Overview

ASHRAE Standard 188P

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- Purpose, Scope, Intended Use
- HACCP Principles
- Developing a Plan
- Documentation, Verification, Validation
- Where to start...
Legionella, a bacteria, causes a uniquely 20th century disease due to engineered water systems

Domestic water services (Heaters, Showers, Sinks)

Open cooling water systems

Pools and Spas
Ice Machines
Water Features
Conditions that increase risk of causing harm...

- Stagnation
- Protozoa
- Biofilms
- Deposits
- pH
- Temperature
- Biocides
- Pathogen Proliferation
- Function/Use
- Defects
- Wind
- Water Flow
- Aerosol Release
- Construction projects
- Pressure shocks
- Vacancies
- Dead-legs
- Water main breaks
- Risk of Causing Harm
- Susceptible Population
- Smokers
- Gender
- Age
- Immunocompromised
What is ASHRAE Standard 188P?

Prevention of Legionellosis Associated with Building Water Systems

- It is not a law regulated in the Code of Federal Regulations (CFR)
- It specifies an industry standard of care for managing and reducing the health related risk associated with *Legionella* in building water systems.
- It provides a model to assess risk based on “Hazard Analysis and Critical Control Point (HACCP)” plans.
- Many experts anticipate that where 188P is referenced in building codes, it may have the force of law.

The Joint Commission, EC 7.10

- Establish and maintain a utility systems management program to promote a safe, controlled and comfortable environment that... reduces the potential for hospital-acquired illness to be transmitted through the utility systems.
- Healthcare Facility identifies and implements processes to minimize pathogenic biological agents in cooling towers, domestic hot/cold water systems and aerosolizing water systems.
What is HACCP?

- Hazard Analysis Critical Control Points
- First developed in the 1960’s by the Pillsbury Company
- Response to NASA’s request for a preventative food safety system for astronauts
- A systematic approach for identification, evaluation and control of food safety hazards

- Intent is to apply control measures to prevent, eliminate or reduce significant hazards to an acceptable level
PURPOSE
“…to present practices for the prevention of legionellosis associated with building water systems.”

SCOPE
Applies to buildings other than single family that have or use engineered water systems. Primarily for centralized industrial/utility and commercial building water systems.

INTENDED USE
“…intended for use by those involved in the ownership, design, construction, installation, (including commissioning), management, operation, maintenance and servicing of centralized industrial and commercial building water systems.”

The standard provides a model for organizing and developing a risk reduction management plan for the control and prevention of legionellosis associated with engineered water systems.
When is a HACCP plan required?

...when any one of the following risk factors apply

- multiple housing units with one or more centralized water heaters,
- more than 10 stories high (including any levels that are below grade),
- inpatient healthcare facility,
- occupants are primarily those over the age of 65 years or those receiving chemotherapy for cancer or bone marrow transplantation,
- one or more whirlpools and/or spas either within it or located on its premises (i.e., adjacent to the building),
- one or more aerosol-generating water features or devices (e.g., ornamental fountains, direct evaporative coolers, misters (atomizers), air washers or humidifiers) either within it or located on its premises,
- total residual halogen concentration of the incoming potable water supply to the building is less than 0.5 mg/L (ppm) as Cl₂, or
- one or more cooling towers and/or evaporative condensers that provide cooling and/or refrigeration for the HVAC&R system.
7 HACCP Principles

Essentially three functions...

1. Identify all relevant building water systems that will require control measures
   - Complete water system inventory/flow diagrams
   - Assess potential hazard (biological, aerosols)
   - Define CP/CCP

2. Establish management and control goals for each water system CP/CCP
   - Monitoring procedures, goals and frequency
   - Performance standards and contingencies
   - Process for verification of control

3. Establish a process to validate the plan and make adjustments
(1) Form a HACCP Team

- The team should include up to ten members who will oversee the plan and make key decisions

- Appoint a team leader who will oversee the plan and ensure it is followed

HEALTHCARE
_Hosp., LTC, etc._

Team Members
- Facilities director
- Administrator
- Infection control
- Health & Safety
- Environmental Services
- Medical director
- Chief Engineer

INSTITUTIONAL
_Edu., Hotels, Casinos, etc._

Team Members
- Facilities director
- Health & Safety
- Housekeeping
- Maintenance & Engineering

INDUSTRIAL
_F&B, Pharma, Mfg., etc._

Team Members
- Plant manager
- Health & Safety
- Maintenance & Engineering

- Many others will be needed for implementation
(2) Water system inventory & flow diagrams

- Domestic services (potable)
  - Water heaters
  - Water storage
  - Points of Use (POU)
    - Sinks, showers, etc.
- Cooling towers
- Pools & Spas
- Decorative fountains
- Water filters
- Irrigation
- Plumbing & distribution
- Ice machines

- Cross-connections
- Fire protection
- Swamp coolers
- Drinking water fountains & coolers
- Other water using devices

Verify inventory and flow diagrams with a facility walk-through…

Notes  Photos  Water Temp  Chlorine
(3) Hazard analysis

- Hazard analysis examines the chemical, physical and biological hazards.

- The intent is to assess the biological hazard associated with *Legionella*.

- Chemical and physical hazards will be addressed by limitations of control practices.
  - The physical hazard associated with hot water is limited to a max temperature to prevent scalding
  - Chemical hazards such as when secondary disinfection (*e.g.*, ClO₂) is applied will be limited per EPA drinking water standards

- As an added benefit, control measures for *Legionella* will also reduce risk of most other biological hazards.

- Steps in the flow process outlined in the flow diagram is evaluated for…
  - Potential for growth
  - Potential for aerosol release & exposure
(4) Define Critical Control Points

Hazard Analysis
Use the process flow diagrams and walk through information (chlorine residual, water temperatures, noted dead-legs/stagnation/vacancies/construction, etc.) to determine…

• Control Points (CP), and
• Critical Control Points (CCP)

*Legionella* proliferation potential and water aerosol potential should also be used to help define CP and CCP.

Control Points
A hazard potential where aerosol risk, bacterial risk, or both may be significant is a CP.

Control points are notable potential hazard points that require monitoring and implementation of risk reduction strategies to reduce risk.

Critical Control Points
A hazard potential that presents a significant risk is considered a CCP and is assigned a number.

A CCP is an operational step in water flow process at which control can be applied and is essential to prevent or eliminate a hazard or reduce it to an acceptable level.

Critical control points require implementation of risk reduction strategies and methods for verification and validation.
## Example Hazard Analysis (Utility Water Systems)

<table>
<thead>
<tr>
<th>(1) Process Unit Operation</th>
<th>(2) Hazard Potential</th>
<th>(3) CP</th>
<th>(4) CCP</th>
<th>(5) Risk Reduction Strategy</th>
</tr>
</thead>
</table>
| **(E) Air Handling Units** Heating, Ventilation, Cooling | **Aerosol Risk** LOW  
Aerosol exposure risk is low if chill coil face velocities do not exceed design, and if air filters of proper efficiency for the application is installed and maintained properly. | LOW  
Bacterial proliferation is low for condensate pans that drain properly, and where no wet humidification is used. | **YES**  
**-------**  
**NO** | Maintain use of high efficiency air filters is necessary for the end use application.  
Maintain clean coils and condensate pans. |
| **(F) Chilled Water Loop & Chillers** Chilled water supply for AHU chill coils | **LOW**  
Closed point in the system. | **MODERATE**  
Bacterial proliferation risk is moderate when temperatures rise above 77°F or during stagnant periods. | **YES**  
**-------**  
**NO** | Perform required maintenance and water treatment for optimum performance. |
| **(G) Condensing Water Loop & Cooling Towers** Condensing water cooling loop for chillers | **HIGH**  
Aerosol risk is high for cooling towers, which by design produce aerosols. | **HIGH**  
Bacterial proliferation potential is high due to high potential for contaminants from the air and due to optimal operating water temperatures and pH that supports bacterial growth. | **YES**  
**-------**  
**YES** | **CCP1**  
* Maintain an effective biocide program to ensure biological control.  
* Clean and disinfect systems according to best practice protocols during start up, shutdown, commissioning, after idle periods and as needed during operation.  
Maintain mechanical (e.g. drift eliminators) and operational elements of the system through regular inspection and review to ensure limited aerosol release within design.  
Maintain a water treatment program for scale and corrosion control |
| **(H) Side Stream Device** Side stream filter device. Applies to CT#1 only | **LOW**  
Closed point in the system. | **HIGH**  
Bacterial proliferation risk is high in filter devices. | **YES**  
**-------**  
**NO** | Perform required maintenance (e.g., back-flushing) for optimum performance and to limit microbial growth. |
(5) Define Monitoring & Control Limits

... for the CP and CCP’s

CONTROL MEASURES
Control measures are evidence based industry best practices that have proven to be effective for reducing risk associated with Legionella.

MONITORING TASKS
Monitoring is necessary to verify the control measures work.

MONITORING FREQUENCY
Set a reasonable frequency for monitoring tasks. Reference industry guidelines.

CRITICAL LIMITS
Set critical control limits for each monitoring task. Establish goals to control within.

CONTINGENCY PLANS
Define corrective action when critical limits are not met.
In southern climates where systems operate year-round, off-line C&D may be necessary twice a year.

OSHA Tech. Manual. (OTM) - Sec. III: Chapter VII: Legionnaires’ Disease. “Cooling towers should be cleaned and disinfected at least twice a year. Normally this maintenance will be performed before initial start-up at the beginning of the cooling season and after shut-down in the fall. Systems with heavy biofouling or high levels of *Legionella* may require additional cleaning. Any system that has been out of service for an extended period should be cleaned and disinfected. New systems require cleaning and disinfecting because construction material residue can contribute to *Legionella* growth.”
(6) Documentation, Verification, Validation

**Documentation**
Defined requirements in the HACCP Plan

Methods may include:
- Building automation system
- Preventive maintenance work orders
- Housekeeping work orders
- Vendor reports
- Paper or electronic logs

**Verification**
Designate a responsible person to ensure that...
- control measures,
- monitoring, and
- corrective action

...is being carried out.

The responsible person must directly review the documentation and verify implementation.

**Validation**
The effectiveness of the HACCP plan must be validated.
- Is the plan being followed?
- Is the plan working as intended?
- Is there any new scientific evidence to validate selection of the CCP or control limits?
Validation Methods

Option A
Cite studies that demonstrate reduced prevalence of *Legionella* as a result of implementing similar control measures.

*This method is passive as it does not provide direct evidence of control based on testing specific to the system.*

Option B
Monitor cases of facility-acquired legionellosis.

*This method is essential for hospitals and LTC facilities.*

*This method is not feasible for most other facilities such as hotels, casinos, institutional facilities, manufacturing, etc.*

Option C
Test the water systems routinely for *Legionella* and evaluate effectiveness of the control measures based on criteria defined in the HACCP plan.

*This method provides direct evidence of control and can help facilities justify changing the CCP, the control limits, or the frequency of testing.*
Assess and develop a plan

Act and implement the plan

Hold team meetings to analyze, verify and validate

Adjust the plan based on…
- Verification and validation results
- New scientific findings
- New standards or guidelines

Start with a simple water system inventory
Nalco – Environmental Hygiene Services

Complete comprehensive service capabilities

HACCP Plan Consulting
- Comprehensive services
- Reduced self-directed options
- Multiple site programs

Cooling System Remediation
- Off-line clean & disinfect
- On-line clean & disinfect
- Acid cleaning methods

Legionella Culturing
- CDC ELITE certified lab
- Comprehensive capabilities
- Includes assistance with interpretation

Domestic Water Remediation
- Hyperchlorination of hot and cold water storage tanks
- Hyperchlorination of building water distribution systems
- Thermal disinfection of hot water systems
- Clean & disinfect ice machines
- Clean & disinfect decorative fountains

Domestic Water Secondary Disinfection Programs
- Continuous water disinfection
- Continuous disinfectant monitoring and verification technology
Question: How Can We Help?
Answer: With the Nalco Legionella Control Program

3 Year Arrangement:

- Hazard Assessment
- Management Plan
- Onsite Testing
- Quarterly Review Meetings
- Ongoing Verification and Validation