○ Review the treatment program. ○ Institute immediate *online disinfection*[2] to help with control ○ Retest the water in 3-7 days. • Continue to retest at the same time interval until one sample retest result is < 20 CFU/mL. With receipt of a result <20 CFU/mL, resume routine maintenance program and plan. • If retest is ≥ 20 CFU/mL but < 100 CFU/mL, repeat *online disinfection*[2] and retest until < 20 CFU/mL attained. • If retest is ≥ 100 CFU/mL but < 1000 CFU/mL, further investigate the water treatment program and immediately perform *online disinfection*[2]. Re-test and repeat attempts at control strategy until < 20 CFU/mL attained. ○ If retest is ≥ 1000 CFU/mL, undertake control strategy as noted below.
For levels ≥ 1,000 CFU/mL perform the following:	○ Review the treatment program and provide appropriate notifications per section 4-1.6 of the regulation. ○ Institute immediate *online decontamination*[3] to help with control ○ Retest the water in 3-7 days. • Continue to retest at the same timer interval until one sample retest result is < 20 CFU/mL. With receipt of a result <20 CFU/mL, resume routine maintenance program and plan. • If any retest is ≥ 20 CFU/mL but < 100 CFU/mL, repeat *online disinfection*[2] and retest until < 20 CFU/mL attained. • If retest is ≥ 100 CFU/mL but < 1000 CFU/mL, further investigate the water treatment program and immediately perform *online disinfection*[2]. Re-test and repeat attempts at control strategy until < 20 CFU/mL attained. • If any retest is ≥ 1000 CFU/mL: ▪ Carry out *system decontamination*[4].

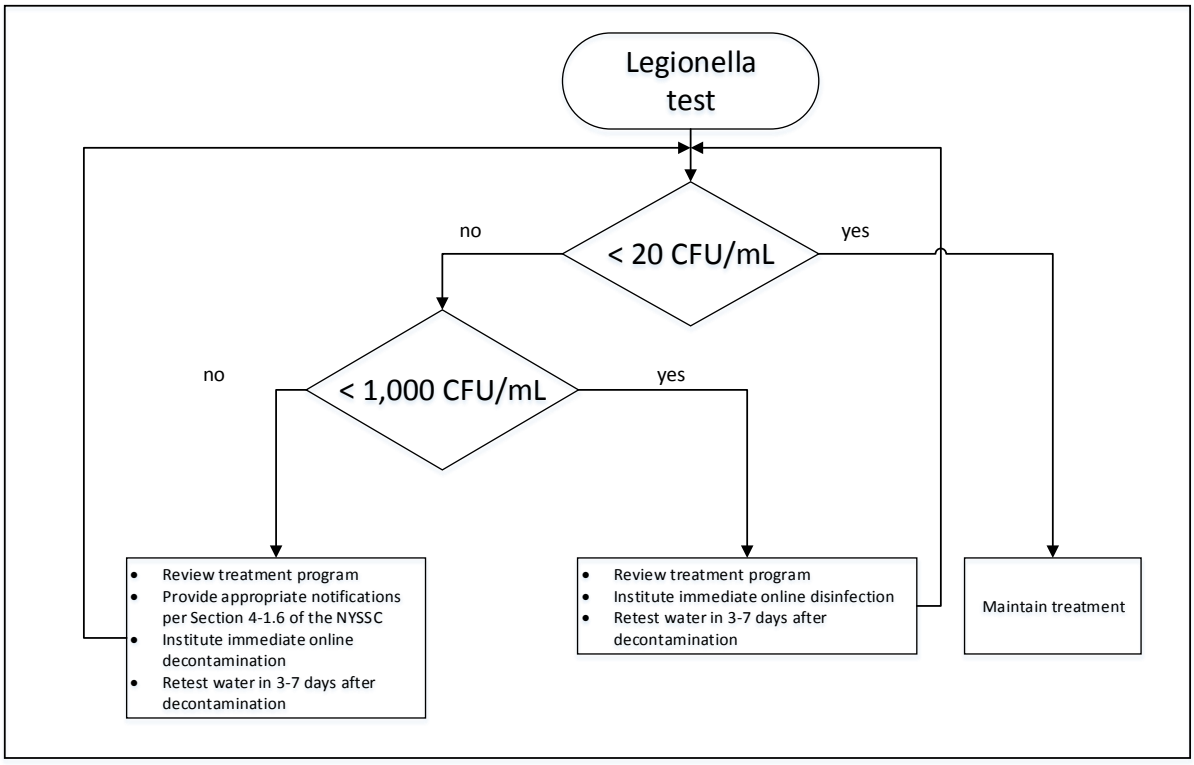
[1] Colony forming units per milliliter

[2] Online disinfection means-Dose the cooling tower water system with either a different biocide or a similar biocide at an increased concentration than currently used.

[3] Online decontamination means – Dose the recirculation water with a halogen-based compound (chlorine or bromine) equivalent to at least 5 milligrams per liter (mg/L) or parts per million (ppm) free residual halogen for at least one hour.

[4] System decontamination means – Maintain between 5 to 10 mg/L (ppm) free residual halogen for a minimum of one hour; drain and flush with disinfected water; clean wetted surface; refill and dose to 1 – 5 mg/L (ppm) of free residual halogen and circulate for 30 minutes. Refill, reestablish treatment and retest for verification of treatment.
For chlorine treatment the pH range should be 7.0 to 7.6; for bromine treatment the pH range should be 7.0 to 8.7. At higher pH values the treatment times may need to be extended.

NOTE: Stabilized halogen products should not be used for online decontamination or system decontamination as defined in this Appendix per footnotes 3 and 4.



SECTION 11. MAINTENANCE, CULTURE AND DISINFECTION REPORTS

[In this section, the service reports should be filed in chronological order. This section should not include responses to bacteriological or Legionella *testing procedures.]*

11.1 MICROBIOLOGICAL TESTING REPORTS

11.1.1 BACTERIA

11.1.2 LEGIONELLA

11.2 INSPECTION REPORTS

11.3 COOLING TOWER CLEANING REPORTS

11.4 ONLINE DISINFECTION/DECONTAMINATION REPORTS

11.5 MAINTENANCE REPORTS

11.5.1 ROUTINE

11.5.2 REMEDIAL

11.6 ANNUAL INSPECTION REPORTS

SECTION 12. CHEMICAL SUPPLY LOG

[Document records of restocking chemicals as a means of tracking the amount of material used for proper management of the water quality of the tower water. The tables shown below are examples of what should be documented for each product used in the maintenance program.]

12.1 RESUPPLY LOG FOR BIOCIDE

[Insert the biocide resupply log]

Item	Resupply date	Quantity

12.2 RESUPPLY LOG FOR CORROSION INHIBITOR

[Insert the biocide resupply log]

Item	Resupply date	Quantity

12.3 RESUPPLY LOG FOR ANTI-SCALANT AGENT

[Insert the biocide resupply log]

Item	Resupply date	Quantity

12.4 OTHER MATERIALS THAT MAY BE USED FOR COOLING TOWER MAINTENANCE AND OPERATION

[Add any additional materials that may be used for cooling tower maintenance and operation.]

SECTION 13. CUT SHEETS FOR PROGRAM EQUIPMENT

[Include the equipment that is used for executing the program and the specific model identified on the document.]

SECTION 14. APPENDIX A

[Use this section to document other items that are needed to define the maintenance program and plan.]