NYSDOH REGULATIONS FOR THE PROTECTION AGAINST LEGIONELLA: COOLING TOWERS AND COVERED FACILITIES

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OUTLINE

- Brief overview of Legionella and Legionnaires Disease
- Overview of Cooling Tower Regulations
- Cooling Tower Maintenance Program Plan
- New Regulations for Hospitals and Health Care Facilities
- Environmental Assessment
- Covered Facility Sampling and Management Plan
- Part 2 – Corrective Actions/Remediation

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LEGIONELLOSIS

- A Bacterial Infection that causes:
  - Legionnaires Disease - A progressive pneumonia
  - Pontiac Fever - Flu-like illness (no pneumonia)

EPIDEMIOLOGY

- Legionella is an aquatic organism that is considered a parasite
  - Ideal growth 77-115 degrees F (25-46 degrees C).
  - Cases have been linked to:
    - Potable water systems;
    - Cooling towers;
    - Showers/faucets;
    - Hot tubs, whirlpool spas;
    - Respiratory therapy equipment; and
    - Room-air humidifiers

INDIVIDUALS AT RISK

- People 50 years or older
- Current or former smokers
- People with a chronic lung disease (e.g., chronic obstructive pulmonary disease or emphysema)
- Individuals with a weak immune system from diseases like cancer, diabetes, or kidney failure
- Those who take immunosuppressant's after a transplant operation or chemotherapy procedure

SUMMARY OF NYSDOH TITLE 10 PART 4

- On July 6, 2016, NYSDOH put into effect a new sanitary code providing measures that protect against Legionella. The code focuses on cooling towers but also requires testing and inspection of potable water systems found in all general hospitals and residential health care facilities.
- Requires registration and development of Cooling Tower Maintenance Program Plans for industrial facilities.
- Requires an Environmental Assessment and a Sampling and Management Plan for Hospitals and Health Care Facilities.
- Allows for the NYSDOH to be more active in monitoring cooling towers, hospitals, and residential health care facilities.

SUMMARY OF NYSDOH PART 4-1 COOLING TOWERS

- A cooling tower is defined as a tower, evaporative condenser or fluid cooler that is part of a recirculated water system incorporated into a building's cooling, industrial process, refrigeration or energy production system.

- The regulation requires the owners of all Cooling Towers to:
  - Register the Cooling Tower with the NYSDOH;
  - Develop and implement a Cooling Tower Maintenance Program Plan ("CTMPP");
  - Use an Environmental Sampling Lab approved by New York State;
  - Complete all inspections and certifications by a: NYS licensed PE; CIH; Certified Water Technologist; or Environmental Consultant with appropriate training and experience; and
  - Retain all records on premises for a minimum of three (3) years.

REGISTRATION

- All Cooling Towers must be registered with the NYSDOH using the statewide electronic system. The following information should be included:
  - Address of the building, with a building identification number;
  - Names, addresses, phone numbers and emails of the owners;
  - Name of the manufacturer of the cooling tower;
  - Model Number;
  - Specific serial number;
  - Cooling capacity;
  - Volume;
  - Intended use;
  - Operational use;
  - Maintenance personnel; and
  - Year Cooling Tower was placed into service.

COOLING TOWER MAINTENANCE PROGRAM PLAN

- As of September 1st, 2016 all owners of Cooling Towers have been required to develop and implement a CTMPP. The plan must include:
  - Schedules for bacterial and Legionella culture sampling;
  - Remedial response actions;
  - A shutdown and disinfection plans;
  - Conditions requiring treatment or flushing during idle conditions; and
  - Startup procedures regarding cleaning and disinfection following Cooling Tower shut down without treatment for more than five consecutive days.

ORIGIN AND PURPOSE OF CTMPP

- Provide the framework for responsible facility personnel to ensure the health and safety of building occupants with respect to Legionellosis.
- Describe the preventive measures required for cooling towers and evaporative condensers.
- Developed in accordance with ANSI/ASHRAE Standard 188-2015.
- Must meet the requirements of the NYSDOH regulation.

CTMPP DEVELOPMENT

1. Assemble Program Team
2. Equipment/Systems Descriptions
3. Analyze Water Systems
4. Develop Control Measures and Corrective Actions
5. Develop Confirmatory Testing Program
6. Establish Documentation and Communication Procedures
7. Write CTMPP

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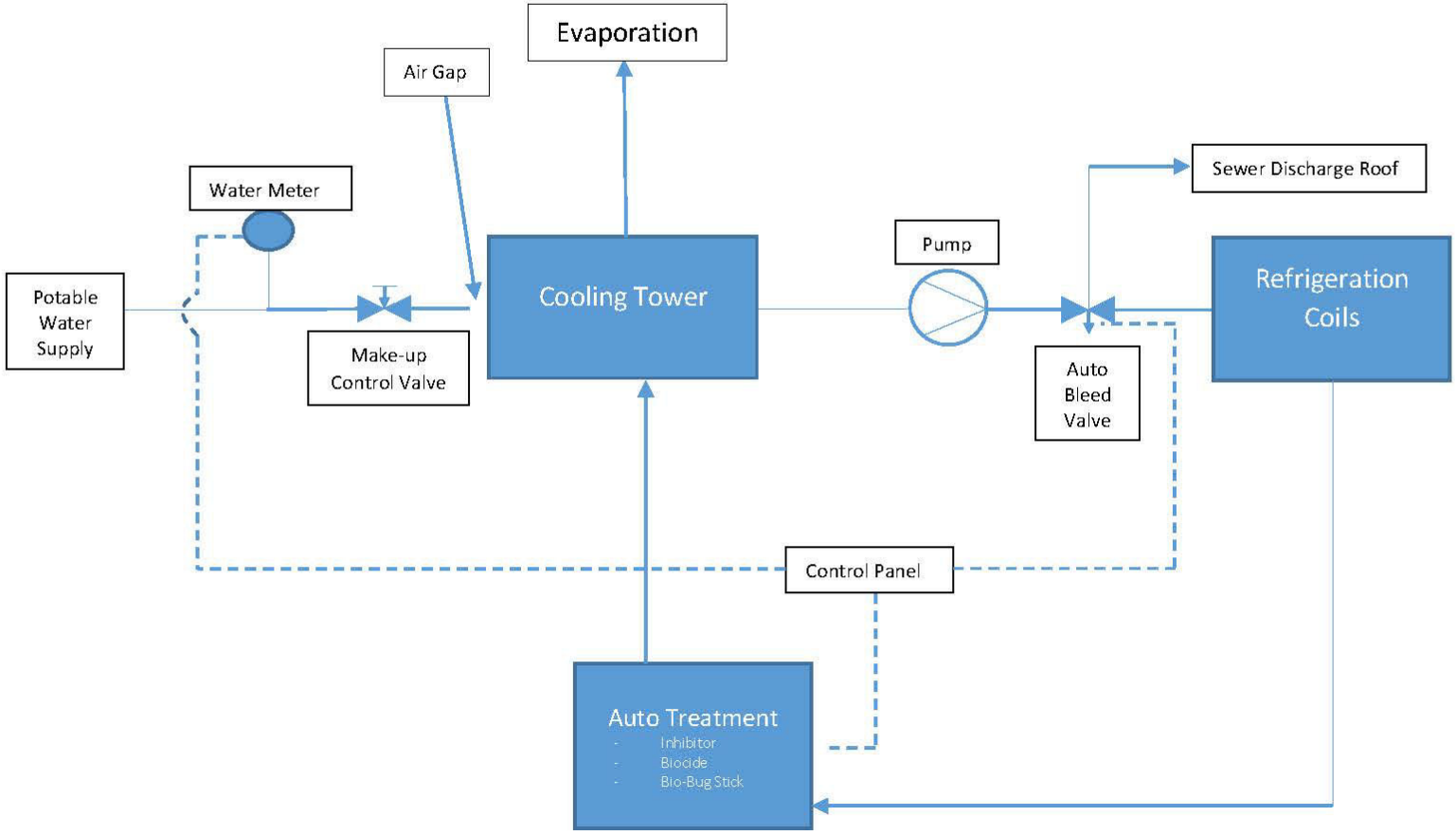
ASSEMBLE PROGRAM TEAM

- Responsible for developing the Program and implementing the tasks for which they are responsible.
- Must have knowledge of the building water system design and water management as it relates to Legionellosis.
- Delegates program tasks to subgroups.
- Typical team includes Facility Manager, Engineering Manager, Outside Technical Support (P. E., CIH, CT Specialist)

EQUIPMENT/SYSTEMS DESCRIPTIONS

- The Program Team shall identify and describe the potable and non-potable water systems within the building and on site.
  - Locations of end-point uses of potable and non-potable water systems;
  - Location of water processing equipment and components;
  - How water is received and processed (conditioned, treated, stored, heated, cooled, recirculated, and delivered to end-point uses); and
  - Develop Process Flow Diagram.

EVAPORATIVE CONDENSER



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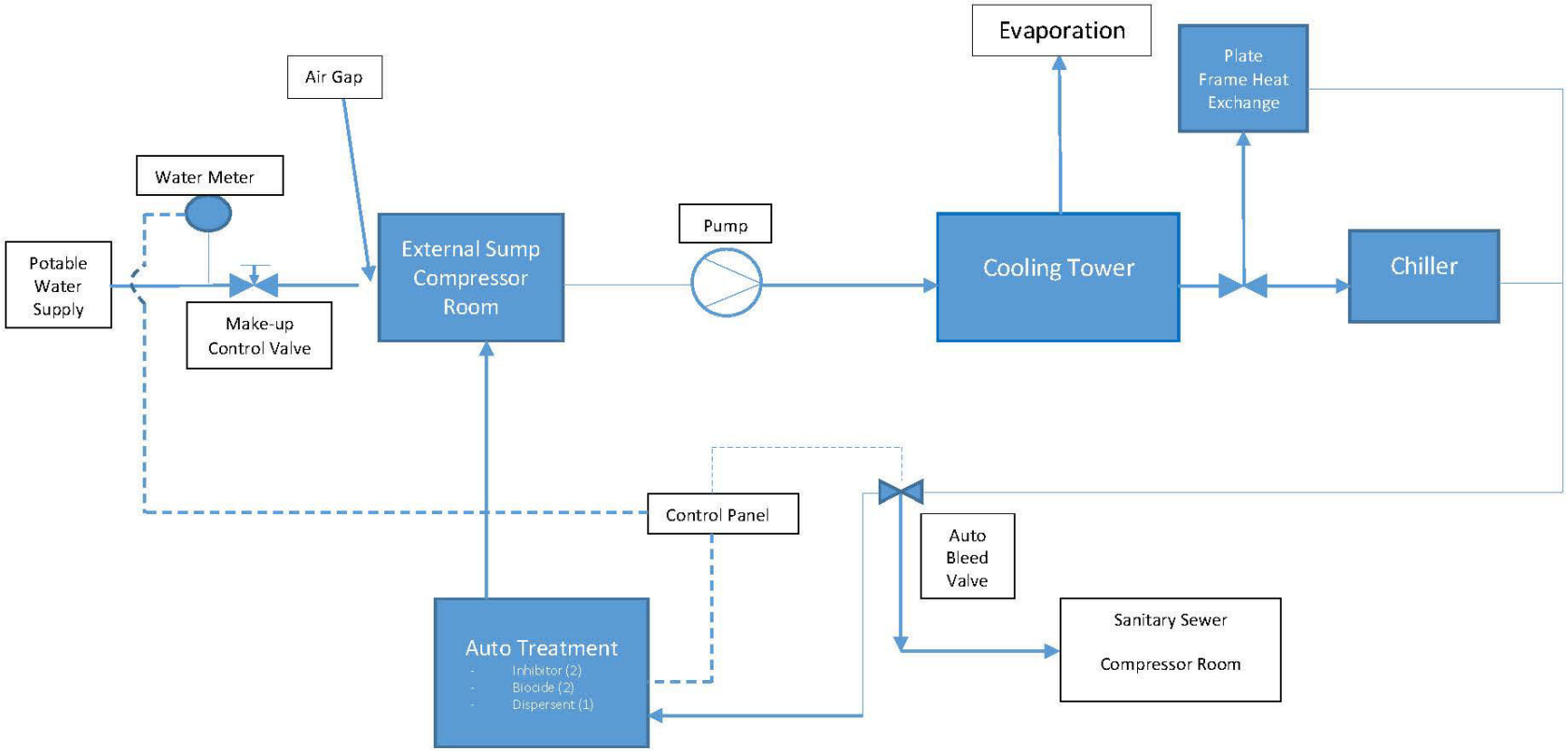
COOLING TOWER



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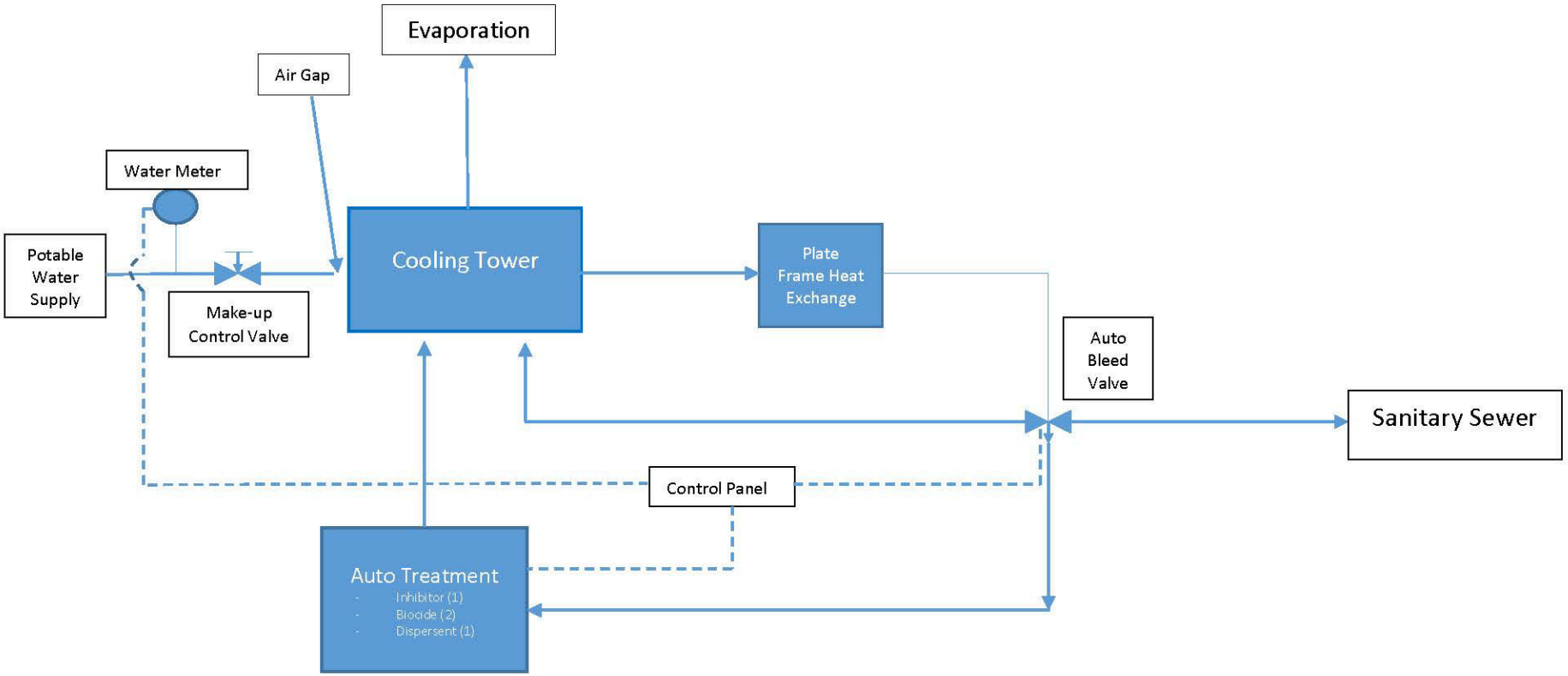
COOLING TOWER



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ANALYSIS OF BUILDING WATER SYSTEMS

- Evaluate where hazardous conditions may occur in the building water systems and determine where control measures can be applied to control potentially hazardous system conditions. Major factors include:
  1. Stagnant water conditions and/or system design configurations that produce stagnation, such as side-arm and dead-leg piping;
  2. Warm water temperatures between 20 and 50ºC (68 to 122ºF);
  3. Bulk water pH in the range of 5.0 to 8.5;
  4. Sediment, scale, deposits, biofilm – support not only Legionella growth, but also that of the very important supporting microbiota for Legionella;
  5. Microbiota, including algae and many bacteria that supply essential nutrients for growth of Legionella;
  6. Certain amoebae and other protozoa that harbor Legionella as endosymbionts – allowing them to thrive, resist harsh environmental conditions (including biocides) and to significantly amplify.
- Take into consideration the vulnerability of occupants and the building water systems.
- Evaluate provisions to respond to water service disruptions.

CONTROL MEASURES AND CORRECTIVE MEASURES

Based on the results of the analysis of building water systems, the Program Team determines the control measures to be maintained including:

- Preplanning of physical design and equipment siting;
- Treatment methods, technical and physical processes, and procedures and activities or actions that monitor and maintain the physical or chemical conditions of water to within established control limits.
- Control Locations: The Program Team shall determine the locations in the building water system where control measures are required.
- Control Limits: The Program Team shall determine a maximum value, minimum value, or range of values to which a chemical or physical parameter must be maintained.
- For each control location, the Program Team shall establish procedures for corrective actions to be taken when monitoring shows that control measures are outside of established control limits.

DOCUMENTATION AND COMMUNICATION

- The Program shall establish documentation and communication procedures for all activities of the Program.
- The Program Team is responsible for all water systems, communication, and coordination among subgroups; covering different portions of the building water system and associated equipment.
- A master index providing the location of all Program documents shall be maintained.

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PREPARING THE COOLING TOWER MAINTENANCE PROGRAM PLAN

- Written Maintenance Program Plan for Cooling Tower and Evaporative Condensers.
- Describes the preventive measures required for cooling towers and evaporative condensers that provide cooling and/or refrigeration for the HVAC&R system or for other devices or systems in the building.
- Identifies responsible persons for every step of each program requirement.

CTMPP EXAMPLE OUTLINE

1.0 Introduction
2.0 Scope
3.0 Program Team
4.0 Equipment Description (Cooling Towers and Evaporative Condensers)
5.0 System Inspections and Maintenance
    5.1 Inspections
    5.2 Maintenance
6.0 Water Treatment
    6.1 Chemical Use
    6.2 Monitoring
    6.3 Corrective Action Plan
7.0 Notifications
8.0 Shutdown and Startup
9.0 Disinfection and Decontamination
    9.1 Online Disinfection
    9.2 Online Decontamination
    9.3 System Decontamination
10.0 Requirement for Cooling Tower Make-up Valves
11.0 Contingency Response Plan
    11.1 Procedures Issued by National, Regional and Local Health Department Authorities
    11.2 Legionella Testing
    11.4 Disinfection and Decontamination
    11.5 Procedures to Prevent Exposure to Contaminated Water

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1.0 Introduction

- Identify location and generally describe facility
- State purpose of CTMPP
- Summarize applicable regulations
- State guidance documents that CTMPP is based upon (i.e., “This CTMPP has been developed in accordance with section 7.2 of Legionellosis: Risk Management for Building Water Systems (ANSI/ASHRAE 188-2015).”

Example: Scope and Program Team

2.0 Scope

This Plan describes the preventive measures required for cooling towers and evaporative condensers that provide cooling and/or refrigeration for the HVAC&R systems or for other devices or systems at the XYZ manufacturing facility located at 123 Main Street, Somewhere, New York.

3.0 Program Team

The XYZ Cooling Tower Maintenance Program Team is responsible for developing and implementing the program and the tasks for which they are responsible. The Program Team has the necessary knowledge of the building water system design and water management as it relates to legionellosis. The Program Team consists of:

- Maintenance Manager - has overall administrative responsibility for implementation of the Program. The XYZ Maintenance Department conducts all maintenance activities, including disinfection, cleaning and decontamination
- XYZ Maintenance Department/Contractor - has responsibility for sampling and analysis, monthly inspections, and treatment of the cooling towers.
- XYZ Engineering Department - completes annual inspections of the cooling towers and will maintain updates of the cooling tower registrations with the NYSDOH

4.0 Equipment Description

- List each cooling tower or evaporative condenser at your facility subject to the regulation.
- Include location within the facility, manufacturers name, model no., serial no. and basin capacity (include a Site Plan).
- Include Process flow diagrams.

5.0 System Inspections and Maintenance

Inspections

Monthly inspections should evaluate:

- Cooling tower and associated equipment for the presence of organic material, biofilm, algae, and other visible contaminants;
- General condition of the cooling tower, basin, packing material and drift eliminator;
- Water make-up connections and control;
- Proper functioning of the conductivity control;
- Proper functioning of all dosing equipment (pumps, strain gauges); and
- Create checklists.

5.0 System Inspections and Maintenance

Maintenance

- Complete basin and/or remote sump cleaning and purging of stagnant or low-flow zones annually to minimize the possibility of bacteria buildup.

- Scheduled sampling, inspections and cleanings should be documented, and completed inspection forms should be maintained on-site.

6.0 Water Treatment

Chemical Use

Chemicals are necessary to control microbiological activity, scale and corrosion. Identify the chemicals used in the system and describe the purpose for each of the chemicals (e.g., inhibit microbiological activity, scale control, corrosion control).

6.0 Water Treatment

Biological Monitoring

Describe the type of biological culture testing and sampling and testing frequency under normal operating conditions; as described in 4-1.

Conduct emergency sampling and testing as a result of:

- Power failure of sufficient duration (i.e., 5 days);
- Loss of biocide treatment sufficient to allow for the growth of bacteria;
- Failure of conductivity control to maintain proper cycles of concentration; and
- Any other conditions specified by the NYSDOH commissioner.

7.0 Notifications

- Notify the local health department if Legionella culture sampling results exceed 1,000 Colony Forming Units per milliliter (CFUs/mL).

8.0 Shutdown and Start-up

- In the event of a cooling tower or evaporative condenser system shutdown lasting greater than 5 days, the system should be drained, then subject to a chlorine “shock” with a chlorine-based disinfectant at a prescribed concentration, based on system capacity.

- This procedure should occur after system shutdown, and prior to start-up (two cycles). Biocide should then be added during start-up, and the system brought to full operation.

9.0 Disinfection and Decontamination

If sampling and testing results determine that corrective actions are warranted, corrective actions will consist of:

- Online Disinfection
- Online Decontamination
- System Decontamination

9.1 Online Disinfection

- Online disinfection of the system will be required when Legionella sampling and testing determines that Legionella culture results are ≥ 20 CFUs/mL, but less than 1,000 CFUs/mL.
- When this occurs, the system should be dosed with a different biocide added at an increasing dose.
- Frequency of application should be increased to maintain bacteria levels within the control limit.
- Retesting of the system is required within 3-7 days.

9.2 Online Decontamination

- Will be required when Legionella sampling results are ≥ 1,000 CFUs/mL.
- Requires notification of local DOH.
- Requires system dosage with halogen-based compound equivalent to 5 milligrams per liter for no less than one hour.
- Retest after 3-7 days.

9.3 System Decontamination

- Requires dosage of the system with between 5 and 10 ppm of free residual halogen for a minimum of one hour; drain and flush the system with disinfected water; clean wetted surfaces; and refill the system with water and dose the system with 1-5 ppm of free residual halogen and circulate for 30 minutes.
- The pH range for chlorine treatment should be between 7.0–7.6 standard units. The pH range for bromine treatment should be 7.0–8.7 standard units.

10.0 Requirements for Cooling Tower Makeup Valves

- Summarize the design, construction and operational requirements for the cooling towers/evaporative condensers demonstrating compliance with the Plumbing Code of New York, Chapter 6, Water and Supply Distribution, Section 604, Design of Building Water Distribution Systems and Chapter 608.13, Backflow Protection.

11.0 Contingency Response Plan

In the event that known or suspected cases of Legionellosis have been associated with a facility's cooling towers/evaporative condensers, procedures must be implemented that conform with:

- Appendix A-4 of the Legionella regulation.

- Directions issued by the National, Regional and Local Health Department Authorities.

11.0 Contingency Response Plan

- A water sample shall be collected for Legionella bacteria analysis from an available location within the affected cooling tower system following the Center for Disease Control and Prevention ("CDC") *Manual Procedures for the Recovery of Legionella from the Environment.*
  - The sample shall be analyzed by a laboratory that is approved to perform such analysis by the New York State Environmental Laboratory Approval Program ("ELAP").

- If laboratory results indicate the presence of Legionella bacteria levels ≥ 1000 CFU /mL, emergency disinfection of the system, following the decontamination and disinfection steps identified in Appendix A-4 of the ER, must occur.

11.0 Contingency Response Plan

Procedures to Prevent Exposure to Contaminated Water

The affected facility is required to limit or prevent exposure to water sources either known or suspected to contain elevated levels of Legionella. To accomplish this, potential interim mitigation measures include:

- Personnel completing maintenance, online disinfection, online decontamination or system decontamination shall wear appropriate personal protective equipment to limit dermal and respiratory exposure to system water.
- For “Shock” disinfection procedures to the system facility management should be notified prior to initiating disinfection procedures. Skin, eye, and inhalation exposure to elevated chlorine or other disinfections can cause minor to severe injuries. Before the system is returned to normal operation, the chlorine levels should be tested to confirm they have returned to background concentrations.

SUMMARY

SAMPLING AND INTERPRETATION OF RESULTS

- Sampling intervals:
  - A schedule for routine bacteriological culture sampling and analysis at intervals no greater than 30 days while in use and additional times as specified by NYSDOH.
  - A schedule for Legionella culture sampling and analysis within two weeks following the start up and at intervals not to exceed 90 days.
  - Immediate Legionella culture sampling following a power failure, loss of biocide of sufficient duration, or if one or more cases of legionellosis are associated with the tower.
- Sampling Results:
  - 0-20 CFU/mL: Maintain the treatment program in accordance with the CTMPP.
  - 20-1000 CFU/mL: Immediately institute online disinfection to control, retest in 3-7 days.
  - Greater than 1000 CFU/mL: Immediately institute online decontamination to control, review the treatment plan and notify the local health department, retest the water in 3-7 days.
    - If retest result is greater than 1000 CFU/mL, carry out system decontamination.
- All culture analyses must be performed by a New York State Environmental Laboratory Approval Program (“ELAP”).

Potable Water in Hospitals and Residential Health Care Facilities

NYSDOH Regulations also apply to the following Facilities defined under Article 28 of Public Health Law (collectively, “Covered Facilities”):

- Hospitals;
- Residential health care facilities (nursing homes); and
- Generally, any facility providing lodging, board, and physical care to residents, or if the facility operating certificate describes facility as a “Health Care Facility”.

SUMMARY OF NYSDOH PART 4-2 COVERED FACILITIES

The regulation requires any Covered Facility to:

- Update and complete an Environmental Assessment (“EA”);
- Prepare and implement a Sampling and Management Plan (“SMP”);
- Use an approved New York State ELAP;
- Retain all records on premises for a minimum of three years; and
- Provide plans for appropriate response actions.

ENVIRONMENTAL ASSESSMENT

As of September 1st, 2016, all covered facilities have been required to perform and update an Environmental Assessment. The assessment includes:

- Facility characteristics;
- Sampling sites;
- Source of water supply and treatment;
- Heating and cooling components; and
- Construction issues.

ENVIRONMENTAL ASSESSMENT

Assessments should be updated annually and under the following conditions:

- The event that one or more cases of legionellosis are associated with the facility;
- Upon the completion of any construction, modification, or repair activity to the potable water system;
- An expansion or relocation of a facility's hematopoietic stem cell transplant and solid organ transplant unit; or
- Any other conditions specified by the Department of Health.

The NYSDOH Environmental Assessment form (DOH-5222) is available through the Health Commerce System

- https://www.health.ny.gov/forms/doh-5222.pdf

NEW YORK STATE DEPARTMENT OF HEALTH
Bureau of Water Supply Protection

Environmental Assessment of Water Systems in Healthcare Settings

1. Type of Assessment (check as appropriate)

☐ On-site assessment ☐ Telephone assessment ☐ Mailed/emailed prior to telephone conference

2. Information about the person doing the assessment

Name _____

Job title _____

Facility name _____

PFI (Permanent Facility Identifier) _____

Facility address _____

_____

_____

Date of assessment _____

3. Contact information

Telephone number (work and/or cell) _____

FAX number _____

Email _____

Instructions and Notes to the User (*please read*)

Please complete this form and keep it with your records. You do not need to submit it to NYSDOH. You will need to produce this form at the request of NYSDOH as part of a routine inspection or during the investigation of an outbreak.

This information collection tool may be used where a thorough understanding of the potable water system of a healthcare facility is needed during a public health investigation. It can be used by a hospital multi-disciplinary group that includes: a hospital epidemiologist, infection control practitioner, engineer, facility manager or other individual(s) engaged in efforts to reduce the risk of legionellosis associated with the facility. It may also be used to assist the facility in efforts to minimize the risk of legionellosis in the absence of evidence of human disease or when a facility is reviewing/implementing the NYSDOH guidance document on hospital-associated legionellosis. It should be completed in as much detail as possible. Some information requested by the tool may not be applicable for every healthcare facility.

For very large, complex healthcare facilities, completing the form may take several hours. Please keep in mind that this initial investment of time is quite important and will be a time-saving device during periodic re-assessments. If follow-up with the facility is needed in subsequent months or years, the information contained in this form will be very valuable. ***Please do not leave sections blank. If a question doesn't apply, write N/A. If a question can't be answered please explain why.*** Where applicable, please specify the unit of measurement being used (e.g., ppm). It is recommended that if you are completing the form electronically, you use a different font and/or italics for your answers. This will make the form much easier to read if additional information is added in the future to an existing form.

Source: NYSDOH https://www.health.ny.gov/forms/doh-5222.pdf

A. Facility Characteristics

1. Number of buildings (including the main facility) that share:
   a. water systems with the facility _____
   b. air systems with the facility _____
2. Number of Intensive Care Unit beds (including surgery, coronary care, etc.) _____
3. Does the facility have a solid organ transplant program? _____ ☐ Yes ☐ No
4. Does the facility have a bone marrow transplant program? _____ ☐ Yes ☐ No
5. Type of healthcare setting (check all that apply): ☐ Acute care hospital ☐ Long-term care facility ☐ Outpatient surgical center ☐ Assisted living facility
6. Organization that owns this facility is: ☐ Public ☐ Private ☐ Veterans Administration ☐ Other (explain) _____
7. Description of **each** building that shares water or air systems with the facility (and including the main facility):

Building Name	Original Construction	Later Construction	Stories	Sq. feet	Beds	Census	Use
List main facility first	Year completed	(renovation, expansion)				(yr. avg.)	List all types of care and/or specify other use
		From/To or N/A	#	Ft^2	# or NA	#/day or NA	I = Inpatient=I O = Outpatient B = Both ICU = Intensive Care Tx = Transplant

Source: NYSDOH https://www.health.ny.gov/forms/doh-5222.pdf

8. Can windows in patient rooms be opened? ☐ Yes ☐ No

Are any cooling towers visible from the rooms where patient windows can be opened? Please describe:

9. Are there decorative fountains, water features, room humidifiers, centralized humidification (e.g. on air-handling units) or any other aerosol-generating devices anywhere on the facility premises? ☐ Yes ☐ No

If **yes,** please describe and indicate their location and operation:.

10. Are there therapeutic whirlpools/spas on-site? ☐ Yes ☐ No

If **yes,** is there a written protocol for cleaning and regular service? Please describe:

11. Has this facility experienced previous Legionnaires' disease cases that were 'possibly' or 'definitely' facility acquired? ☐ Yes ☐ No

If **yes,** please describe (e.g., number of cases, dates):

12. Does the facility have a surveillance program for Legionnaires' disease? ☐ Yes ☐ No

If **yes,** please describe:

13. Does the facility have an environmental program for Legionella prevention? ☐ Yes ☐ No

If **yes,** please describe (prevention/surveillance, etc.):

14. Does the facility regularly test the fire protection system (i.e. sprinkler head flow tests)? ☐ Yes ☐ No

If **yes,** how often?

What precautions are taken to protect staff and patrons from aerosols during testing of sprinkler heads?

Source: NYSDOH https://www.health.ny.gov/forms/doh-5222.pdf

B. Outside water supply

1. What is the source of the water used by the facility? *(Check all that apply)*

   ☐ Public water supply ☐ Well ☐ Other _____

If the facility is served by a public water supply, please answer the remaining questions (2 through 4 below), otherwise skip to section C.

2. Name of supplier _____
3. How is municipal water disinfected?

   ☐ Chlorine ☐ Monochloramine ☐ Other _____ ☐ Don't Know
4. Has treatment of the public water supply changed in the last six months? ☐ Yes ☐ No

   If **yes,** specify _____

C. Design of the existing potable water system(s) [Note: A simplified schematic on a separate page and/or facility blueprints are useful for demonstrating the design including number or supply laterals from the public water supply, number and location of risers, whether a water system is fed from the "bottom- up" or "top down", etc.]

1. What type of heating system is used for the potable hot water system? *(Check all that apply)*

   ☐ Instantaneous heaters without storage of hot water ☐ Heaters with hot water storage tanks

   ☐ Other *(Please describe)* _____
2. How is the hot water system configured to deliver water to each building?

Building name	Type of system I = Instant H = Heater/boiler	Name of system (e.g., Boiler #1, Loop #1)	Date of installation	Total capacity (gallons)	Usual temperature setting (°F/°C)

Source: NYSDOH https://www.health.ny.gov/forms/doh-5222.pdf

3. Is there a recirculation system for the hot water? ☐ Yes ☐ No

If **yes,** please describe (including delivery and return temperatures) _____

4. If you use storage tanks for heated water how and when are the tanks serviced? _____

5a. What is the lowest documented HOT water temperature measured at any point within the facility? _____

_____ °F or _____ °C

When were these measurements made (Month/Date/Year)? _____ / _____ / _____

5b. What is the highest documented COLD water temperature measured at any point within the facility? _____

☐ None taken

_____ °F or _____ °C

When were these measurements made (Month/Date/Year)? _____ / _____ / _____

6. Are mixing valves used at a point after the water heater so that you can maintain higher heating/storage temperatures but deliver at a safe temperature? ☐ Yes ☐ No

If **yes,** describe the heating/storage temperature and the delivered mixed hot water temperature. _____

7. Are thermostatic mixing valves used anywhere in patient care areas? ☐ Yes ☐ No

If **yes,** where? *(Please describe)* _____

8. Does the facility have a water softener on site? ☐ Yes ☐ No

If **yes,** please describe *(Include routine service)* _____

Source: NYSDOH https://www.health.ny.gov/forms/doh-5222.pdf

SAMPLING AND MANAGEMENT PLAN

On December 1st 2016, the NYSDOH mandated that all covered facilities were to have prepared a Potable Water Sampling and Management Plan ("SMP"). The plan was to include:

- Location of Legionella sampling sites;
- Intervals of sample collection; and
- Response actions to Legionella culture analysis results.

ORIGIN AND PURPOSE OF SAMPLING AND MANAGEMENT PLAN

- Provide the framework for responsible facility personnel to ensure the health and safety of building occupants with respect to Legionellosis.
- Describe the preventive measures required for potable water systems.
- Designate specific sampling sites.
- Identify time intervals for sample collections.
- Determine immediate response actions address to any outbreaks.

PREPARING THE SAMPLING AND MANAGEMENT PLAN

- Written Management Plan for potable water systems in covered facilities.
- Describes the plan for sampling measures that are required for potable water systems and identifies response actions.

SMP EXAMPLE OUTLINE

1.0 Introduction

2.0 Scope

3.0 Facility Description

4.0 Environmental Assessment

5.0 Legionella Culture Sampling and Management Plan

- 5.1 Previous Sampling and Testing
- 5.2 Sample Locations
- 5.3 Sampling and Analysis
- 5.4 SMP Review

6.0 Corrective Actions

7.0 Recordkeeping

1.0 Introduction

- Identify location and generally describe facility
- State purpose of SMP
- Summarize applicable regulations

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Example: Scope and Facility Description

2.0 Scope

This Plan describes the preventive measures required for potable water systems that provides water intended for human contact or consumption or for other devices or systems at the XYZ health care facility.

3.0 Facility Description

XYZ is located at 123 Main Street, Somewhere, New York. It is a general hospital/nursing facility. The XZY facility is a four (4) story structure with attached structures. It has a total of 25 acute care beds, 9 acute rehab beds, and 30 long-term beds. There is one (1) potable water system servicing the facility. There are a total of two (2) boilers and two (2) hot water storage tanks providing hot water for the baseboard heating system, cleaning purposes, showering, and bathing. The boilers and tanks are located on the ground floor.

4.0 Environmental Assessment

- Describes the purpose of the Environmental Assessment
- Reports the last date the previous assessment was performed
- Includes conditions that require updates to the Environmental Assessment

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5.1 Previous Sampling and Tests

- Describes any previous sampling and testing conducted at the facility
- Supports the selection of sample locations based on collected results

5.2 Sample Locations

- Detailed location for each proposed sample Including:
  - An identifying name;
  - The purpose/use of the hot water;
  - Any nearby identifiers; and
  - The floor of building.

- Any additional samples that should be collected and tested for Legionella bacteria.
- Typically requires a site visit by an environmental specialist.

5.3 Sampling and Analysis

- Frequency of sampling – 90 days for first year.
- Conditions that require additional sampling
- The use of a laboratory that is approved by the New York State ELAP to perform such analysis

5.4 Sampling and Management Plan Review

- Reassessment of the Sampling and Management Plan
  - Frequency of review process - Annually
  - Conditions requiring review – Facility changes, personnel changes.

6.0 Corrective Actions

- Interpretation of sample results
- Short-term control measures
- Long-term control measures
    - Qualified professionals
- Appropriate timeframe to recollect samples

SUMMARY

SAMPLING AND RESPONSE ACTIONS

Legionella culture sampling and analysis at intervals not to exceed 90 days for the first year; and annually thereafter.

- Facilities that serve hematopoietic stem cell transplant or solid organ transplant patients shall be sampled at intervals not to exceeded 90 days.
- Additional sampling requirements may be required by the NYSDOH at any time if it is determined that one or more cases of Legionellosis are associated with the facility.

Legionella Sampling Results:

- Where ≥ 30% of the total number of sampling locations are positive (i.e., legionella bacteria is detected in the sample); immediately institute short-term control measures and notify the NYSDOH.
- Where results are at ≥ 30% positive on a persistent basis, conduct long-term control measures.

7.0 Recordkeeping

- Copies of the completed Environmental Assessment, Sampling and Management Plan, and any associated sampling results should be retained at the facilities premises for at least three (3) years.

Part 2
Corrective Actions and Remediation

- Premise plumbing includes that portion of the potable water distribution system associated with schools, hospitals, public and private housing, and other buildings.
- It is connected to the main distribution system via the service line.
- The quality of potable water in premise plumbing is not ensured or monitored by U.S. Environmental Protection Agency (EPA) regulation.

Control Technologies

- The EPA advises facility owners or operators to consult with the primacy agency and/or water supplier about applicability of such requirements to a premise plumbing system.

Temperature for Legionella Control

- Thermal control involves maintaining the temperature in hot and cold water systems outside of the range in which Legionella can ideally grow (between 35 and 46 degrees C or 95 to 115 degrees F).
- Although cold water systems are usually maintained at a temperature less than 20 degrees C (68 degrees F), the temperature can increase during periods of low flow or non-usage as well as during seasonal temperature fluctuations.

Temperature Control

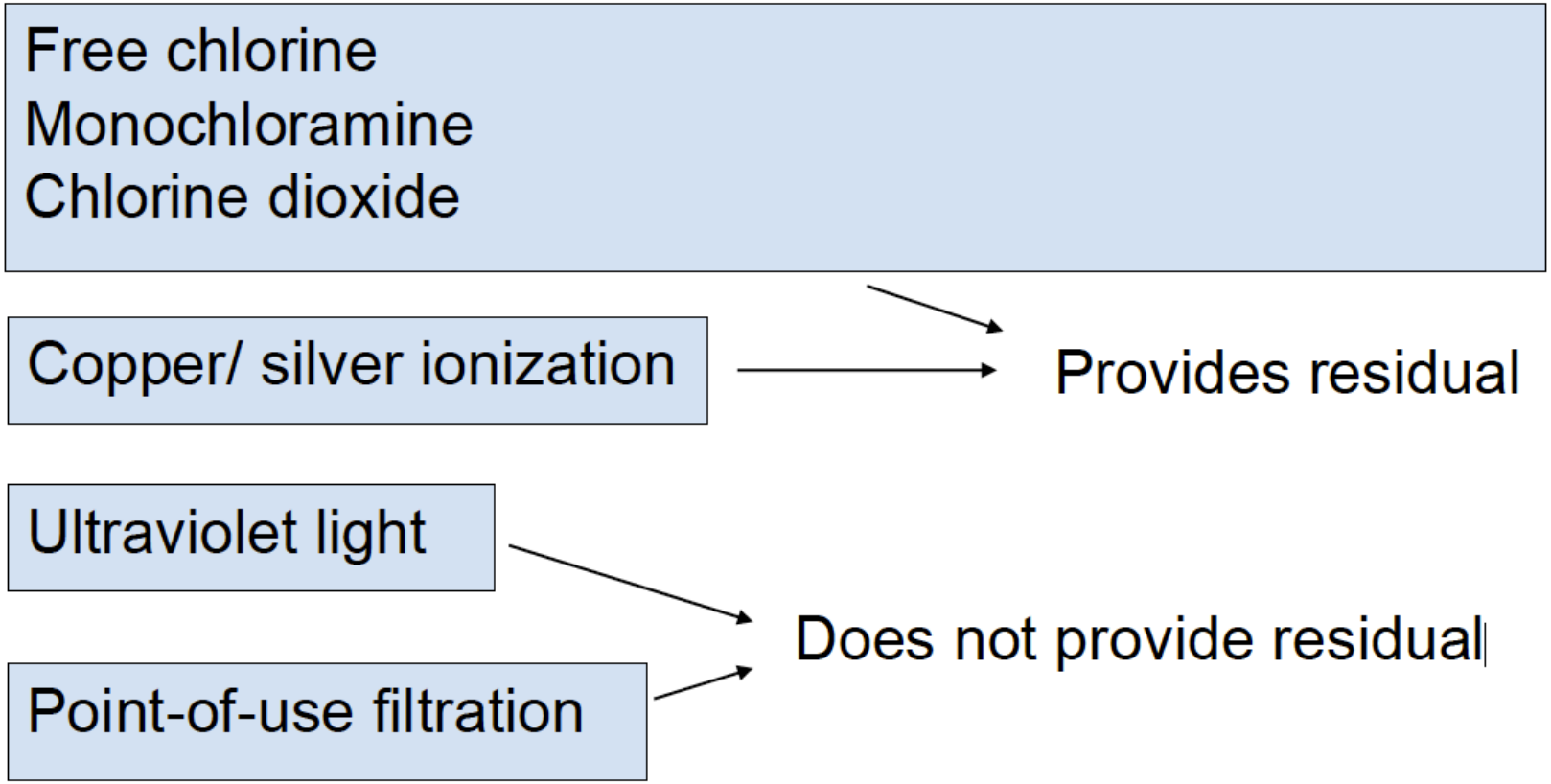
A number of entities suggest raising the hot water temperature to a certain level for effective control of Legionella growth. To inhibit Legionella growth in health care facilities, nursing homes and other high-risk premise plumbing systems, several reports suggest that the hot water temperature be at least greater than 50 degrees C (122 degrees F) at outlets Specific suggestions for hot water temperature control include the following:

- Bédard et al. (2016) reported that corrective measures were implemented to control L. pneumophila in the hot water system of a hospital. The corrective measures included increasing the hot water temperature from 55 degrees C (131 degrees F) to 60 degrees C (140 degrees F).
- Bédard et al. (2015) found that systems in which water temperature was maintained higher than 60 degrees C (140 degrees F) coming out of water heaters and greater than 55 degrees C (131 degrees F) throughout the hot water system were negative for L. pneumophila.

Shock Chlorination

- Periodic hyper-chlorination to create a minimum of 2 ppm free chlorine residual for not less than two (2) hours and no more than 24 hours. The target is to maintain a 0.5 ppm free chlorine residual at the most distant locations within the facility.
- Low level continuous chlorination to create a target concentration level of 0.5 ppm at the most distant locations.

Plumbing Treatment Options



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Free Chlorine

- Chlorine can be applied by facilities for routine treatment of both hot and cold domestic water; it can be applied to the cold and hot water tanks or to the entire distribution system. However, free chlorine degrades rapidly in hot water systems.
- For chlorine to be effective against microorganisms, it must be present in sufficient concentration, and must have adequate time to react.

Operational Control

Both laboratory and full-scale studies have been conducted to assess the effectiveness of chlorine against *Legionella*. These studies included a range of physical and chemical water conditions such as chlorine dose and residual levels, temperature and pH. Findings related to chlorine disinfection include the following:

- Relatively high doses of chlorine (2–6 mg/L) were needed for continuous control of *Legionella* in water systems.
- Chlorine was more effective at a higher temperature (43 ° C (109.4 ° F) compared to 25 ° C (77 ° F)), but it decayed faster at the higher temperature.
- Operations and maintenance practices for chlorine disinfection systems include maintenance of an appropriate disinfectant residual, regular system cleaning and flushing, inspections, and water quality monitoring.
- Routine flushing and water quality monitoring are recommended to assure that adequate disinfectant levels are maintained throughout the premise plumbing system

Chlorine Dioxide

Chlorine dioxide is a water-soluble gas that can easily diffuse through cell membranes of microorganisms. It has been found to be superior in penetrating biofilms as compared to chlorine.

Studies have shown that chlorine dioxide is an effective disinfectant (when used correctly) for inactivating certain bacterial pathogens (e.g., *E. coli*, *Salmonella*), viruses (e.g., poliovirus, coxsackie virus) and protozoan pathogens

Operational Control

- Dosage rate is an important design criterion for chlorine dioxide disinfection systems. Chlorine dioxide dosage rates of 0.4 to 0.7 mg/L were reported by systems experiencing successful treatment performance.
- Maintaining a total chlorine dioxide residual of 0.1–0.5 mg/L at the tap is usually sufficient to control *Legionella*, although higher residuals may be necessary in a heavily colonized system.
- Operation and maintenance practices for chlorine dioxide disinfection systems include maintenance of a disinfectant residual, regular system cleaning and flushing, inspections and water quality monitoring. Routine flushing and water quality monitoring are recommended to assure that adequate disinfectant levels are maintained throughout the premise plumbing system.

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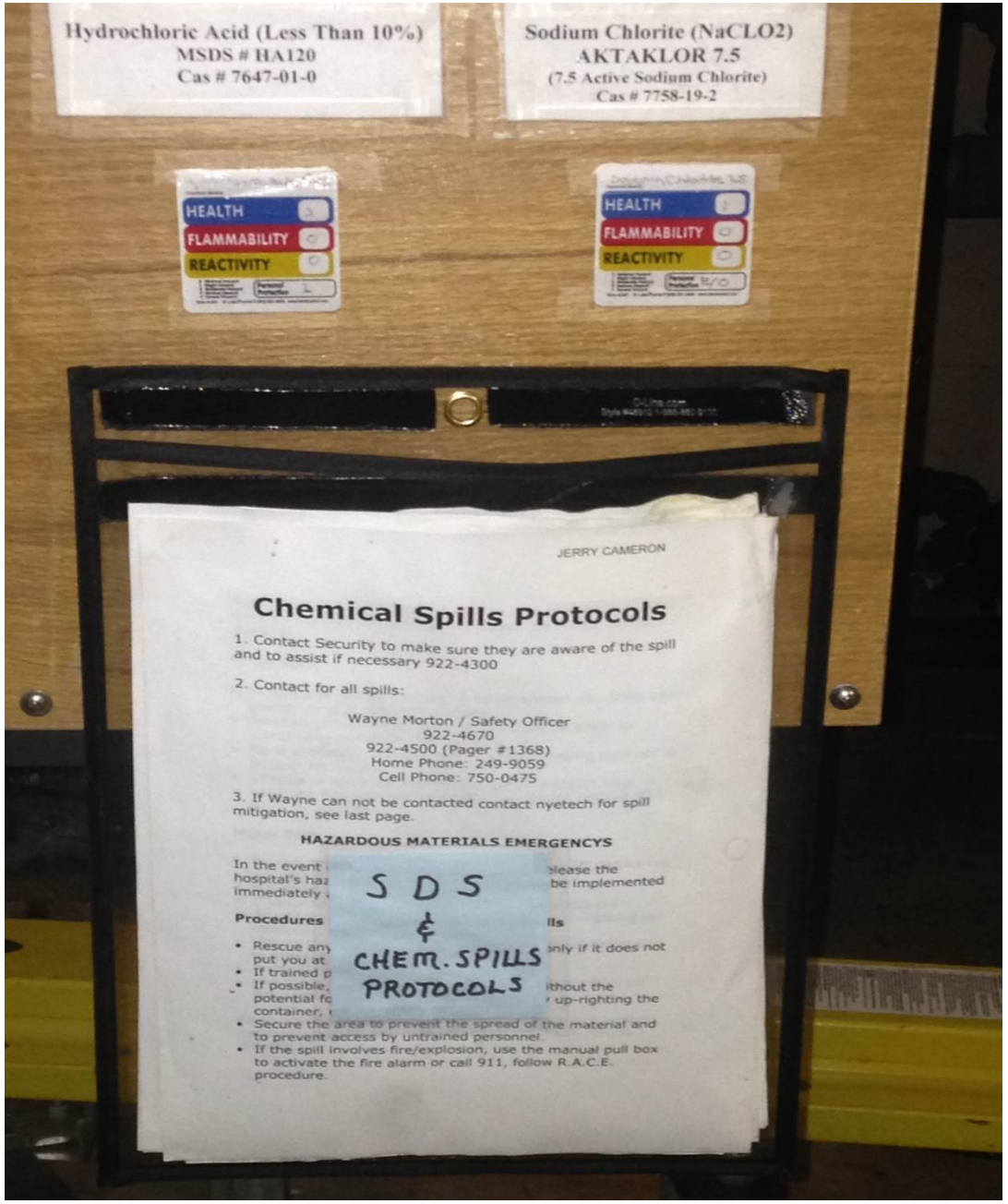

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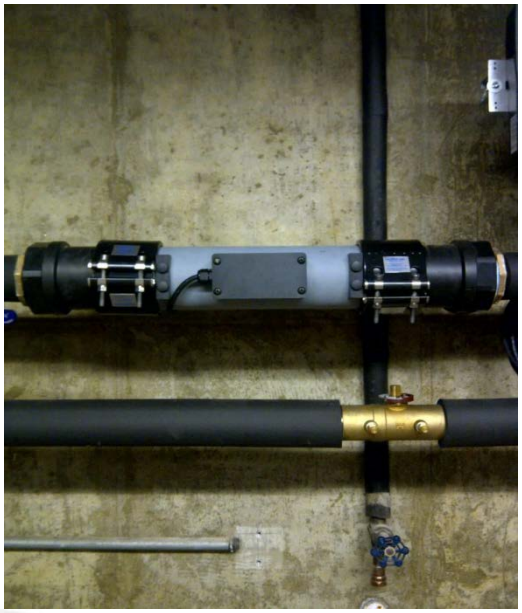
Copper Silver Ionization

- CSI systems typically consist of flow cells that contain metal bars or anodes (containing copper and silver metals) surrounding a central chamber through which piped water flows. A direct electric current is passed between these anodes, releasing the copper and silver ions into the water stream. The amount of ions released depends on the composition of the anode and is controlled by the electrical current applied to the bars and the water flow rate.
- The use of silver ionization for water disinfection was developed by the National Aeronautics and Space Administration (NASA) for Apollo spacecraft
- Dziewulski et al. (2015) demonstrated the efficacy of CSI for inactivating both *L. pneumophila* and *L. anisa* under alkaline water conditions (pH 8.7–9.9) in two health care facilities. After CSI treatment was established, culture positivity was reduced from 70 percent to <30 percent. The study suggests that silver ions played a major role in controlling legionellae, generally in the range of 0.01-0.08 mg/L.

Operational Controls

Maintaining copper and silver at the levels recommended by the manufacturer is a best practice in achieving operation effectiveness. Note that monitoring typically includes measurement of the total metal concentration, which includes copper and silver that are bound up as complexes, as well as copper and silver ions. The presence of copper and silver ions is thought to be critical for treatment effectiveness, so maintaining proper pH and avoiding interfering materials (e.g., phosphates, chlorides) is also important .



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Ultraviolet Light

UV disinfection is a well-established treatment technology for inactivating pathogens present in the environment. In the drinking water context, UV disinfection was initially most widely used in Europe, with hundreds of installations in place by 1985 (USEPA, 2006c). In North America, UV disinfection has been more widely employed in drinking water applications since 2000 to address health concerns associated with *Cryptosporidium*.

UV Light

There are several important lessons from installations of UV disinfection in hospital settings and UV installations in general:

••UV disinfection can be effective at controlling *Legionella* in facility piping. In the case of one new facility, a UV disinfection unit was installed on the incoming water supply, and none of the 930 cultures of hospital water were positive.

•UV is only effective at inactivating *Legionella* in the water that flows through the UV reactor. For existing facilities with *Legionella* present in the piping systems downstream of a UV reactor, supplemental controls such as thermal treatment or chemical disinfection will be necessary.

••UV reactors need to be maintained to remain effective. The quartz sleeves that house thereactors can be fouled by iron, manganese, calcium carbonate or other deposits that decrease UV output. Lamps and other reactor components also need to be replaced periodically in order to maintain treatment effectiveness. Fouling of the UV lamps was found to decrease effectiveness of the UV treatment. Liu et al. (1995) added filters to prevent scaling on UV lamps installed near the point of use in a hospital's cold and hot water systems. After treatment with superheat/flush and shock chlorination, and installation of filters to remove particles that foul the UV lamps, the UV intensity of the lamps remained at 100 percent throughout the experiment and the showers remained *Legionella*-free for a period of three months.

Operations Controls

Water quality data are needed to adequately characterize the water to be treated by a UV reactor and identify any pre-treatment or UV equipment design features that may be necessary.

•Temperature – Some reactor components may not be tolerant of water >35 degrees C (95degrees F). For this reason, the UV manufacturer should be consulted about the thermal tolerances of the equipment for installations on hot water plumbing.

•Turbidity – Excessive turbidity and certain dissolved species inhibit the effectiveness of UV disinfection.

••Disinfectant type and residual – Some reactor components may not be tolerant of certain disinfectants or high doses, so UV equipment manufacturers should be consulted about exposure of UV reactors to chemical disinfectants.

•UVT – Components in the water can absorb UV light and reduce the dose delivered to the microorganisms from the UV reactor.

••Iron and manganese – These constituents can foul quartz sleeves, leading to decreased UV output. Iron concentrations >0.1 mg/L may cause operational issues.

Point of Use Filtration

- POU filtration is defined as the use of a device applied to a single tap for the purpose of reducing contaminants in drinking water at that one tap. POU filtration can be used at specific taps, faucets and showerheads as a temporary measure to provide a physical barrier against *Legionella*.
- Maintenance of the filters is required and must be managed.

Summary of Potential Actions

1. There is no one-size-fits-all approach to addressing Legionella concerns in premise plumbing systems.
2. In some buildings, risks associated with premise plumbing (including Legionella) in large buildings may be addressed without additional treatment by implementing appropriate risk management approaches (CDC, 2016).
3. Facility owners or operators who are considering adding treatment to their building's premise plumbing system may wish to consult with their primacy agency for any specific requirements that may apply before they add any treatment.
4. Facility owners or operators may also wish to consult with their water supplier (i.e., public water system (PWS)) to better understand any potential water quality issues before making treatment-related decisions.
5. Avoiding dead ends and stagnation and optimizing thermal control of hot and cold water loops in the design of a premise plumbing system could help to mitigate growth of Legionella.
6. https://www.epa.gov/sites/production/files/2016-09/documents/legionella_document_master_september_2016_final.pdf

Questions

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