

ARCADIS Design & Consultance for matural and built assets



Legionella Continues to Make the News



Topic of Interest to Building Owners

ASHRAE Standard 188-2018

7.2.7 Location of Coding Tower Makeup Valve, The Program absonment shall include requences for the location of coding unver makeup valves and for immuning orden and regulations of non exist for the location, then the Program shall include requencemes for minimizing compliance with ASME/ANSI A112.1²³ for air gaps and for minimizing omplications with octas and equalitations black on the locations, selected by the owner of adiagnee, for backflow preventes.

Tampa Bay Times

for the second second

sing toerestry requiring owners to regularly circus, maintain, rest, nple and report results. If a cooling tower harbors Legionella growth, it is the reported to the health department, possibly requiring public tification.

Volug tweers came almost half of the recorded outbreaks and most internal-association cases of distance. Lowering, there is no englisty of there they are located or requirements for them to need the conditions that encourage Legisland Bayesth. A 2009 speed from the Matisaal kashenias of Science estimated the number of cases in the United States args from 5,2000 tr y2000 a yars. The first second for first generate of some in 2004. It trends hold, the number of cases couraring in Floridas up be chose to c_{0} for 0 gapon atmuly.

The benefits will outweigh the cost to building sensers if the final law sames that performationals performing the inspections, resting and poverment oversight are adequately trained by the American Industrial Sygteme Association (AIHA) and the National Europeanmental Health isociacion (NEHA). With robust implementation and effective oversight of the agencies, the bill could significantly improve public health for Worldans and towards.

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You May be the Eyes on the System

What I saw this morning...your work can impact building water quality

- · Galvanized piping and corrosion
- · Wrong sizing of components
- · Wrong placement of components
- Water off while repairs are made
- · Rotating equipment or valves
- · Non-potable systems connected within the building

You May be the Eyes on the System

Mark Inmann..

Installation effects components of the backflow preventer: Water Quality, Installation Environment, System Hydraulics

- These can impact Legionella growth or nutrients in the system

Ken Waite...

Caution considering thermal expansion and backflow prevention placement.

- Also consider hot/cold crossconnection or supplemental disinfection installed on hot water for Legionella control.

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Adam Risher...

The public utility faces challenges in implementing backflow prevention program.

- Same challenges for Legionella.
- Old complicated buildings and plumbing systems.
- Decorative water fountains and other non-potable system connections
- Public utility not always permitted to look inside buildings past the meter

Today's Topics

- · Current regulatory perspective
- Legionella and other waterborne pathogens
- · Water system risk assessment and testing approach
- · Water safety and management programs
- Legionella and construction

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MCLG

 Maximum Contaminant Level Goal



Public Water Systems Safe Drinking Water Act

			 No known or expected
Organism	MCLG	MCL	 No known or expected health risk
Cryptosporidium	0	TT	Non-enforceable
Giardia lamblia	0	TT	MCL
Heterotrophic Plate Count	n/a	TT	 Maximum Contaminant Level
Legionella	0	TT	
Total Coliforms	0	5.0%	 Highest level allowed using best available treatment technology
Turbidity	n/a	TT	TT
Viruses (enteric)	0	TT	
			 Treatment technology

 Process intended to reduce the level of contaminant

Legionella TT – No testing required to validate

Public Water Systems EPA Contaminant Candidate List CCL 4 – Final November 2016

- CCL 5 Closed December 2018
- Currently not subject to any proposed or promulgated NPDW regulations
- Known or anticipated to occur in public water systems
- May require future regulation under SDWA

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CCL4: 12 Microbial Contaminants, Including Legionella

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Building Water Systems Codes and Commissioning

IPC 2015, Section 610

- Disinfection Method
- AHJ
- AWWA C651/652
- IPC Method
- Confirmation Approach
 - Bacteriological examination that no contamination remains

Building Codes Do Not Address Legionella

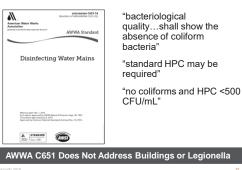
Disinfection Standards – AWWA C651





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Disinfection Standards – AWWA C651



IPC Definition of contamination

An impairment of the quality of the potable water that creates an actual hazard to the public health through poisoning or the spread of disease by sewage, industrial fluids or waste.



Healthcare Water Systems



Guidelines for Environmental Infection Control in Health-Care Facilities

Recommendations of CDC and the Healthcare Infection Control Practices Advisory Committee (HICPAC) U.S. Department of Health and Human Services Centers for Disease Control and Prevention (CDC) Atlanta, GA 30329

2003 Updated: July 2019

"Moist environments and aqueous solutions in healthcare setting have the potential to serve as reservoirs for waterborne microorganisms"

Local Regulations

Established

- New York City Cooling Towers
- · New York State Cooling Towers
- New York State Healthcare .
- Garland, TX Cooling Towers •
- · Veterans Admin Potable Water

Proposed

- Florida Cooling Towers
- New Jersey All water systems



Services News Geve

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Centers	for	Medicare	&	Medicaid
Services	5			

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SUBJECT	Requirement to Reduce Legisselle R Prevent Cases and Outbreaks of Legi	isk in Healthcare Facility Water Systems to remains" Disease (LD)	•	Specify

- ct a facility risk sment
- nent a water gement program
- y testing protocols, control measures, etc.

National Regulation to Address Legionella in Potable Water

Legionella and Legionnaires' disease

A Case of Legionnaires' Disease

Source: Public water supplies

Growth: Building (warm) water systems

- · Faucets, showers
- · Hot water tanks
- Decorative fountains
- · Pools, spas
- · Cooling tower

Not airborne, surfaces, condensation

Reservoir



A Case of Legionnaires' Disease

Legionella is not ubiquitous, ~50% of building water systems Lots of Legionella species and serogroups (>60) Legionella pneumophila serogroup 1 causes majority of infections





A Case of Legionnaires' Disease

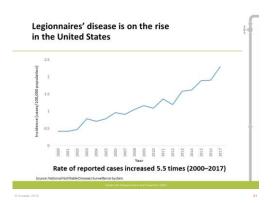
3 Routes: Aspiration, Aerosolization, Direct Installation

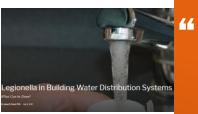


A Case of Legionnaires' Disease

Primarily: Elderly, Smokers, Immunocompromised







...mortality for Legionnaires' disease continues to be high – as high as 25 percent for cases acquired in the healthcare facility"

https://www.workingpressuremag.com/Legionella-inbuilding-water-distribution-systems/

Management of Legionella in Water Systems

mmittee on Management of Legione/Ia in Water Systems Water Science and Technology Board Board on Life Sciences Board on Repulation Health and Public Practice Derision on Earth and Life Studies Health and Medicine Division

A Consensus Study Report of The National Academies of SCIENCES • ENGINEERING • MEDICINE

> THE NATIONAL ACADEMIES PRESS WaitingAw, DC www.nap.edu



Other Opportunistic Waterborne Pathogens



Opportunistic Waterborne Pathogens

Legionella

Pseudomonas aeruginosa

Nontuberculous mycobacteria (NTM)

Acinetobacter

Burkholderia

Stenotrophomonas

Fungi Serratia marcescens

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	7900 Security Beakward, Mail Step (2-21-10 Beltimers, Maryland 21244-1050	CIVIS						
	Center for Clinical Standards and Qua	lity/Quality, Safety and Oversight Group						
	DATE: June 02, 2017	Ref: QSO-17-30- Hospitals/CAHs/NHs REVISED 07.06.2018						
	OBSERVE	195511641105						
		The Hospital Water Supply is a Source of Nosocomial Infections						
	A Plea for Action	A Place for Action						
	Alam), Analosis, MD; Scott R. Propal, Pharmitt M. Coul	In Physical, MD						
	Mortality from selected disea by water - United States, 200							
	J. W. Gargano, E. A. Adam, S. A. Colli							
	and M. J. Beach							
	Address Cardy & A Height of Epidemiology (2018), 3-9 de 2010/11/14-2010/00							
	Original Article	SHEA						
S		infection risks from water-related DC consultations, 2014—2017						

Source/Reservoir

Legionella Building Water Systems	Other Pathogens Building Water Systems
	Surfaces
	Soil, Dust, Debris
	Air
	Cleaning Solutions, Soap
	Medical Devices, Solutions
	Sink Drains, Sanitary
	Flowers, Fruits and Vegetables
	Infected Patients or Staff
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Transmission

Legionella Aspiration Inhalation / Aerosols

Other Pathogens Aspiration Inhalation / Aerosols Direct Contact Indirect Contact Environmental Contact

Infection Site

Legionella Lungs / Pneumonia

Other Pathogens

Lungs / Pneumonia Urinary Tract Soft Tissue / Eyes Burns Wounds Blood

Also: Growth Factors, Survival Outside of Water, Susceptibility to Disinfectants

Environmental Testing

Different sampling plans

Different culture media

Not the same as clinical medias

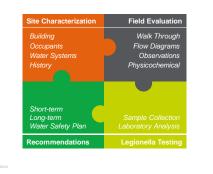
Different laboratory qualifications and methods



Risk Assessment and Water Safety Programs



Risk Assessment

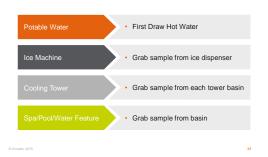


Sampling Plan for Risk Assessment





Sampling Approach for Risk Assessment



Other Sampling Plans



Evidenced Based Recommendations

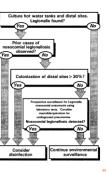
Data Analysis

- Physicochemical measurements
- Environmental testing results
- · Clinical data (testing or cases)

Outcomes

- · Water system adjustments
- Disinfection
- Water Safety Plan

Approaches to Prevention and Control of Legionella Infection in Allegheny County Health Care Facilities. 1997.



Water Safety and Management Program

ASHRAE Standard 188 First and only *Legionella* standard in the United States

Scope:

- Minimum Legionella risk management requirements
- Applies to human-occupied buildings (except single-family)
- Intended for use by owners and managers of buildings
- Includes design, construction, commissioning, operation, and repair of buildings



Legionellosis: Risk Management for Building Water Systems

Note that the second se





ASHRAE 188 – Water Safety Approach

Program Team	 Persons responsible for Program development and implementation
Flow Diagrams	Water system descriptions Water system schematics
Analysis	 Assess potential for Legionella growth and determine control locations
Control Measures	Determine control limits to manage potential for Legionella
Monitoring/Corrective Actions	 Establish monitoring procedures for controls Determine actions to take when outside limits
Confirmation	Verification: Is program being implemented Validation: Is <i>Legionella</i> being controlled
Documentation	Program documentation and communication

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ASHRAE 188 – Design & Commissioning

Design Compliance	Design address potentially hazardous conditions which could promote <i>Legionella</i> growth
Documentation	Final installation deliverables
Balancing	All water systems are balanced and reported
Commissioning	 Post-construction flushing and disinfection prior to beneficial occupancy

Legionella and Other Pathogens

Risk Assessment

- Assessment for other pathogens should be driven by infection prevention concerns
- · Water may not be the only source of other pathogens

Water Safety Plans

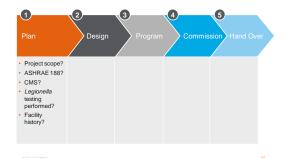
ASHRAE 188 written for Legionella

Legionella and Construction

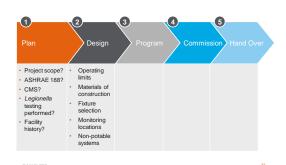
 Other pathogens may have different control measures, mitigation approaches, and validation methods

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Legionella and Construction





Design Stage

Materials

- Choices
- SS, copper, PVC, CPVC, PP-R, PE-X, PE-RT, DI, CI, rubber, epoxy...

Uses

Pipe, valves, equipment, gaskets, filters, coating...

Interactions

Disinfectants, water chemistry, dissimilar metals Fixtures

- Opportunity to promote bacteria growth
- Point of use filter compatibility
- Disinfection compatibility
- Splashing and surfaces

Design Stage

Monitoring Points

- Temperature
- Flow •
- Water quality
- Sample collection
- Flushing •
- Chemical injection

Non-Potable Systems

- . Backflow prevention
- · Proximity to occupants
- Extent of aerosolization
- Chemical treatment program
- Isolation of piping or basins

Legionella and Construction



Program Stage

Coordination with WSP Examples:

- Check/change filters, but not accessible
- Control limit monitoring, but no sample point
- Flush tank or basin, but insufficient drain point
- Maintain complete circulation, but off-line basin or pipe segment

Mitigation Approaches Examples:

- Thermal disinfection, but • mixing valves installed
- Chemical disinfection, but incompatible materials
- Install POU filter, but no adapters

Legionella and Construction



Commissioning – ASHRAE 188

Does say

Meet AWWA C651/652 or Local Regulation

Complete within 3 weeks prior to occupancy

If delayed occupancy flushing or re-disinfection

Confirm water system meets performance parameters for operation

Does not say...

Actual chioritant regularements Actual chioritant regularements I (CP Pumbing Code Sing) (Lor 24 hours I (CP Pumbing Code Sing) (Lor 24 hours I (CP Pumbing Code Sing) (Lor 24 hours ParPard chiorita checks and logging Extent of flushing and dsinfection Qualification regularements of company performing disinfection Is Legionaliti testing needed Spacies, concentration, extent, action limits Is Legionaliti testing needed Uho is responsible to perform testing? What it testing fails? How to maintain water systems after testing How to maintain water systems after testing Who is responsible for company flushing Who is responsible for coupany extends beyond three weeks

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Vol. 46, No. 5

Concerns with Commissioning

1. Standards not designed for building distribution systems or *Legionella* validation

Disinfection Standards – AWWA C651



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Concerns with Commissioning

- 1. Standards not designed for building distribution systems
- 2. Legionella is more resistant to chlorine than coliforms

APPLIED AND ENVIRONMENTAL MICROBIOLOGY, Nov. 1983, p. 1134-1139 099-224053/11134-06802.000 Copyright © 1983, American Society for Microbiology

Susceptibility of Legionella pneumophila to Chlorine in Tap Water JOIN N. KUCHTA,¹⁴ STANLEY, JSTRIS ANN M. KANARA¹ ROBERT M. WADOWSKY,¹ Der ROBERT & VIET Der Robert and State Finder State University Brancher (Branch State) (Enclosely): Galaxies, Finder, Franker (Branch State)

Legionella is more resistant to chlorine than other bacteria such as coliform bacteria.

- At 21°C and 0.1 mg/L free chlorine
- 99% kill Legionella pneumophila in 40 minutes
- 99% kill *E. coli* < 1.0 minute

Concerns with Commissioning

- 1. Standards not designed for building distribution systems
- 2. Legionella is more resistant to chlorine than coliforms
- 3. Assumption that if coliforms or HPC is controlled then no risk for *Legionella*



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Validation of Legionella Control





Goal: Prevent Disease

Regulatory

- · Some regulations, standards and guidelines exist
- · Need to do more to protect the public from Legionella

Other Opportunistic Pathogens

- · Other pathogens are associated with water
- · Primarily a healthcare concern
- · Consider risk approaches differently than Legionella



Goal: Prevent Disease

Risk Assessment and Water Safety

- Approaches existing to understand and manage risk
- Environmental testing for Legionella only way to determine risk
- No correlation between Legionella and other pathogens

Construction

- Address conditions favorable to Legionella growth
- · Legionella specific commissioning required
- Actively test building water systems prior to and after beneficial occupancy

Questions/Discussion



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Thank you!



FRANK SIDARI III, P.E., BCEE National Drinking Water Design Lead 215 931 4355 412 491 0961 frank.sidari@arcadis.com

Acknowledgement:

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