‘Legionella Focus and the Regulatory Landscape since ASHRAE Standard 188’

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EXPERTISE AND SKILL:

➢ WATER TREATMENT – Certified Water Technologist (CWT)
  • Cooling Towers/Process waters, Closed Loop Systems, Boiler Water Systems,
  • Water Treatment Chemistry: Formulations / Scale, Corrosion & Microbial Control

➢ LEGIONELLA – SME
  • Consultant / Expert Witness
  • ASHRAE SSPC-188 / Legionella Standard, Vice Chair
  • AWT Legionella Task Force, Chair
  • AWT Legionella Guideline, author
  • CTI GDL-159 / Legionella Guideline, Chair
  • ‘Legionella Water Management Specialist’ / ASSE Qualifications Working Group

PROFESSIONAL BACKGROUND:

▪ Special Pathogens Laboratory: Sr. VP Business Development / Apr’16-Dec’17
▪ Southeastern Laboratories, Inc: VP Consulting & Technical Services / Sep’75-Mar’16
▪ AWT / Ray Baum Memorial Water Technologist of the Year Award (2005)
▪ BS Biology / Medical Biochemistry
Disclosures / Disclaimer

• Liaison for AWT to ASHRAE and CTI as a representative, member and participant with various Legionella and water treatment subject-related committees, working groups, and program activities.

• This presentation is as an independent SME and industry consultant – and not representing any professional or personal organizations, associations or affiliations.
1. The increasing **focus** on *Legionella* and building water safety since ASHRAE Standard 188 – June of 2015!

2. *Legionella* as a waterborne pathogen: the basics, a few tidbits, myths & misconceptions – and some cool slides

3. The regulatory landscape of ‘acronym activity’ w/AHJs, plus: ASHRAE, CDC, **CMS**, TJC, EPA, NSF, NASEM, State/Local DoHs/Regs-Law → AWT, CTI, WQA, ASHE, AIHA, ASTM, ASSE, AWWA … **others & others!**

4. ASHRAE 188 – the importance of **here and now!**
LEGIONNAIRES’ DISEASE CASES ON THE RISE...

Legionnaires’ Disease Is On the Rise
2000–2015*

*National Notifiable Diseases Surveillance System
LEGIONELLA LITIGATION (CASES) ON THE RISE . . .
GOOD JUDGEMENT COMES FROM EXPERIENCE.

GOOD JUDGEMENT?

AND EXPERIENCE? WELL THAT COMES FROM POOR JUDGEMENT.

So: Let those already ‘EXPERIENCED’ provide you GOOD JUDGEMENT!
The NEW FOCUS on **Legionella** and Disease Prevention . . .

A LOT has happened since 2015 – following ASHRAE Standard 188!
Let’s go back to 1976 for a brief review of Legionnaires’ Disease & Legionella
1976: Bellevue-Stratford Hotel/Philly

Legionnaires’ Disease

221 Sick!

34 Deaths!
The cause of Legionnaires’ disease was a common aquatic (water) *bacteria!*
Legionella pneumophila (Lp)

- One of 60+ named Legionella species / has 15+ serogroups
- \textit{Lp} - the species responsible for >90\% of disease cases
- The major infectious serogroup is serogroup 1 (\textit{Lp1}) causing >80\% of disease cases

\textit{"Lung-Loving"}
Legionella Species*

Legionella adelaidensis
Legionella anisa
Legionella beliardensis
Legionella birminghamensis
Legionella bozemanae
Legionella brunensis
Legionella busanensis
Legionella cardiaca
Legionella cherrii
Legionella cincinnatiensis
Legionella clemsonensis
Legionella donaldsonii
Legionella drancourtii
Legionella dresdenensis
Legionella drozanskii
Legionella dumoffii
Legionella erythra

Legionella fairfieldensis
Legionella fallonensis
Legionella feeleii
Legionella geestiana
Legionella genomospecies 1
Legionella gormanii
Legionella gratiana
Legionella gresilensis
Legionella hackeliae
Legionella impletisoli
Legionella israelensis
Legionella jamestowniensis
Legionella jeonii
Legionella jordanis
Legionella lansingensis
Legionella londiniensis

Legionella longbeachae
Legionella lytica
Legionella maceachernii
Legionella massiliensis
Legionella micdadei
Legionella monrovia
Legionella moravia
Legionella nagasakiensis
Legionella nautilus
Legionella parisiensis
Legionella pittsburghensis
Legionella pneumophila
Legionella quateirensis
Legionella quinlivanii
Legionella rowbothamii

Legionella rubrilucens
Legionella saoudiensis
Legionella santhelensi
Legionella santicrucis
Legionella shakespearei
Legionella spiritensis
Legionella stelei
Legionella steigerwaltii
Legionella saoudiensis
Legionella taurocenis
Legionella thermalis
Legionella tucsonensis
Legionella tunisiensis
Legionella wadsworthii
Legionella waltersii
Legionella worsleiensis
Legionella yabuuchiae

* Per Wikipedia listing and identification description
Various species include:

• *L. anisa*,
• *L. bozemanni*,
• *L. dumoffii*,
• *L. gormanii*,
• *L. longbeachae*,
• *L. rubrilucens*, and

• *L. clemsonensis*  
  *(Oct 2016)*
Legionellosis: Pontiac Fever

- Mild, flu-like illness—without pneumonia
- Appears w/in 24 hours to 3 days after exposure
- Lasts up to 5 days, generally less
- Does not require hospitalization or antibiotics
- **Susceptibility:** ~95% (±) of those exposed
Legionellosis: Legionnaires’ Disease

- Potentially fatal, multisystem respiratory illness, accompanied by pneumonia
- Symptoms: high fever, chills, muscle pain, headache, dry cough; diarrhea, vomiting, confusion and delirium are also common
- Appears 2-10 days after exposure
- Recovery can be long term, debilitating
- Susceptibility: ~5% (±) of those exposed
Disease Cause & Transmission Sources

Inhalation/Aspiration of Aerosols (droplets) containing *Legionella* bacteria

**Legionnaires’ disease**, a type of severe pneumonia, is caused by breathing in small droplets of water that contain *Legionella*.

**Common Sources of Infection**
Outbreaks of Legionnaires’ disease are often associated with large or complex water systems, like those found in hospitals, hotels, and cruise ships. The most likely sources of infection include:

- Water used for showering (potable water)
- Cooling towers (parts of large air conditioning systems)
- Decorative fountains
- Hot tubs
Transmission and Infection

✓ Legionellosis is **not transmitted** from person to person
  – *It is not a contagious disease* *

• **Inhalation** (into the lungs) → of water aerosols or soil containing LB, can cause disease

• **Aspiration** (into the lungs) → of water/fluids resultant of gagging/swallowing/etc. problems, can cause disease

Legionella Microbiology

- Gram negative, rod-shaped, aerobic bacterium
- 60+ species and 70+ serogroups have been described for the genus
  - Commonly found, natural inhabitant of fresh waters, muds and some soils
  - Survives and multiplies as intracellular parasites in certain Protozoa (amoebae)
What filter size would you use for a *Legionella* control strategy?

*Legionella* Bacteria are ... very, very, very, very ... *small* bacteria

0.3–0.9 µm (by)
2–20 µm
Legionella is not ubiquitous (everywhere) in water systems or devices.

It is a common bacteria and natural inhabitant of fresh waters, muds and soils – generally, in very low levels and not causing disease.

Scientific evidence: a wide variance, but found in ~30-70% of premise plumbing (man-built) systems – if/when favorable conditions present.

That’s what ASHRAE Standard 188 is about – managing building water systems that can/could harbor Legionella!
Legionella: Thrive within Biofilm
Biofilm is in (films) our Water Systems!
But, *Legionella* ‘Live’ within Protozoa!

(*Intracellular Parasites*)
**Legionella → Pathogenesis**

1. Enter the host, penetrating deep into the alveolar regions of the lungs …

2. Macrophages come to **ingest** and destroy the invading bacteria;

**However**, *Legionella survive* & multiply within the macrophage, as they do in nature – living within host Protozoa (Amoebae) …
3. The *Legionella* ultimately lyse (burst open) the macrophage cell, killing it, while releasing many new *Legionella* and worsen the infection.
SO – let’s see a ‘MOVIE’ of this . . .
Risk of Acquiring Legionellosis ...

Exposure Alone ≠ Disease Infection

**Legionella in water (reservoir)** +/→ **Transmission to host (exposure)** +/→ **Susceptible Host (at risk)**

**Legionella Virulence ... (genetics)**

**Infectious Dose ... (not known)**
Aerosol (Mist) Producing Devices ...

- Faucets and shower heads
- Spas and whirlpool tubs
- Humidifiers
- Decorative fountains
- Sprinklers
- Cooling towers
- Evaporative condensers
- Medical/dental equipment . . .
  and others
The potable (domestic) water distribution systems of large buildings, including hospitals and hotels, are considered the primary source of *Legionella* and disease as supported by peer reviewed research data and expert sources, such as the CDC.

*Cooling Towers* - long thought to be the major source for *Legionella* and disease - are considered an overemphasized source according to current data.
Who Would Think – A Grocery Store?

- An ultrasonic mist-maker device was operating over one section of the produce display …

- No one at the grocery store was familiar with the operation or maintenance of the device …

- High levels of *Legionella (Lp1)* were recovered from the device: 34 cases/2 deaths! (Bogalusa, LA / Winn-Dixie store)
Aspiration of ice chips contaminated w/LB
20% of Ice Machines had Lp1
3 Cases / 1 Death (2013)
Water Birth & Legionnaires’ Disease 😞

- **Case 1**: Home delivery in a tub filled with warm tap water.
- **Case 2**: Home delivery in a rented ‘hot tub’ filled with tap water.

Tub was kept at 98°F the week prior to delivery!
A LOT has happened in less than 4 years - since ASHRAE 188!

... after many years of getting our head out of the sand since 1976 ... 😊
2015: Summer of *Legionella* ...

1. First US Legionella Standard published
   June 26, 2015

2. Start of New York City LD Outbreak
   July 2015

3. Emergency LB regulations passed (NY)
   August 20, 2015
12 Die of Legionnaires’ Disease in New York City!

Legionnaires’ outbreak widens to 12 dead in New York

130 Cases Reported with 12 Deaths. Officials say the outbreak is centered on the area near the Opera House Hotel in South Bronx.
CDC Reports on Legionella & WMPs June 2016

June 2016

CDC provides “Toolkit” for ASHRAE 188 June 2016

June 2016

CDC provides ‘VitalSigns’ LD Reporting

2016: CDC Focus on Legionella & 188 ...
CDC Releases new reports on Legionnaires’ Disease!

Legionnaires’ cases increasing

Reported cases of Legionnaires’ disease in the U.S. per 100,000 population, by year, 2000-2014:

- 0.4 cases per 100,000 population in 2000
- 1.6 cases per 100,000 population in 2014

June 6, 2016
CDC Provides a “Toolkit” for ASHRAE Standard 188
2017: **CMS** Issues a *Legionella* Memorandum ...

1. CDC reports new Disease research data!
   - June 2017

2. CMS sends LB directive to HC-Facilities
   - June 2, 2017

June 2017
- CDC updates ‘Toolkit’ and ‘VitalSigns’ *(Healthcare!)*
June 2017 Report = 4.5 x!

Legionnaires’ Disease Is On the Rise
2000–2015*

Incidence (cases/100,000 population)

Year


2015 = 6,079
2014 = 5,166
2010 = 3,516
2005 = 2,301
2000 = 931

*National Notifiable Diseases Surveillance System

CDC / MMWR
CDC: *Vitalsigns™* (June 2016 / 2017)

**DATE:** June 02, 2017

**TO:** State Survey Agency Directors

**FROM:** Director
Survey and Certification Group

**SUBJECT:** Requirement to Reduce *Legionella* Risk in Healthcare Facility Water Systems to Prevent Cases and Outbreaks of Legionnaires’ Disease (LD)

Effective Immediately: June 2, 2017
"Conduct a facility risk assessment to identify where Legionella and other opportunistic waterborne pathogens could grow and spread in the facility water system."
“Implement a **Water Management Program** that considers the ASHRAE industry standard (188) and the CDC Toolkit that includes”:

- Control measures ...
- Temperature management ...
- Disinfectant level control ..., and
- Environmental testing for pathogens ...
This policy memorandum applies to:
- Hospitals
- Critical access hospitals (CAHs), and
- Long-term care (LTC) facilities ...

This policy memorandum is also intended to provide general awareness for all healthcare organizations.
CMS: Water Borne Pathogens

- *Legionella*
- *Pseudomonas aeruginosa*
- *Acinetobacter*
- *Burkholderia*
- *Stenotrophomonas*
- Nontuberculous mycobacteria (NTM)
- Fungi ...
Expectations for Healthcare Facilities and Surveyors

Review policies and procedures and reports documenting water management implementation results to verify that the facility has:

- Conducted **risk assessment** for potential areas of growth and spread.
- Implemented a **water management program** that considers the ASHRAE industry standard and CDC toolkit and that includes control measures (e.g., physical controls, temperature management, disinfectant level control, visual inspections, and environmental testing).
- Specified **testing protocols** and acceptable ranges for control measures and documented the results of testing and corrective actions taken when control limits are not maintained.
NOTE: CMS does not require water cultures for Legionella or other opportunistic water-borne pathogens. Testing protocols are at the discretion of the provider.
CDC at NASEM 1st Legionella Meeting...

The National Academies of Sciences • Engineering • Medicine

Management of *Legionella* in Water Systems

Centers for Disease Control and Prevention

February 8, 2018
"Legionella Management and Guidelines"

Water Research Foundation Webinar
December 4, 2018
Legionnaires’ Disease continues to rise in the US!

Rate of reported US cases increased **5.5 times**! (2000-2017)

CDC Source: National Notifiable Diseases Surveillance System
Reported rates of legionellosis cases in the US in 2007:

Cases/100,000 population

CDC Source: National Notifiable Diseases Surveillance System
Reported rates of legionellosis cases in the US …

Reported cases by state

2012
Cases/100,000 population

CDC Source: National Notifiable Diseases Surveillance System
Reported rates of legionellosis cases in the US…

CDC Source: National Notifiable Diseases Surveillance System
Possible reasons for increasing number of reported cases *

- **Increased susceptibility of the population**
  - Aging U.S. population
  - More people on immune suppressing medications

- **More *Legionella* in the environment**
  - Warmer temperatures
  - Aging infrastructure
  - Water-saving building modifications

- **Improved diagnostic capabilities**
  - Urinary antigen test (UAT) availability

- **Improved diagnosis and reporting**
  - Increased awareness and testing
  - Increased surveillance capacity

* CDC Source: National Notifiable Diseases Surveillance System

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2017 = 7458
2015 = 6079
2010 = 3516
2005 = 2301
2000 = 931
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CDC/MMWR
Legionella (now) has Everyone’s Attention ...

• ASHRAE, AWT, CTI, IWC, NSFi, NSF, NASEM, ASTM, AWWA, WQA, IFMA ...

• CDC, EPA, VHA, State and Local DOHs / DHMHs / ASHE, AIHA, CMS, TJC, NIH ...

• Related industry organizations APIC, ASPE, ASSE, IAPMO, WRF...

... and many, more!
Compliance w/ASHRAE 188 requires facility owners (managers) to:

1. Establish a Team with assigned responsibilities & accountabilities

2. Have, Practice, Audit and Maintain a Water Management Program (WMP) for legionellosis risk management within building water systems and devices
ASHRAE 188: Water Management Plan (WMP)

(Section 6)
Figure 1.
Elements of a Water Management Program (WMP)

ANSI/ASHRAE Standard 188-2015

1. **PROGRAM TEAM**—Identify persons responsible for Program development and implementation.

2. **DESCRIBE WATER SYSTEMS/FLOW DIAGRAMS**—Describe the potable and nonpotable water systems within the building and on the building site and develop water-system schematics.

3. **ANALYSIS OF BUILDING WATER SYSTEMS**—Evaluate where hazardous conditions may occur in the water systems and determine where control measures can be applied.

4. **CONTROL MEASURES**—Determine locations where control measures must be applied and maintained in order to stay within established control limits.

5. **MONITORING/CORRECTIVE ACTIONS**—Establish procedures for monitoring whether control measures are operating within established limits and, if not, take corrective actions.

6. **CONFIRMATION**—Establish procedures to confirm that
   - the Program is being implemented as designed (verification), and
   - the Program effectively controls the hazardous conditions throughout the building water systems (validation).

7. **DOCUMENTATION**—Establish documentation and communication procedures for all activities of the Program.
State Health Officials hold the keys to *Legionella* prevention …

- Regulations are ultimately needed for facilities to implement WMPs, state officials hold the keys to preventing Legionnaires’ disease – as states are the entities most likely to regulate.

- The CDC won’t establish regulations. It has influence but does not issue regulations.

- The EPA focuses on water distribution up to the street tap, not on systems within buildings.

- Water treatment professionals, engineers, and consultants can continue talking about better methods and procedures – **but the information won’t prevent disease unless it changes the way building water systems are designed, operated, and maintained** – which, will invariably depend on regulations to do so.

Ultimately, then, it’s up to health departments or other state agencies.
Regulations based on a Standard can be established quickly …

- CMS simply issued a memorandum that hospitals and nursing homes must implement a WMP that reduces the risk of Legionnaires’ disease
- The entire memorandum was less than 3.5 pages, primarily background information. The directive itself consisted of only three sentences!
- With just the stroke of a pen, CMS did more to increase Legionella prevention in hospitals and nursing homes than had been accomplished with decades of guidelines, warnings, standards, articles, speeches, conferences, seminars, webinars and e-courses!

CMS could not have established the requirement so simply or quickly without a standard (ASHRAE 188) to reference as a guide for WMPs.
ASHRAE Standard 188 is the best standard on which to base *Legionella* regulations – why?

- **It is ready** – here and now – waiting for a “better” standard will cost health and life.

- **It is in continuous maintenance** – there is a formal process for accepting and considering comments and making changes.

- **188 outlines the essential elements and framework** for a WMP – states can monitor documentation for specific procedures and performance criteria they deem imperative.

- **ASHRAE has proven trustworthy** …
Summary

✓ *Legionella* is a common bacteria in man-built water systems

✓ Disease causation is *not* simple – involves many factors:
  • favorable conditions for LB growth, means of transmission (aerosols) and exposure route to susceptible persons

✓ Cooling water and potable water systems *all* important

✓ *There IS a ‘standard of care’ – not ‘best practice’ – that has gained recognition and is required by certain AHJs for Legionellosis Risk Management in Building Water Systems – ASHRAE Standard 188.*