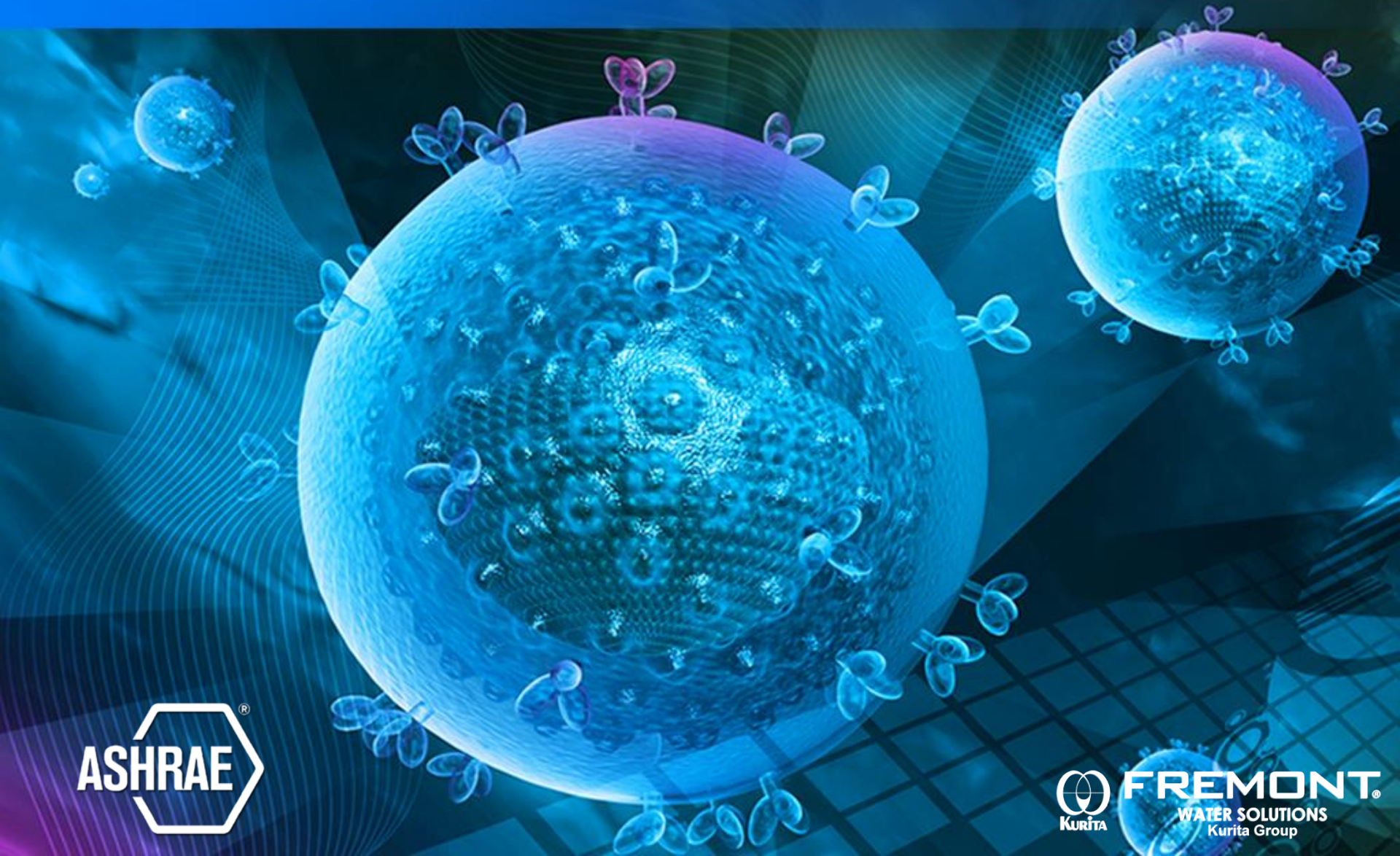
Managing Waterborne Pathogens & ASHRAE Standard 188



ASHRAE®

KURITA FREMONT® WATER SOLUTIONS Kurita Group

Agenda

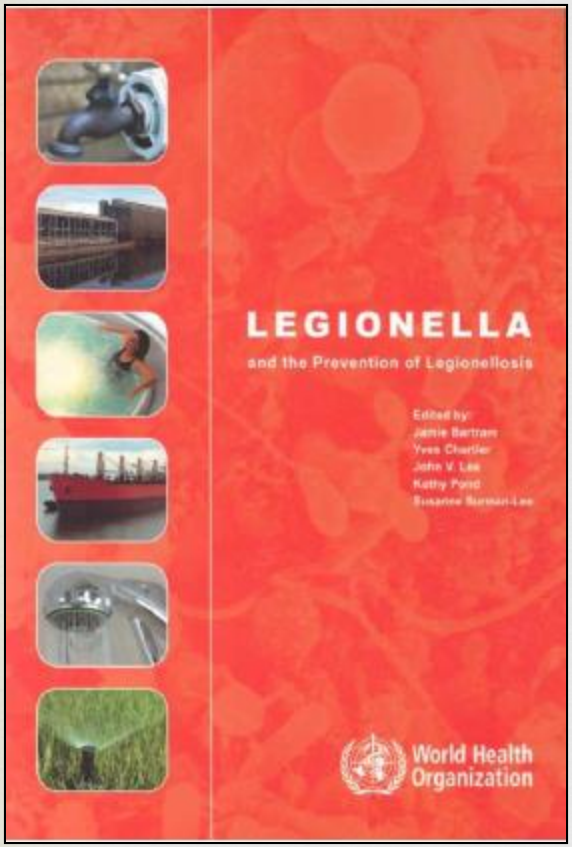
- Why ASHRAE Standard 188?
  - Legal aspects and industry trends
- Waterborne Pathogens
  - Legionella…hiding in plain sight
    - Understanding Legionella & Biofilm
    - Ice Machines, Ventilator-associated pneumonia (VAP), air conditioners/cooling towers, spas, fountains…
    - Plumbing Systems & dead-legs
- Water Treatment Pos/Cons
  - Mechanical
  - Chemical
- Meet the new Standard
  - Scope
  - Understanding the core elements
  - What does a Water Management Plan based on ASHRAE Standard 188 actually look like?

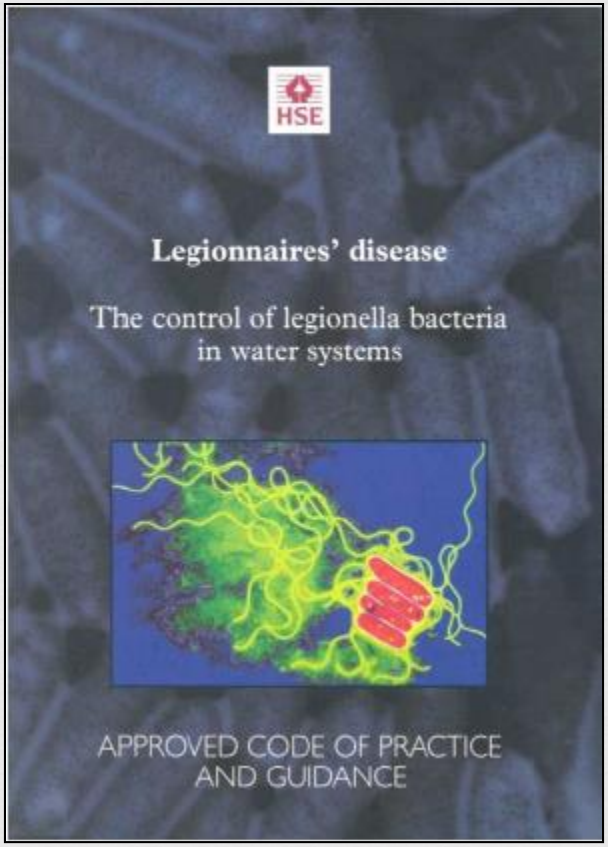
Why the New Standard?

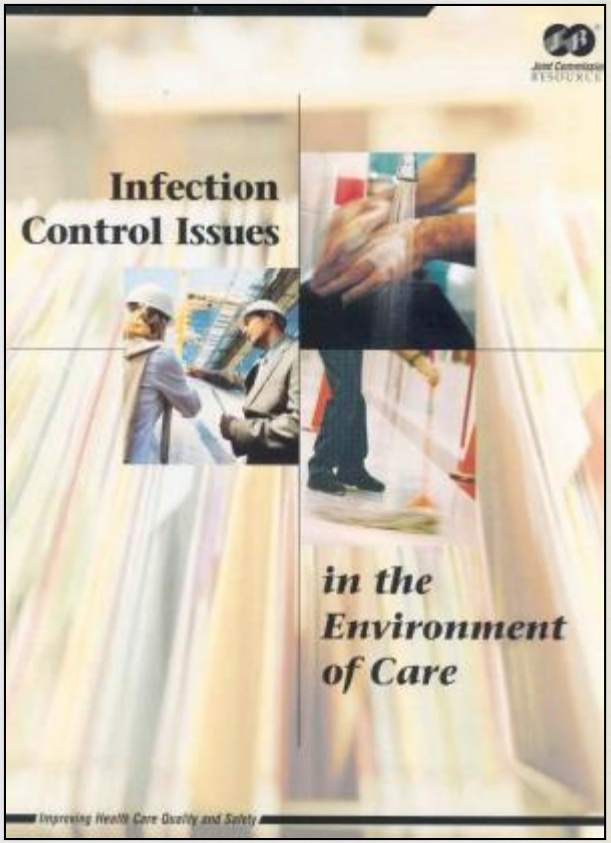
Quick Side-Bar

We Currently Have Lots of Guidance Documents, Why do We Need Another One?

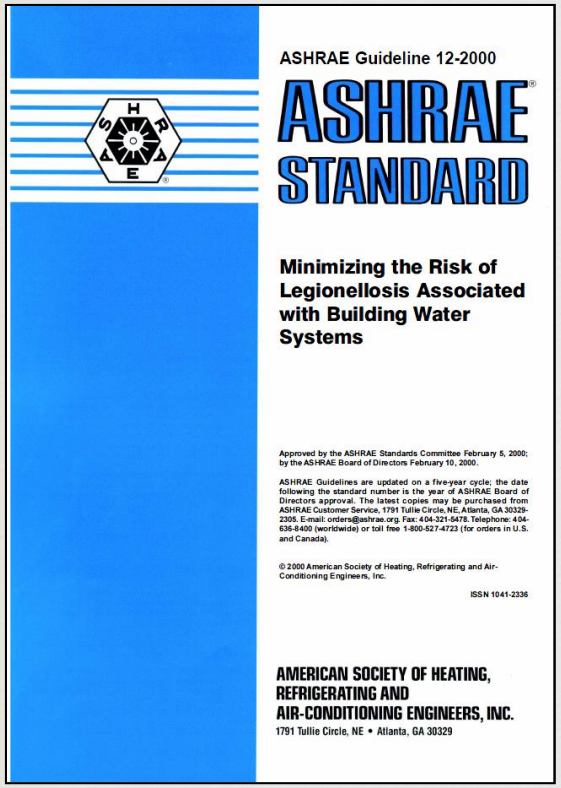
Lots of Legionella Guidance Documents







Lots of Legionella Guidance Documents



ASHRAE Guideline 12-2000

ASHRAE STANDARD

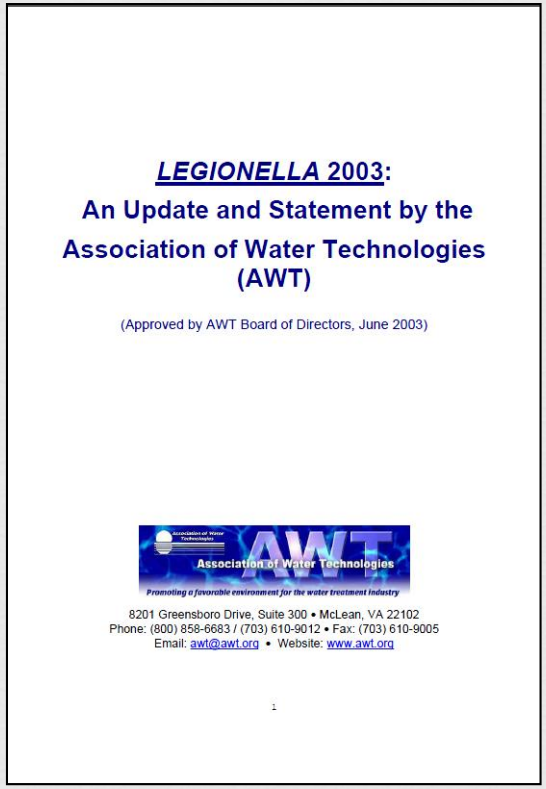
Minimizing the Risk of Legionellosis Associated with Building Water Systems

Approved by the ASHRAE Standards Committee February 5, 2000; by the ASHRAE Board of Directors February 10, 2000.

ASHRAE Guidelines are updated on a five-year cycle; the date following the standard number is the year of ASHRAE Board of Directors approval. The latest copies may be purchased from ASHRAE Customer Service, 1791 Tullie Circle, NE, Atlanta, GA 30329-2305. E-mail: orders@ashrae.org. Fax: 404-321-5478. Telephone: 404-636-8400 (worldwide) or toll free 1-800-527-4723 (for orders in U.S. and Canada).

ISSN 1041-2336

AMERICAN SOCIETY OF HEATING, REFRIGERATING AND AIR-CONDITIONING ENGINEERS, INC.
1791 Tullie Circle, NE • Atlanta, GA 30329

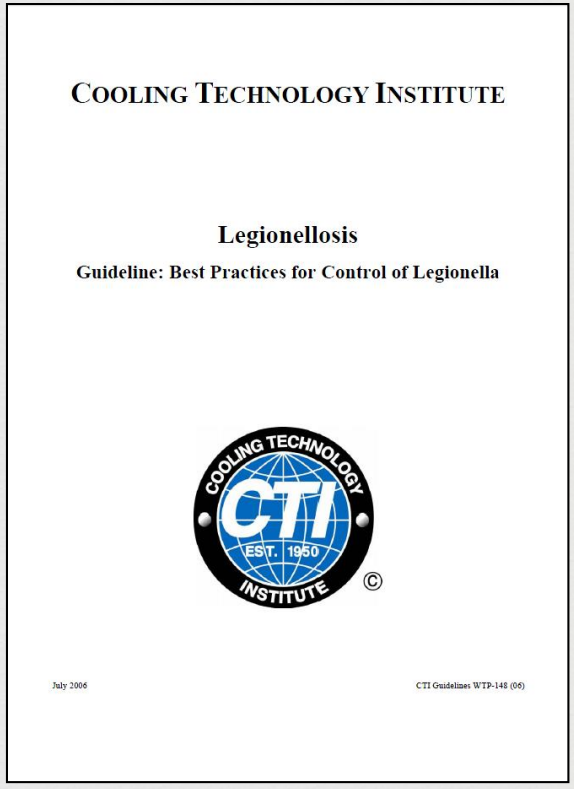


***LEGIONELLA* 2003:**

An Update and Statement by the Association of Water Technologies (AWT)

(Approved by AWT Board of Directors, June 2003)

8201 Greensboro Drive, Suite 300 • McLean, VA 22102
Phone: (800) 858-6683 / (703) 610-9012 • Fax: (703) 610-9005
Email: awt@awt.org • Website: www.awt.org



COOLING TECHNOLOGY INSTITUTE

Legionellosis

Guideline: Best Practices for Control of Legionella

July 2006

CTI Guidelines WTP-148 (06)

The Law 40 Years Later

To date, there has been little uniformity in what actions, if any, designers, owners and facility managers should take to guard against the waterborne bacteria that cause Legionnaires' disease

Saul Ewing LLP

Courts Do Not Look At Current Guidelines as Setting Industry Standards

"The Lack of Uniformity Contributes to Healthcare Exposure to Legal Liability When Illness or Death Occurs from Legionnaires' Disease"

Saul Ewing LLP

Industry Trend – a Policy of Avoidance

Most wait to address the problem until after a case or cases of Legionnaires' disease are diagnosed

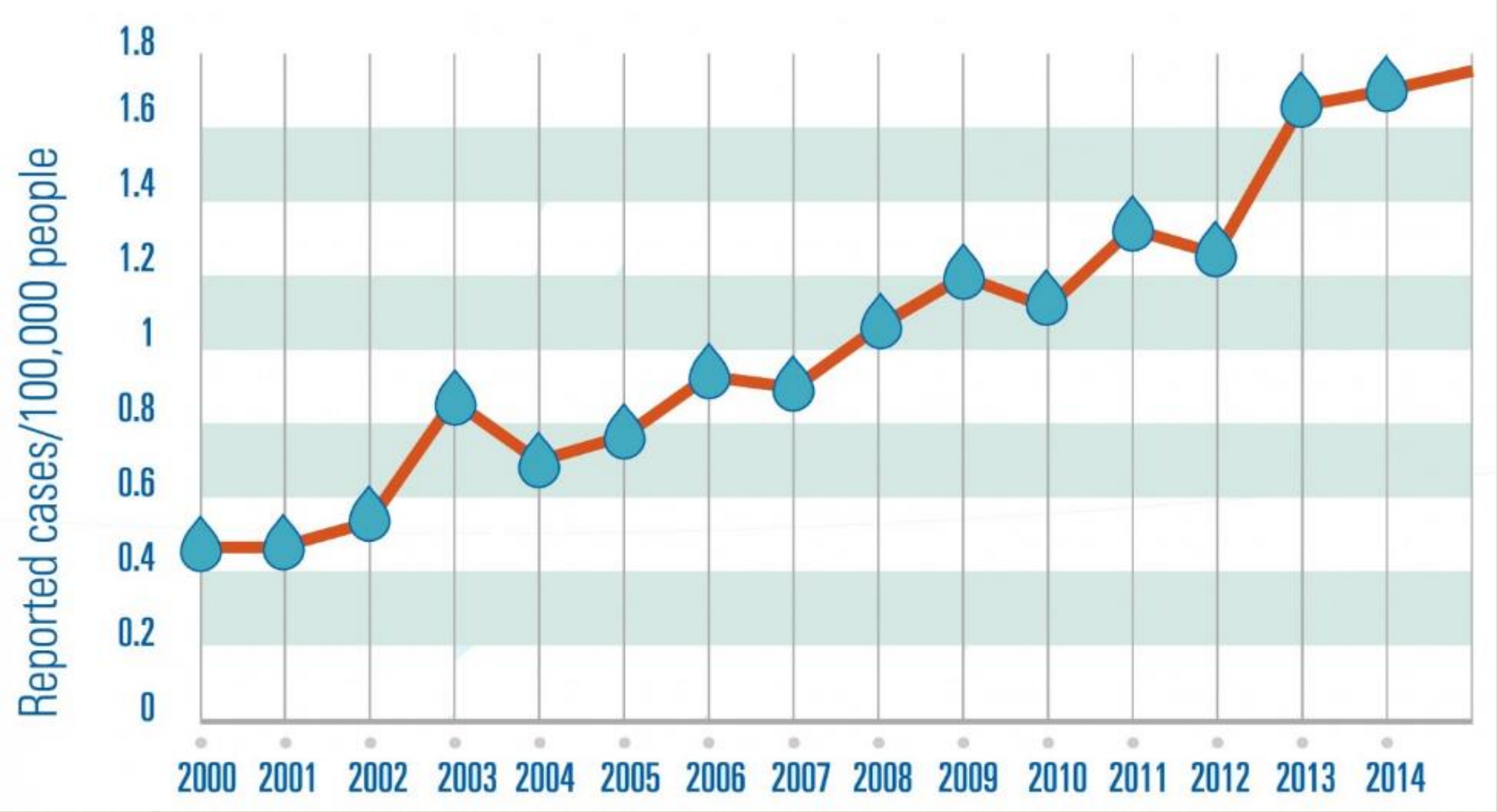
Legionnaires' Outbreaks Preventable with Water Management Programs

"The most important finding from the CDC's Morbidity and Mortality Weekly Report is that the vast majority of outbreaks could have been prevented if facility staff had implemented a water management program, as suggested by Standard 188-2015."

NOVEMBER 2016 ashrae.org ASHRAE JOURNAL

Legionnaires' outbreaks: Cases nearly quadrupled in 15 years

The Washington Post



When Do We Test for Legionella & When do we Develop A Plan to Control Legionella

Infection Control & Clinical Quality

Pittsburgh prison knew about contaminated water months before medical director died from Legionnaires'

Written by Brian Zimmerman | November 21, 2016 | Print | Email

On Aug. 9, Joseph Mollura, MD, the 60-year-old medical director for State Correctional Institution – Pittsburgh, died from complications related to pneumonia. The condition was likely spurred by a *Legionella* bacterial infection. Three months prior to Dr. Mollura's death, the bacteria was detected in one of the prison's cooling towers. Employees weren't notified about the contamination issue until Sept. 1, according to a report *Trib Live*.

New York Ordering Tests of Water-Cooling Towers Amid Legionnaires' Outbreak

By WINNIE HU and NOAH REMNICKAUG. 6, 2015

Mayor Bill de Blasio announced on Thursday that building owners will be required to assess and clean water-cooling towers. Bryan R. Smith for The New York Times

NYC Death Toll in Legionnaires' Outbreak Rises...

Death Toll in Legionnaires' Outbreak Rises to 12 [with 124 cases] as 2 More Buildings Test Positive for Bacteria

Legionella Outbreak NYC

- "The city has an opportunity to be a leader in the country with coming up with a strong regulation that could help people from becoming sick and dying," said Patrick Racine, a member of a committee for legionellosis risk-management with the American Society of Heating, Refrigerating and Air-Conditioning Engineers. "Sometimes it takes events like this to get people to jump into action."
- At the news conference on Tuesday, Mr. de Blasio said the city planned to tighten regulation of the towers, but in recent days, community leaders, neighborhood residents and industry experts have faulted the city for failing to have a more rigorous inspection regime in place.

Question & Answer

- Why with all the guidance and Standards documents, we still do not have control of Legionella?
- What impact may the NYC outbreak have on ASHRAE Standard 188 nationally?
- What relevance might this have for Industry?
- How is the public reacting to Legionella outbreaks?

legionella lawyers

All News Images Shopping Maps More Settings Tools

About 37,200 results (0.45 seconds)

Legionella Attorneys - MHH Law - Contact Us For A Consultation

Ad www.legionnaire**attorney**.com/consultation

If You're Affected by **Legionnaires**' Disease You May Be Entitled to Compensation!

Legionnaires' Disease Contact Us

FAQs

Legionnaires Lawsuit? - You May Be Entitled to Compensation

Ad www.the**legionnaireslawyer**.com/ (866) 508-5373

Talk To An Experienced **Lawyer** Today

Memphis La Quinta Inn · Legal FAQs · Get a Free Consultation · Elderly Legionnaires Case

Legionnaires' disease? - We represent victims nationally

Ad www.legionnaire**lawyer**.com/ (215) 395-1083

Call now for your free consultation

Jules Zacher, Attorney · Call for a consultation

SE Valley Law Firm - wgandf-law.com

Ad www.wgandf-law.com/

Attorneys, Advocates, Litigators Offices in Gilbert & Queen Creek.

Types: Family Law, Bankruptcy, Criminal Defense

Need to file bankruptcy? · Need a divorce? · Child custody issues?

How is the Public Reacting to Legionnaires Disease

How is the Public Reacting to Legionnaires Disease

Nov 30 2016

Cooling tower confirmed as one source of Ohio outbreak

Case Overviews, Reported and Suspected Outbreaks

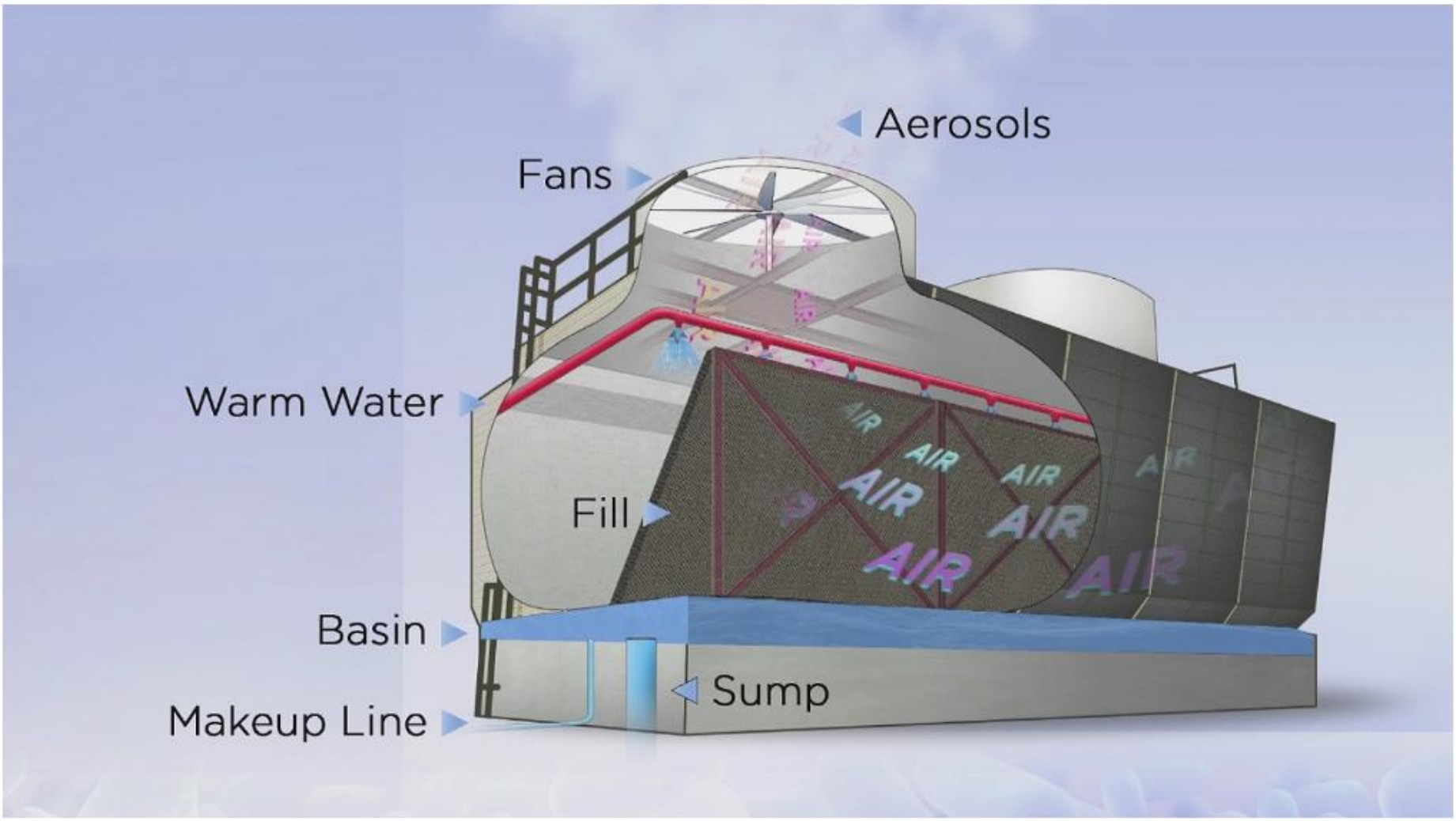
Nov 18 2016

One dead and 10 more ill with Legionnaires' disease in Lake County, Ohio

Reported and Suspected Outbreaks

Cooling Towers and Pathogens

- **Question**: Where do they come from?
  - **Answer**: Air pulled into the tower and makeup water
- **Question**: Do all cooling towers have pathogens?
  - **Answer**: Inevitably yes
- **Question**: Do all cooling towers have Legionella pneumophila?
  - Answer: No



Cooling towers, which are often part of the air conditioning systems of large buildings, are a common source of Legionella exposure in outbreaks. Cooling towers need to be properly maintained in order to prevent Legionnaires' disease. (CDC)

Cooling tower Evaporation can travel miles

Cooling towers could be evolutionary hotspots for new respiratory diseases" according to Texas A&M microbiologist Jeffrey Cirillo.

According to Dr. Cirillo and other researchers, "Many species of bacteria, including those that cause legionnaires' disease, are thought to have evolved in association with an amoebic host. Now it seems that the warm, wet conditions found in cooling towers make them a perfect spot for amoebas and bacteria to thrive, increasing the chances of new strains of pathogenic bacteria emerging."

Common Waterborne Pathogens

Cryptosporidium - parasite
Escherichia coli - bacteria
Giardia lamblia - parasite
Hepatitis A - virus
Pseudomonas aeruginosa - bacteria
Stenotrophomonas maltophilia - bacteria
Acinetobacter - species
Legionella pneumophila - bacteria

Legionella Bacteria

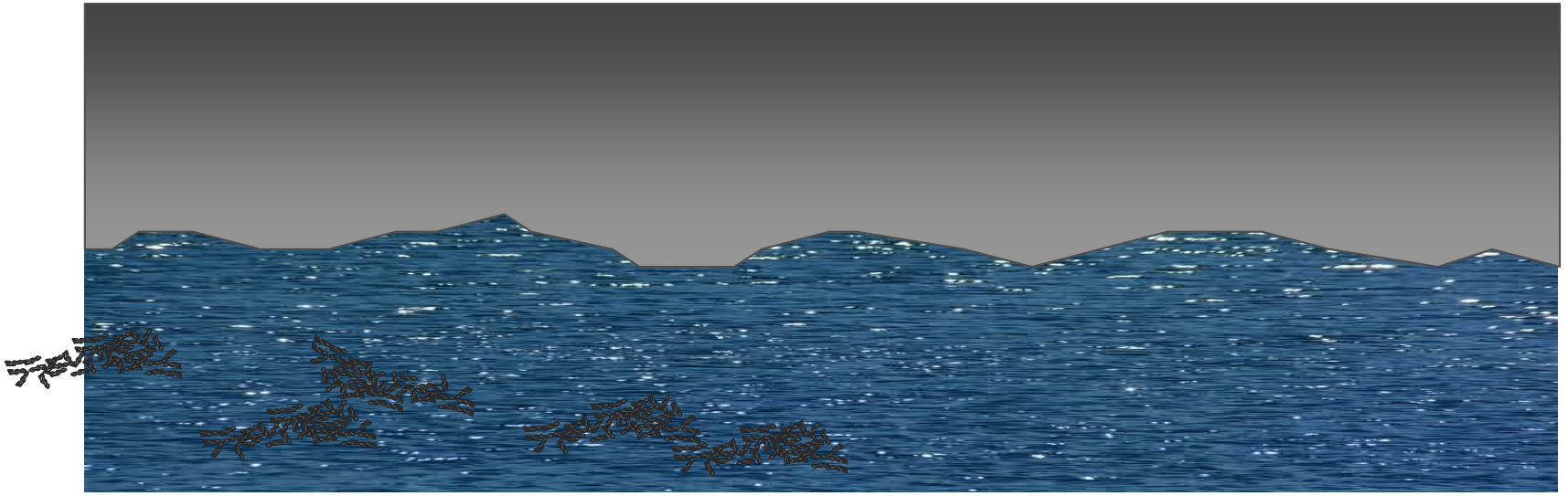
Legionella pneumophila
Family Legionellaceae

Gram-negative, non-spore-forming aerobic bacillus

Legionella – Hiding in Plain Sight

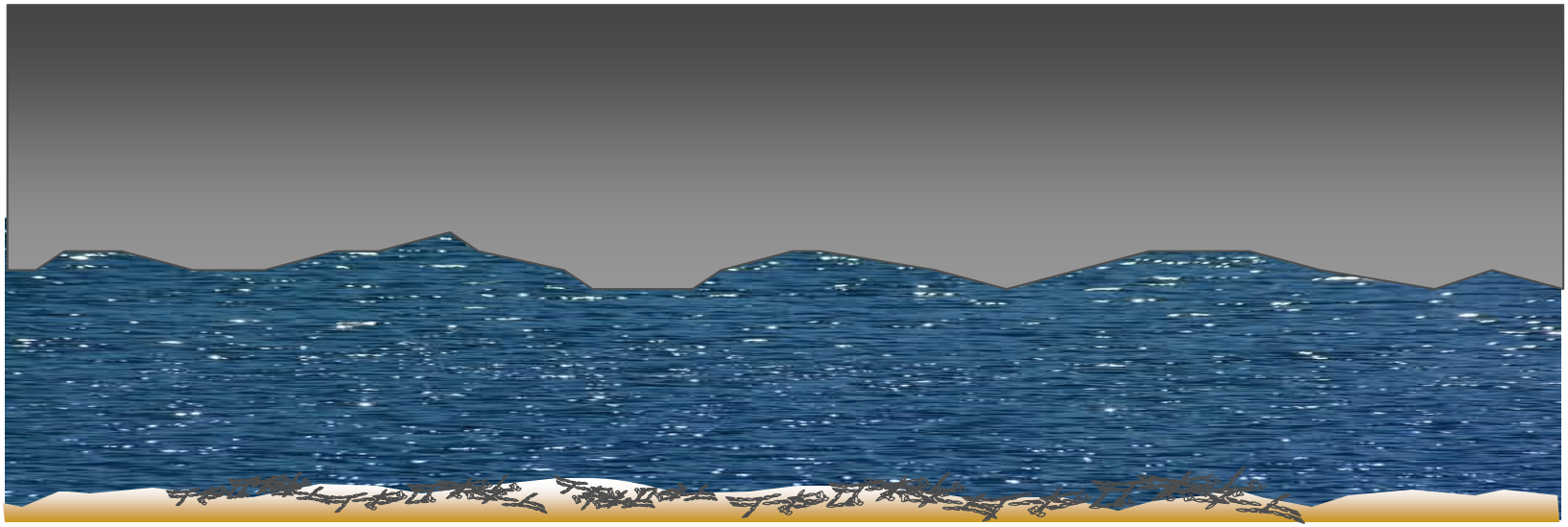
New cooling tower and potable water system clean piping

Stage 1- Biofilm forming bacteria enters domestic water system



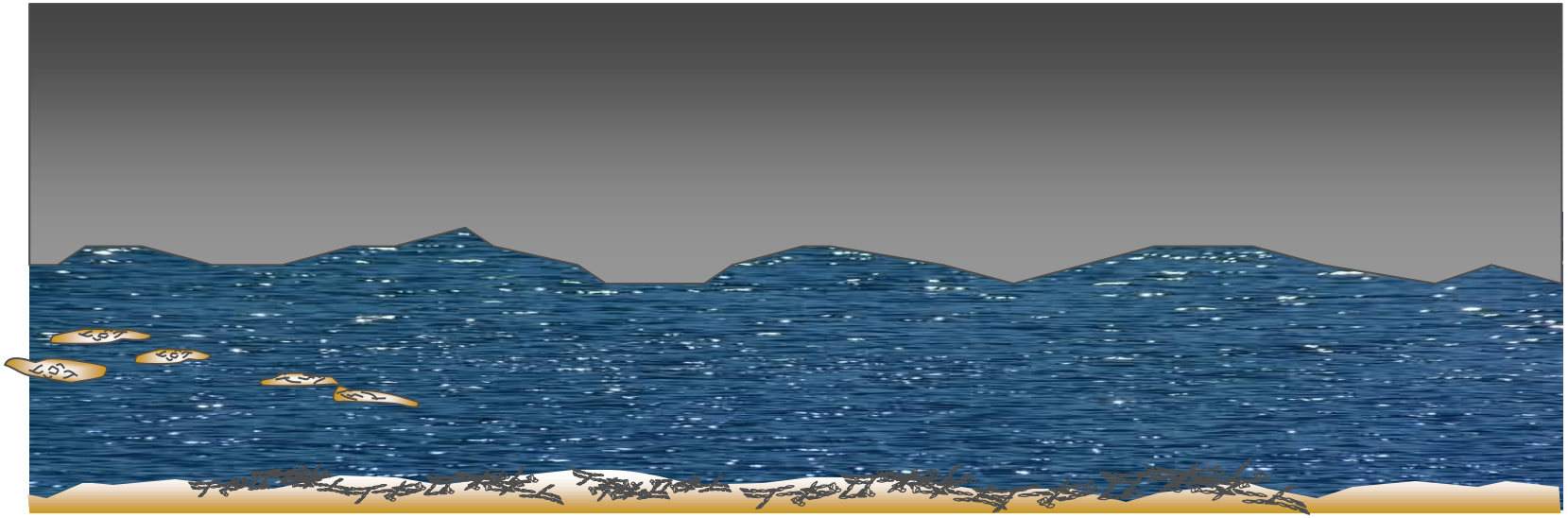
Example, Pseudomonas aeruginosa (slime former), a very common and highly opportunistic pathogen

Stage 2- Bacteria creates active biofilm

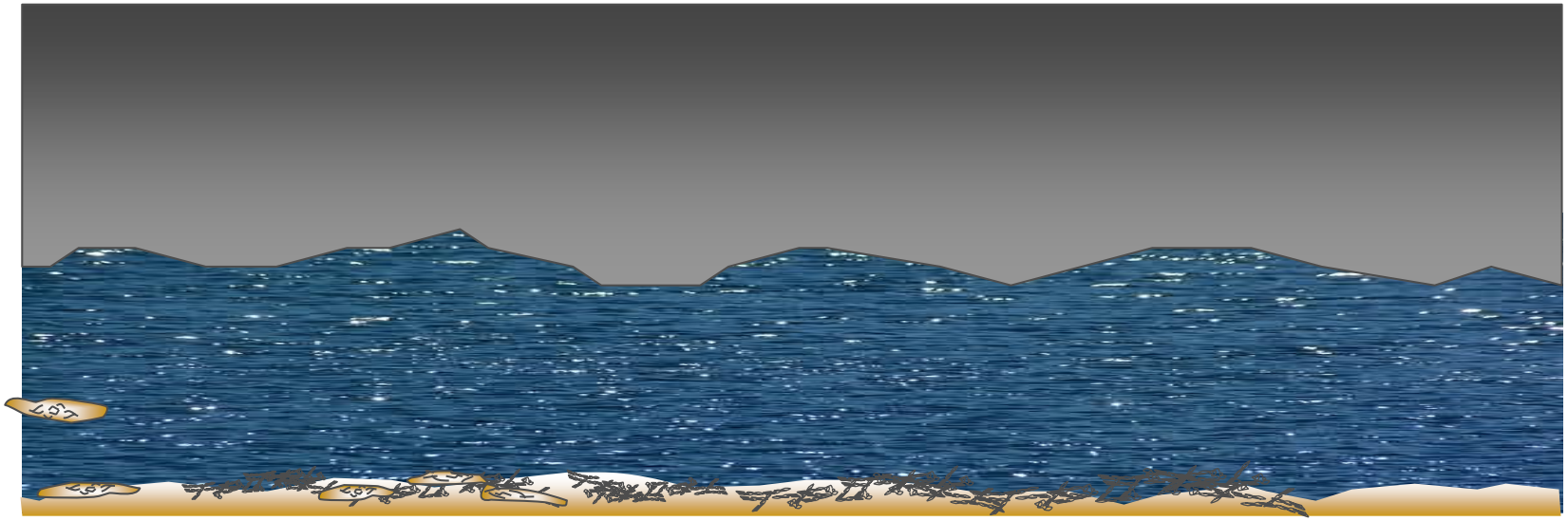


- Ability to create monolayer biofilm in 15 minutes
- A functional population of $5x10^8$ colonies in 4 days
- The biofilm matrix is 15% cells and 85% polysaccharide

Stage 3- Legionella enters system with protozoan host

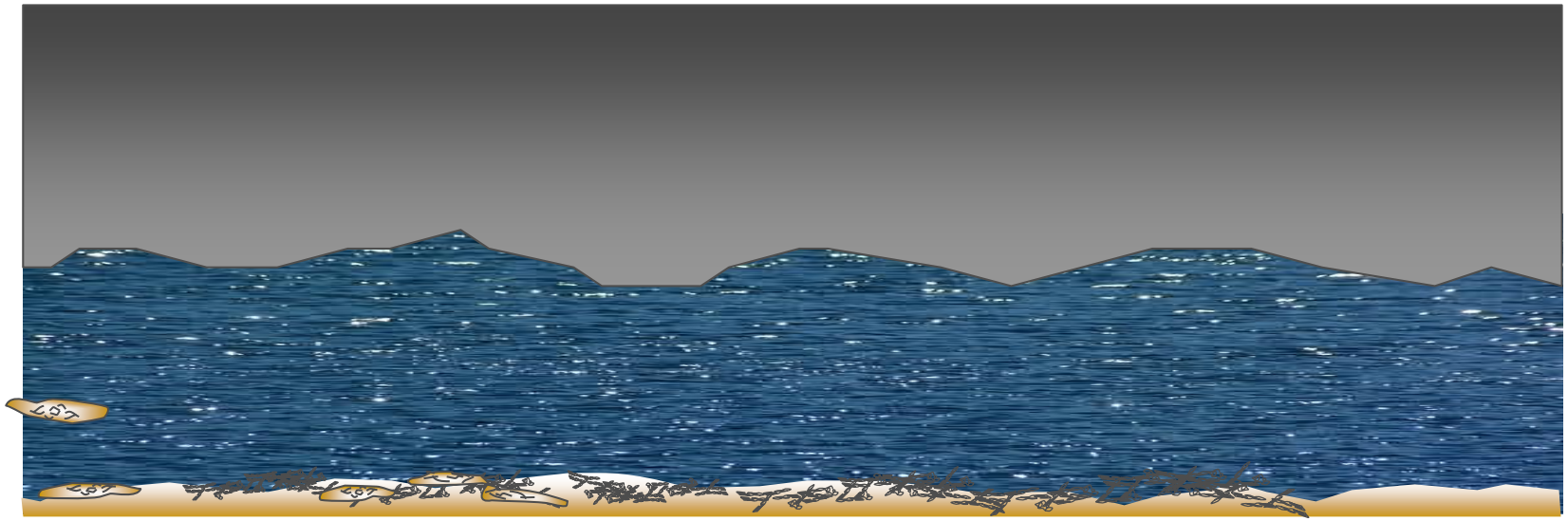


Stage 4- Active biofilm becomes habitat for protozoan & Legionella



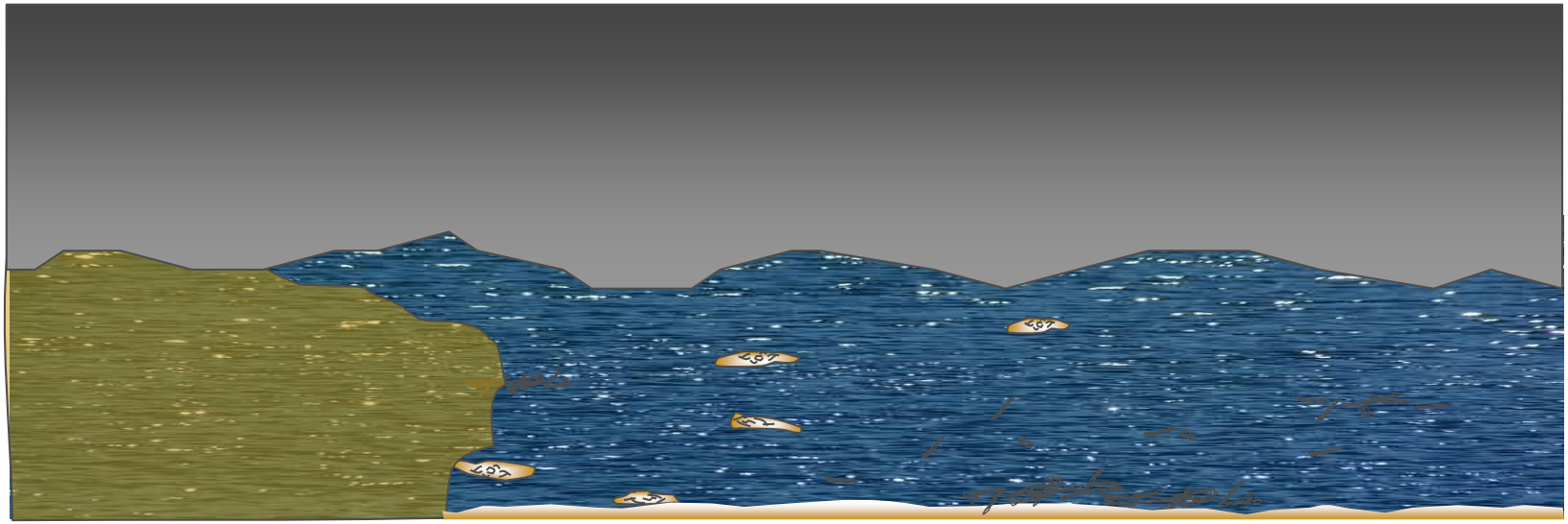
Legionella and Protozoan host flourish in and are protected by biofilm matrix from external factors.

Stage 5- Initial attempts at controlling Legionella: Hyperchlorination



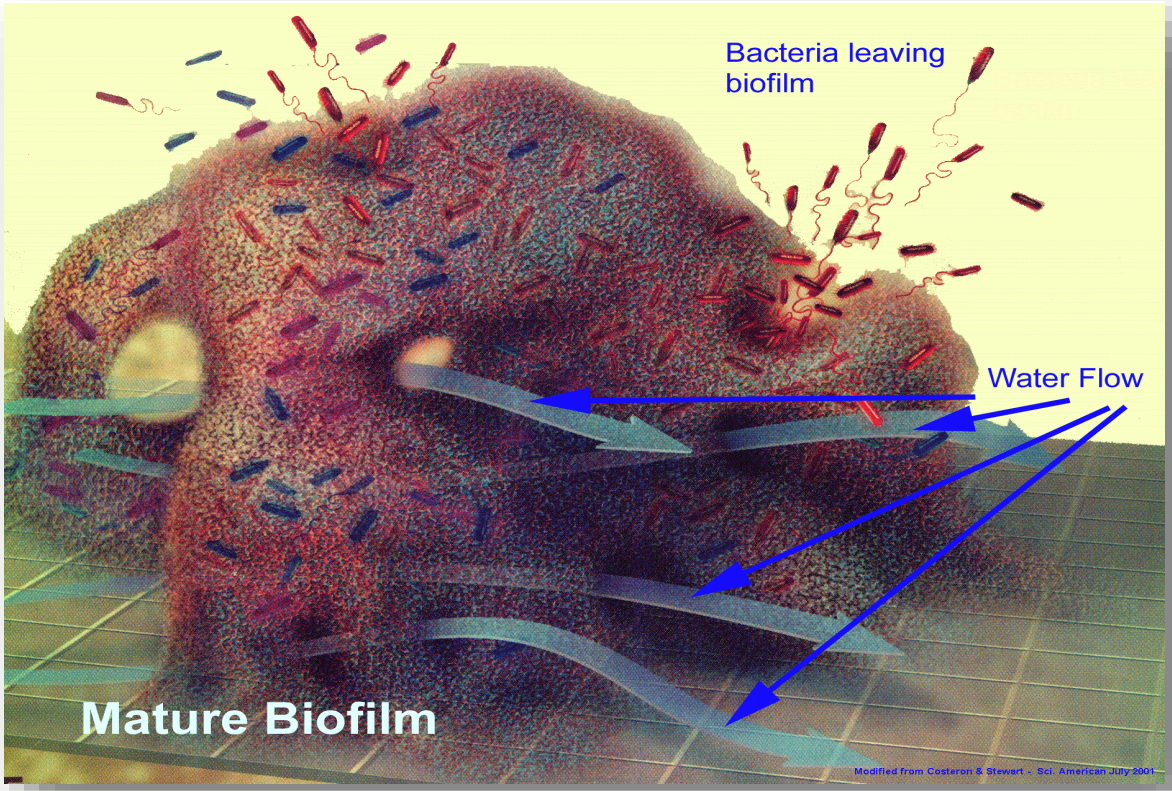
Kill minor colonies of Legionella in bulk water system, has little affect on biofilm layer and therefore no impact on protozoan/Legionella colonies

Stage 6- System upset disrupts biofilm



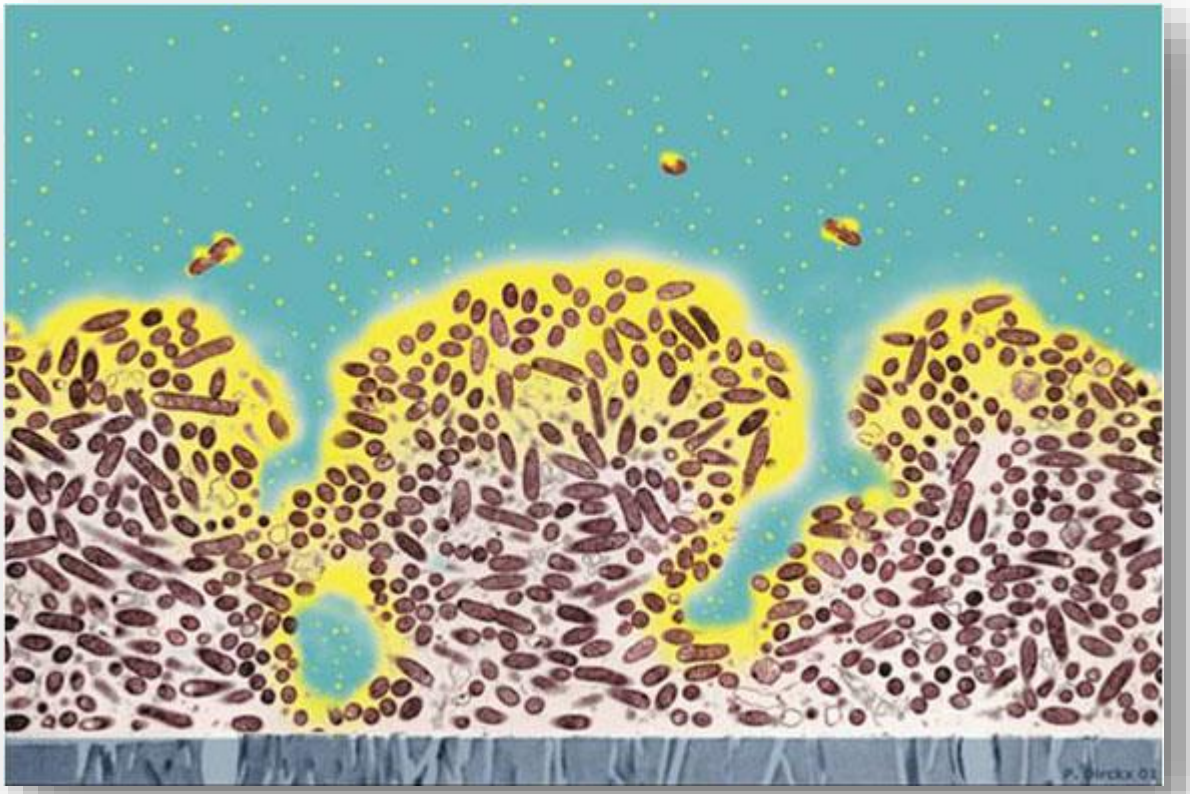
Disrupted biofilm actively releases Protozoa and Legionella into bulk water system.

Biofilm chemistry



Typical biofilm

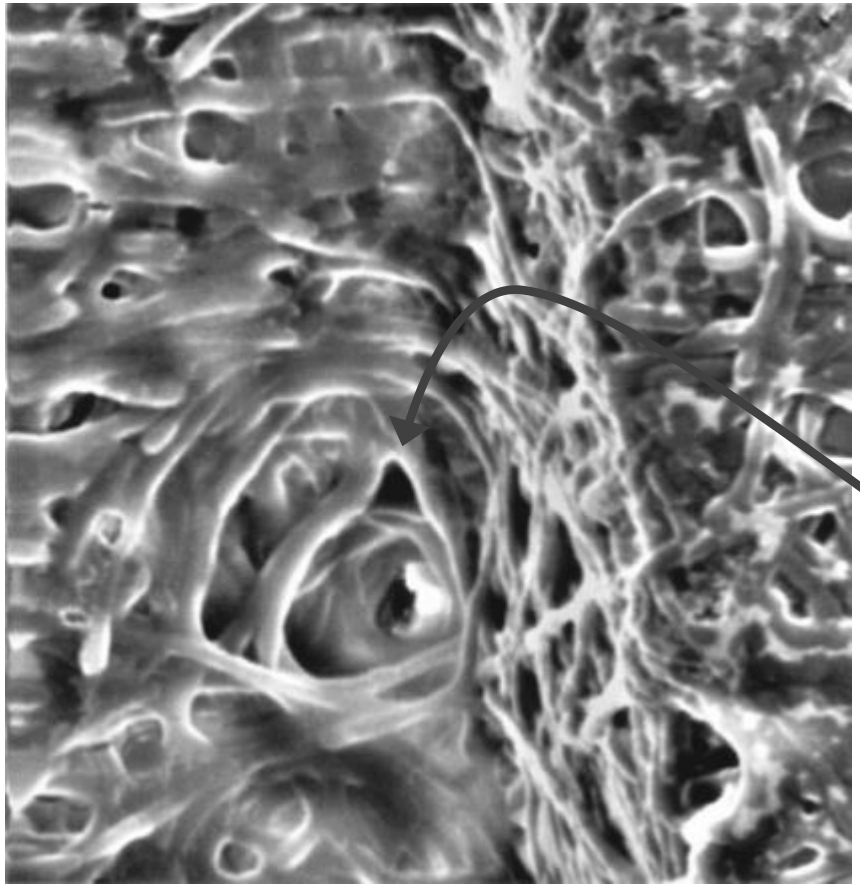
Biofilm chemistry



Biocide applications typically kill only surface bacteria

Remaining bacteria react by creating more biofilm

Biofilm chemistry



50 to 90% of biofilm is a non-uniform hydrated polysaccharide matrix composed of microcolonies of different bacteria. Example is The gram-negative facultative anaerobic pathogen Pseudomonas aeruginosa. Anionic properties are conferred to the biofilm by the bacteria allowing Divalent cations to cross-link strengthening the film.

A water channel is seen in the biofilm matrix.

American Society for Microbiology Magnification, ×1,000

Where Do We Find Legionella

- Legionella bacteria found in hospital ice machines at UPMC Presbyterian
- Legionella Outbreak from Ice Machine at the Super 8 Motel on College Street in Lacey, Washington.
- Brisbane hospital ice machine tests positive for legionella pneumophila following patient diagnosis
- Ventilator-associated pneumonia (VAP)
- Cooling towers, Spas, fountains, plumbing and dead-legs, HVAC systems

Water Treatment Pros/Cons

Mechanical

- Sub micron Point-of-Use Filtration
- Superheat and Flush; 60-70 ºf for 30 minutes
- Ultra Violet Light; Not recommended

Chemical

- Chlorine; .5-1.0 free residual
- Shock Hyperchlorination; 20–50 mg/L of free chlorine
- Chlorine Dioxide; .3-.5 mg/l
- Ozone; not recommended
- Monochloramine; 2-3 mg/l
- Copper/Silver; copper and silver ion concentrations control 0.30 and 0.02 ppm, respectively

Meet The New Standard

Effective June 26, 2015

ASHRAE®

STANDARD

ANSI/ASHRAE Standard 188-2015

Legionellosis: Risk Management for Building Water Systems

Approved by the ASHRAE Standards Committee on May 27, 2015; by the ASHRAE Board of Directors on June 4, 2015; and by the American National Standards Institute on June 26, 2015.

Scope

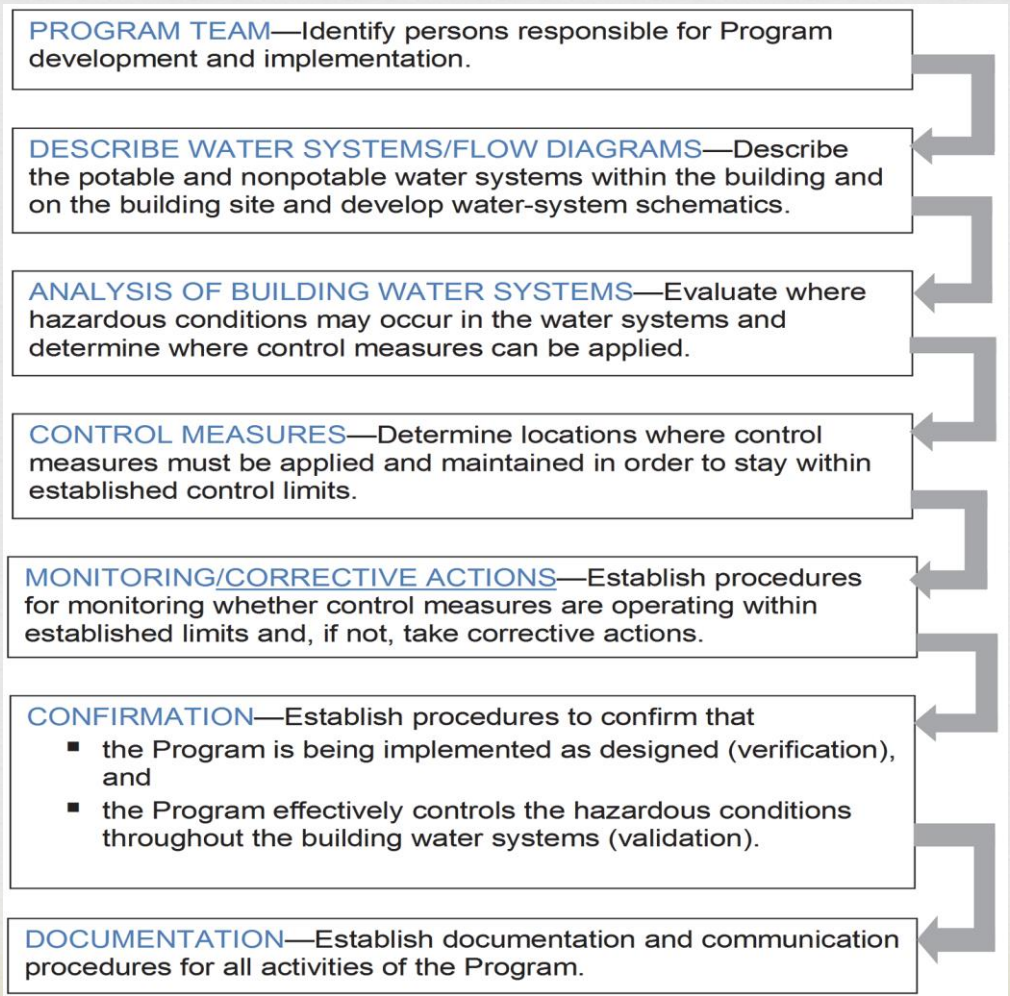
2.1 This standard provides minimum legionellosis risk management requirements for the design, construction, commissioning, operation, maintenance, repair, replacement, and expansion of new and existing buildings [Plants] and their associated (potable and nonpotable) water systems and components.

4.2 Building Owner Requirements

4.2.1 The building owner [or facility manager] shall survey each existing building, new building, and any renovation, addition, or modification to an existing building and its water systems as described in Section 5.

The survey and conformance with the compliance requirements of Section 4 must occur prior to occupancy of a new building [plant] and before construction begins on renovations, additions, or modifications to existing buildings [Plants].

Elements of a Water Management Program



A2. DESIGNATED TEAM LEADERSHIP

a. a person with senior organizational leadership authority to make command decisions about water restrictions or other response measures;

b. a member of the facilities management staff familiar with the *building [Plant] water systems*; and

c. Others – Suppliers, Consultants

Personal Responsibility

The program documents shall include identification of the responsible persons for every step of each *Program* requirement.

Control Measures

6.2.5 *Control Measures*. Based on the results of the *analysis of building [Plant] water systems* in Section 6.2.4, the *Program Team* shall determine the *control measures* to be maintained.

Control measures shall include preplanning of physical design and equipment siting. *Control measures* shall include treatment methods, technical and physical processes, and procedures and activities or actions that monitor or maintain the physical or chemical conditions of water to within established *control limits*.

7.2 Cooling Towers and Evaporative Condensers

7.2.4 Water Treatment. The *Program* documents shall include the water treatment requirements to *control* microbiological activity, scale, and corrosion and shall also

a. specify all equipment and chemicals used for the purpose of treating the open recirculating loop;

b. include the minimum required schedule for inspection, maintenance and *monitoring*, and a *corrective actions* plan; and

c. identify the minimum requirements for documenting system water treatment.

The core elements to the successful implementation of ASHRAE Standard 188 are:

Verification

- "initial and ongoing confirmation that the *Program* is being implemented as designed."

Validation

- "initial and ongoing confirmation that the *Program*, when implemented as designed, effectively controls the *hazardous conditions* throughout the *building [plant] water systems*."

Question: Why can't your current water treater simply implement the plan for you?

Answer: Because a water treatment supplier is not recognized by ASHRAE 188 as a 'responsible' entity such as an owner, manager or contractor

The Final Element is the Water Management Plan Document (Verification)

The plan is to be reviewed and update yearly

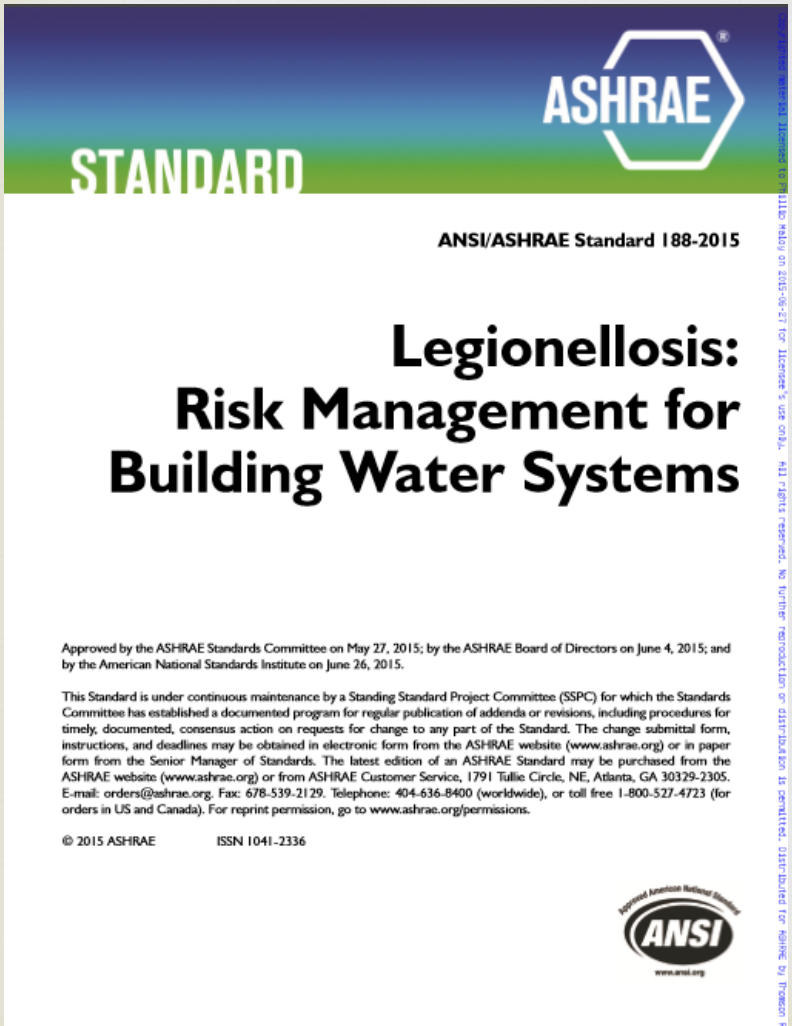
What About Validation?

Validation is monitoring and corrective action. Taking water and culture samples, ensuring control parameters are maintained and documenting hazardous conditions are effectively being controlled

What does a Water Management Plan Based on ASHRAE Standard 188 Actually Look Like

What Are the Elements

ASHRAE Standard 188


STANDARD

ASHRAE

ANSI/ASHRAE Standard 188-2015

Legionellosis:
Risk Management for
Building Water Systems

Approved by the ASHRAE Standards Committee on May 27, 2015; by the ASHRAE Board of Directors on June 4, 2015; and by the American National Standards Institute on June 26, 2015.

This Standard is under continuous maintenance by a Standing Standard Project Committee (SSPC) for which the Standards Committee has established a documented program for regular publication of addenda or revisions, including procedures for timely, documented, consensus action on requests for change to any part of the Standard. The change submittal form, instructions, and deadlines may be obtained in electronic form from the ASHRAE website (www.ashrae.org) or in paper form from the Senior Manager of Standards. The latest edition of an ASHRAE Standard may be purchased from the ASHRAE website (www.ashrae.org) or from ASHRAE Customer Service, 1791 Tullie Circle, NE, Atlanta, GA 30329-2305. E-mail: orders@ashrae.org. Fax: 678-539-2129. Telephone: 404-636-8400 (worldwide), or toll free 1-800-527-4723 (for orders in US and Canada). For reprint permission, go to www.ashrae.org/permissions.

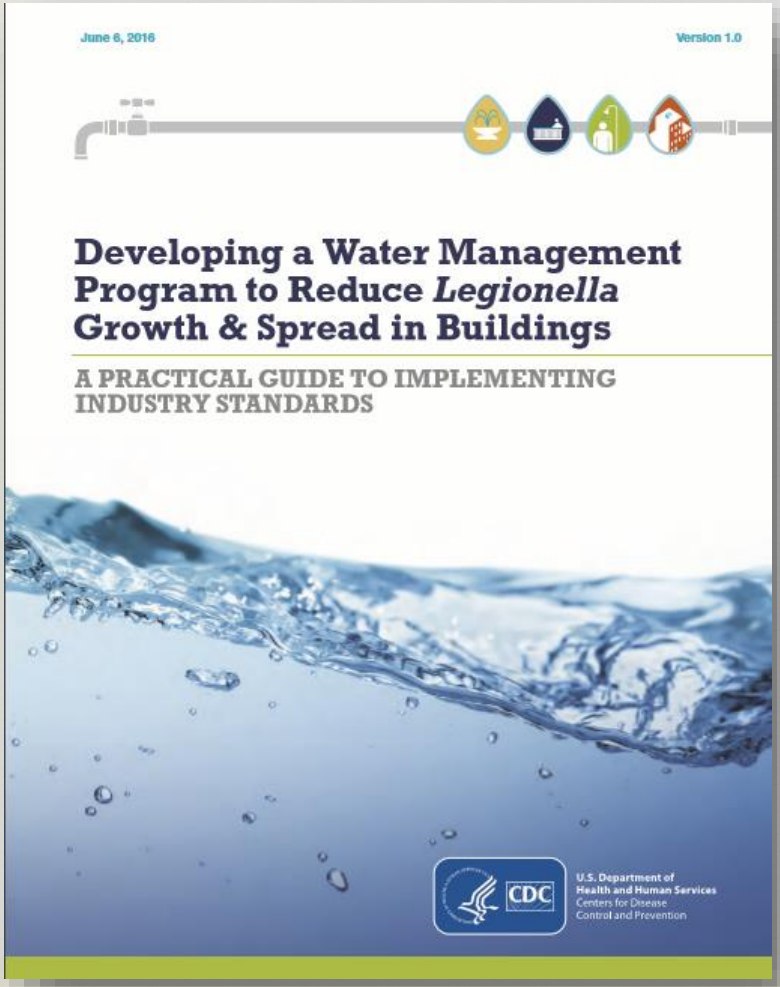
 ISSN 1041-2336

ANSI

FOREWORD -

The purpose of ASHRAE Standard 188 is to establish minimum legionellosis risk management requirements for building water systems.

CDC is Finally Coming to the Table



Forward – Legionella water management programs are now an industry standard for large buildings in the United States (ASHRAE 188: Legionellosis: Risk Management for Building Water Systems June 26, 2015. ASHRAE: Atlanta).

Risk Assessment & Preliminary Site Assessment

Phase 1

An on-site assessment will be conducted to survey the building water systems and collect site specific information to provide a baseline understanding of risk and support short and long term recommendations.

Risk Assessment & Preliminary Site Assessment

- **Site Survey**
- • Development of a sampling plan.
- • Walkthrough of buildings and their water systems.
  • Review of water systems from point of supply to usage.
- • Collection of water samples for Legionella culture and field measurement of physicochemical parameters (temperature, pH, conductivity, disinfectant)
- • Create Report

Water Management Plan

Phase 2

A Water Management Plan utilizes an accepted risk management methodology to provide a proactive approach for on-going management of building water systems, while specifically addressing Legionella risk.

The Water Management Plan provides defensible guidance for water system operation, including schedules for on-going monitoring and sampling, documentation and corrective actions, while establishing a means to audit the Water Management Plan.

Elements of Water Management Plan

- Proactive and documented management of building water systems.
- • Agreed upon actions for operating goals, system monitoring, documentation, and performing corrective actions if they become necessary.
- • Demonstrated operational excellence by addressing the new industry standard, ASHRAE 188 Legionellosis: Risk Management for Building Water Systems.

Elements of Water Management Plan

- : • Identification of Water Safety Team and responsibilities
- • Facility characterization and process flow diagrams
- • Legionella hazard analysis
- • Control limits and operating goals
- • Monitoring schedule and procedures
- • Corrective actions
- • Documentation requirements
- • Auditing (verification and validation activities)

Thank You


Q&A