Water Management in Health Care Facilities

Complying with ASHRAE Standard 188

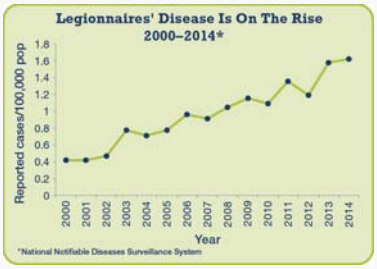
Presentation Objectives

- Review the impact of Legionella and other Water borne pathogens
- Understand the importance of a water management program
- Review the water system requirements of §482.42 and CMS CoP regarding Infection Control & Utility Management Standards
- Review the requirements of ASHRAE Standard 188
- Review the guidance in ASHE Water Management Monograph
- Reduce Water Bourne HAI's!

Legionellosis – How it Infects

- Legionellosis: respiratory disease that can cause death or serious harm to building occupants. Caused by exposure to Legionella.
- Per CDC: 8,000 to 18,000 hospitalized cases each year (10% fatality rate)
- Typically spread to humans when water that contains Legionella is aerosolized in respirable droplets

Impact of Legionellosis



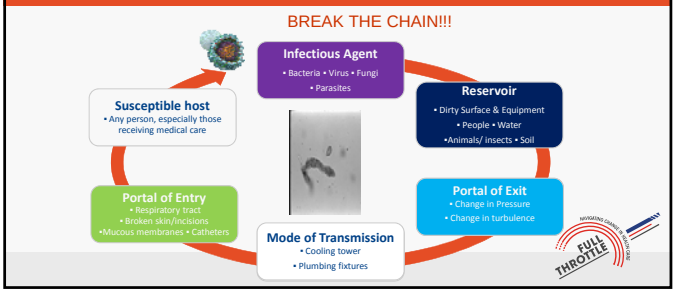
Where Legionella Grows:

- Water storage tanks
- Water heaters
- Water-hammer arrestors
- Water filters
- Aerators
- Faucet flow restrictors
- Showerheads/hoses
- Pipes/Valves/Fittings
- Infrequently used equipment
- Ice machines
- Cooling towers
- Medical devices

Other Waterborne Pathogens

- Escherichia coli (E. coli)
- Pseudomonas aeruginosa
- Klebsiella pneumonia
- Cronobacter
- Acinetobacter baumannii
- Klebsiella oxytoca
- Elizabethkingia anopheles

Chain of Infection



CMS CoP §482.42 & EC.01.01.01 EP 8

- **CMS CoP Requirement:**
  - The hospital must provide a sanitary environment to avoid sources and transmission of infections and communicable diseases. There must be an active program for the prevention, control, and investigation of infections and communicable diseases.
- **The hospital has a written plan for managing the following: Utility systems**
  - EC.04.01.01 EP 15 – Annual Evaluation

EC.02.05.01 EP 14

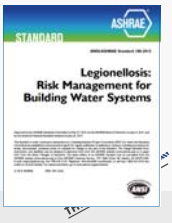
- **The hospital minimizes pathogenic biological agents in cooling towers, domestic hot- and cold-water systems, and other aerosolizing water systems.**
- **Issued in 2001**
- **Established to reduce organization-acquired illnesses (HAI's!)**

Utility Management Plan

- **Requirements**
  - Purpose
  - Scope
  - Authority
  - Risk Assessment
  - Design
  - Inventory
  - Inspection/Maintenance
  - Verification
  - Maps of System
  - Labeling
  - Disruptions
  - Shutdowns
  - Clinical Interventions
  - Responses
  - Data
  - Reports

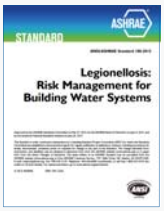
ASHRAE 188

- **Finalized and Published June 2015**
  - Section 1 - Purpose
    - Establish minimum legionellosis risk management requirements for building water systems
  - Section 2 - Scope
    - Human-occupied
      - Commercial
      - Institutional
      - Multiunit Residential
      - Industrial
- **To Date - Limited Adoption**



ASHRAE 188

- **ASHE worked with ASHRAE**
  - Align 188 with Utility Mgmt Requirements
  - Align 188 with Healthcare Operations
    - Risk Assessment Based
    - Risk Mitigation Process
    - Operational Management of Risk
    - Planned Remediation
- **Not 100% Successful**
  - Normative Annex A
  - Continuous Maintenance

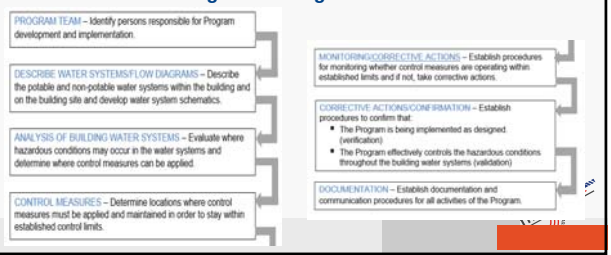


Water Management Plan Approach

- **ASHRAE Standard 188 establishes risk management requirements.**
- **Requires creation of a team that develops a water management program to identify and adequately manage the risk.**
- **BREAK THE CHAIN**

ASHRAE 188

- **Elements of Water Management Program**

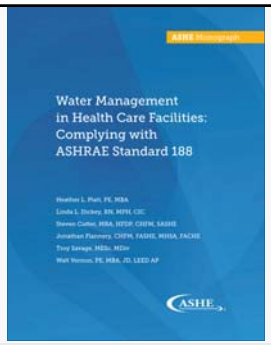


Hospital Action

- **In response to ASHRAE188, hospitals should:**
  - Establish a designated team
  - Develop a building water flow diagram
  - Identify at-risk populations
  - Identify the areas, equipment, and systems at risk
  - Develop strategies to mitigate the risks

Hospital Action (cont.)

- **In response to ASHRAE188, hospitals should:**
  - Assign responsibility to implement risk mitigation
  - Establish a program to monitor the strategy parameters
  - Develop actions to be taken when monitoring results are outside of established parameters
  - Document all activities
  - Periodically review the water management plan

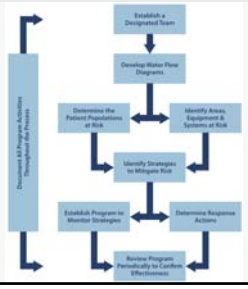


http://www.ashe.org/education/wsm/index.shtml

Purpose - Guidance

- **Monograph provides guidance and best practices for hospitals in developing and implementing water management plans**
  - Hospitals have unique resources and unique requirements
  - Hospitals may be pressured to take steps that are not required, unnecessarily costly or not helpful

Hospital Water Management Program



Create a Team

- **Designated Team consists of**
  - Hospital executive
  - Facility manager
  - Infection preventionist
  - Nursing management
  - Occupational and environmental safety management
  - Representatives from high risk areas
  - Others

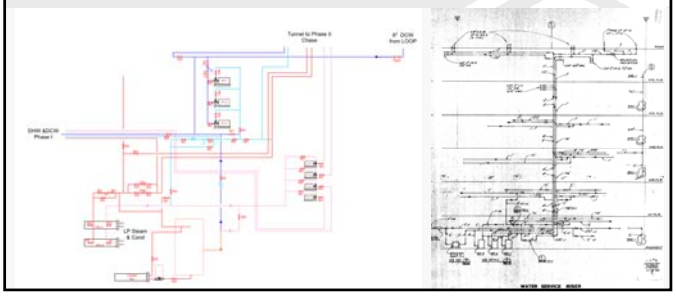
Team Purpose

- **Establish standard building water system procedures.**
- **Potentially seek support from:**
  - Engineer with waterborne pathogen experience
  - Infection preventionist
  - Water treatment specialist
  - Industrial hygienist

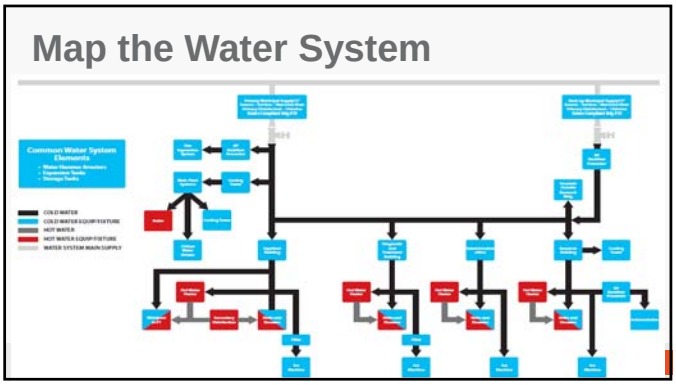
Map the Water System

- **Identify potential hazard conditions and high risk patient care locations**
- **Everyone on team must understand how water flows through building**
- **Keep updated map of water system**

Map the Water System



Map the Water System



Identify Risk Areas

- Systematically evaluate physical and chemical condition of each step in water system flow diagram (slow/stagnant water)
- Systematically identify areas housing populations with low immunity
- Estimate risk level
- Consider risk from water supply. If risky test and document disinfectant levels.

Control Locations and Control Limits

- Based on the water system map and risk assessment identify sensitive locations to control. (Control locations)
- At control locations, decide on any control measures to ensure the location stays within control limits.

Control Locations and Control Limits (cont.)

- Control measures could include: disinfectant, heating, cooling, filtering, flushing
- Develop monitoring procedures to monitor control measures

Example:

Ornamental Fountain


Ornamental Fountain

Risk mitigation strategy:
- Maintain a minimum chlorine level of 0.5 ppm to ensure no algae or slime build-up

Methodology
- Test water weekly to ensure chlorine level; add chlorine as appropriate
- Visual inspection for algae or slime
- Document results

Remediation actions
- Drain and clean fountain, refill and bring chlorine levels to 1.0 ppm

Complete the Plan

- Each action required by the management plan must be assigned to a responsible party
- Standardized maintenance protocols must be adequate and followed. Document everything
- Plan must indicate procedures to follow in case of elevated risk
  - Include contingency response plans for known or suspected cases of waterborne pathogens.
- Procedures for periodic review should be developed.

Complete the plan (cont.)

- **Include contingency response plans for known or suspected cases of waterborne pathogens.**
- **Procedures for periodic review should be developed.**

Standard Operating Procedures

- **Procedures for design and installation of utility systems**
  - If not done correctly new installations can create changes that spur pathogen growth.
- **Procedures for System Evaluation:**
  - Annual review of water risk management plan
  - Review and update water flow diagram
  - Review at-risk population areas
  - Review monitoring activities

Start-up and Shutdown

- **No-flow condition are opportunities for pathogen amplification.**
- **Written procedures outline steps taken whenever idled system placed in service**

Maintenance and Monitoring

- Maintain equipment: hot and cold water storage tanks, ice machines, water hammer arrestors, expansion tanks, water filters, shower heads and hoses, electronic faucets, aerators, faucet flow restrictors, non-steam aerosol-generating humidifiers, water heaters, etc..
- Change filters often.
- Document all maintenance activity.

Treatment

- Identify monitoring methods and temperature measurement for all water systems
- Schedule for disinfection
- Treatment methods should outbreak occur

Treatment Options	Summary	Procedure	Advantages	Disadvantages
Chlorine Dioxide Gas	Oxidizing biocide that kills by disruption of transport of nutrients across cell wall	Chlorine dioxide gas is dosed into the water and is activated by adding an acid	•Works at wide pH range. •Effective in removing biofilm and legionella. Prevents biofilm at low dose	•Decomposes rapidly. Monitor residual to maintain correct level •Heating water removes ClO2 therefore additional equipment necessary for heating system.
Thermal Eradication	Increase temperature of water system to kill legionella then flush system	Increase temp to 158° F then flush all water outlets for at least 45 minutes. Check distal outlets to assure at least 140° F achieved for at least 45 mins	•No special equipment so can be initiated expeditiously	•Disinfection is temporary •High risk of patient scalding
Hyper-chlorination	Oxidizing agent that can be used as disinfectant	Pulse into water to concentration of 20-50ppm. Drain and mix with incoming water to return to standard residual level	•Provides residual disinfection concentration throughout the water system.	•Corrosive so can lead to pipe, fitting damage. •Only suppresses not kills legionella •May form carcinogenic byproducts in water system.
Ultraviolet light sterilization	Disrupts DNA replication	UV lights installed at "point of use." Water flows through a hydraulic chamber where it is exposed to ultraviolet light.	•Easy installation •No harmful by-products produced	•No effect on biofilm formation •High O&M demands •No residual protection
Copper-silver ionization	Distort bacteria cell wall permeability leading to cell lysis. Copper ions remain within biofilms causing residual effect.	Deactivates bacteria and organisms in slow-running water. Layers on biofilm causing encapsulation effect. Electrolytically	•Easy installation and low upfront cost •Works at any temp •Kills Legionella including in biofilm	•Ion creation system must be cleaned regularly •Possible fluctuation in ion levels •Annual maintenance can be expensive.

Water Flow and Age

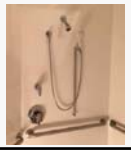
- Keep water age, the time it takes water to travel through system, low
- Avoid and plan to eliminate dead legs and dead ends
- Establish procedure to identify dormant lines and outline protocol for inspection and disinfection prior to being placed back in service

Temperature

- Legionella ideal growth temperature 77°F to 108°F. It can grow in water 68°F TO 122°F
- Hot water system above 122°F might have sections within the growth temp range
- Temperature and chemical residuals should be monitored
- Cold water systems should be kept cold enough to discourage pathogen growth

Drainage

- Shower heads that are not self-draining present location for pathogen growth
- Consider policy requiring self-draining shower heads
- Consider removing shower hooks that prevent handheld shower hoses from draining



Equipment Selection

- Equipment selection is an important factor in reducing waterborne pathogen risk
- Equipment that reduces flow rates should be chosen carefully
- Oversizing water pipes can also lead to low flow situations
- Consider biomedical equipment (e.g. dialysis or heart-lung machines) that use water
  - Ensure no standing water in equip

Cooling Towers

- Cooling towers aerosolize water
- pH and chlorine level should be tested regularly
- Need to regularly inspect and clean
- Need shut-down/start-up procedures

Water Features

- Fountains, water features, therapy pools and spas
- Develop policies and procedures for maintaining these
- Must operate and maintain per manufacturer requirements

Emergency

- Water must be in emergency plan
- Include potential reasons for loss of water, alternative sources (and duration) and when to consider evacuation
- Alternate means include: second water feed from different main, onsite storage, drinking water from bottled water, bathing with wipes, trucked water on contract, etc..

Document and Communicate

- Once plan is developed and implemented document everything
- Communicate to everyone affected by plan
- Document all actions and changes

ASHRAE 188

- Legionellosis Risk Management Plan
  - Purpose
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  - Designated Team
  - Risk Assessment
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  - Map of System
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Utility Management

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Summary

- **Environment of Care Impacts Clinical Outcomes**
- **Utility Management is Essential to the EOC**
- **ASHRAE 188 Fosters Management of Water Systems**
- **Normative Annex A Developed to Align with Current UM Requirements**

Questions?

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