Today’s Presentation
1. Legionella Overview
2. How does ASHRAE 188-2015 Affect Us and our Customers?
3. Best Practices
4. Proactive Remediation

Legionella Overview
- Family Legionellaceae
- Gram-negative, non-spore-forming bacillus
- More than 40 species & 61 serogroups
- > 70% of infections caused by L. pneumophila serogroup 1
- Amoebae, ciliated protozoa & cyanobacteria can act as hosts
- Legionella is a waterborne bacteria
Biofilm

Source: Cunningham et al.

Six-Link Chain of Causation

Breaking the Chain?

Reservoir
Amplification
Dissemination
Virulent Strain
Inoculation (Lungs)
Susceptible Person
Legionnaires’ Disease

1. Attachment
2. Growth
3. Dispersal

Source: Cunningham et al.
“Safe” Legionella Levels?

The Old Adage

“It is recommended that the threshold level for positive distal sites be set at 30%.”

The Reality of 2015

Strive for Eradication of Legionella from the drinking water “...as there is no known safe level of Legionella”

ASHRAE 188-2015 and Us

Section 1.0 Purpose:

“The purpose of this standard is to establish minimum Legionellosis risk management requirements for building water systems.”

188-2015 Highlights

- Section 4 and 5, Does it apply to me?
- Section 6, Requirements
  - Water Management Plan
  - Team
  - Flow Diagrams
- Section 7, Procedures
- Section 8, Design Requirements
  - Not discussed today

Does it apply to me?

- Outlined in sections 4 and 5
  - ASHRAE 188-2015 will apply if the building has:
    - Cooling towers
    - Spas water features
    - Potable hot water loop
    - 10 stories high including basement
    - All healthcare facilities
How do I comply?

- Section 6, Requirements
  - Water Management Plan
    - A written legionella control plan
  - Team
    - Form a legionella control team with the owners, operators, plumbers, and water treatment experts
  - Flow Diagrams
    - General outline of the water flow including processing points
- Section 7, Procedures- Longest section of 188
  - Written procedures for any expected or unexpected plumbing or hydronic work

What does a mechanical contractor need to know?

- ASHRAE 188-2015 is here
- The sky is not falling
- Compliance does not need to be prohibitively expensive
- The mechanical contractor should be part of the water management team
- The building owner is ultimately responsible
- Klenzoid can provide the needed support services

Best Practices

- Cooling tower disinfection
- PPE
- Legionella prevention
- Legionella response
Cooling Towers

- Have been proven to be the source of Legionella outbreaks
  - New York 2015
  - West Chester University, 2015

- Cleaning and Disinfection
  - Cleanings at least twice annually - follow CTI standards
  - Disinfect before cleaning
    - Shock cooling tower with disinfectant and dispersant 24 hours before cleaning will minimize the risk of Legionella exposure and can aid in biofilm removal

- A quality maintenance water treatment service is ESSENTIAL

Legionella Prevention

- Culturing
  - The ONLY way to know if you have Legionella
  - Cultures require about 10 days for full analysis

- Disinfection
  - Chemically disinfect your cooling towers

- Remediation
  - Chlorinate new pipes and water equipment
  - Proactively remediate with an EPA listed potable water disinfectant as needed

Legionella Response

- Cooling Towers
  - Disinfect and clean
  - Use the right disinfectant and dispersant to penetrate the biofilm and destroy the microorganism

- Potable Water
  - Assess the risk
    - You may need to just replace an infected fixture or you may need to remediate entire buildings

PPE

- “Question: What type of breathing protection should you use if you have to work near a source of water that has tested positive for Legionella? …do you need to wear a respirator?”

- Answer: If your work involves aerosols of water or mist, then a P95 respirator is ideal. If it does not, then a dust mask is ok. Breathing aerosols of water vapor or drinking the water can lead to Legionnaires’ disease. Touching the water is not a risk.”

Source: http://legionella.org/faqs/engineers/

- PPE should be utilized in accordance with any known hazards and your company’s corporate policy

PPE

- “Question: What type of breathing protection should you use if you have to work near a source of water that has tested positive for Legionella? …do you need to wear a respirator?”

- Answer: If your work involves aerosols of water or mist, then a P95 respirator is ideal. If it does not, then a dust mask is ok. Breathing aerosols of water vapor or drinking the water can lead to Legionnaires’ disease. Touching the water is not a risk.”

Source: http://legionella.org/faqs/engineers/

- PPE should be utilized in accordance with any known hazards and your company’s corporate policy
What does this mean for the mechanical contractor?

- Sell disinfections as part of a tower cleaning
  - Protect your people and add value to your customer
- Wear the right PPE
- Recommend Legionella culturing as a preventative measure
- Be proactive - Not reactive

Proactive Remediation

- A disinfection treatment applied before an outbreak is discovered, to potable water systems.
- Drinking water is subject to local, state and federal regulations

Disinfection Regulations

- EPA Safe Drinking Water Act (SDWA)
  - Maximum Residual Disinfectant level (MRDL)
  - Maximum Contaminant Level (MCL)
- State Drinking Water Enforcement Agencies (Primacy)
  - States are allowed to set lower MRDL and MCL levels
- National Sanitation Foundation (NSF)
- American National Standards Institute (ANSI)
  - Standards 60 & 61 for Drinking Water

EPA Listed Disinfectants

- Hypochlorite → cheap, simple to use, less effective, toxic by-products, high residuals required
- Chlorine dioxide → very good disinfectant, used in drinking water
- Monochloramine → very good disinfectant, used in drinking water, used for Legionella remediation with success
Chlorination

- Long established technology
- Legionella control may be achieved if free chlorine is continually maintained at 2.0-6.0 PPM,
- Most incoming city water contains below 1.0 PPM
- Multitude of chemical feed and monitoring equipment available

Chlorination System

Chlorination

- Why Not Chlorination?
  - Peer reviewed studies show a constant residual 2.0ppm minimum is required for control
  - Residual required for Legionella control may violate the Safe Drinking Water Act (SDWA)
    - MRDL for chlorine is 4.0 PPM
    - Some States set MRDL at 2.0 PPM
  - Disinfection byproducts formed
    - Trihalomethane (THM)- Known Carcinogen
    - Haloacetic Acids (HAA5)

Chlorination

- Why Not Chlorination?
  - Chlorine attacks metal pipes, leaks and corrosion failures likely to occur
  - Corrosion must be minimized by using a secondary corrosion inhibitor chemical
Chlorination

- Why Not Chlorination?
  - Chlorine may not kill Legionella, it may only suppress Legionella bacteria growth in bulk water
  - If Chlorination system fails, Legionella can experience rapid growth and recolonization in the system
  - Chlorine does not penetrate biofilm
  - Chlorine taste and odor complaints
  -Difficultly maintaining chlorine in a recirculated hot water system

Chlorine Dioxide

- 8 Times the efficacy of chlorine
- Legionella control achieved at 0.5 PPM of ClO₂
- Most effective choice for complex plumbing systems with multiple hot water recirculation loops
- No THM or HAA5 Formation
- Penetrates and destroys biofilm
- Some generation equipment is NSF/ ANSI Standard 61 Approved
- No taste & odor

Chlorine Dioxide System

- Why Not Chlorine Dioxide?
  - Varying generation technologies
  - Some generators require strong acids or chlorine gas be stored onsite
  - Some manufactures generate chlorine dioxide at unstable levels (> 3000 mg/l)
  - High cost of some generators
  - Not all offerings are NSF/ ANSI Stds. 60 or 61 certified
  - Damage to plastic piping systems. ClO₂ permeates into pipe and causes embrittlement and failure.
Monochloramine- Sanikill®

- Proven to be the most effective disinfectant against Legionella and many other Waterborne pathogens.
- Higher efficacy than chlorine dioxide
- Penetrates and destroys biofilm
- No listed DBP’s formed
- NSF/ ANSI Std. 60 listed reagents
- NSF/ANSI Std. 61 listed wetted components
- New technology successfully delivered controlled doses of Monochloramine
- Rapid reduction of distal site positivity

Sanikill® System

Sanikill® Monochloramine

- Why Not Monochloramine?
  - Best applied to hot water recirculation loop
  - Dosing control must maintain proper reagents ratio
- Sanikill’s® Answers
  - Single main can be treated to feed multiple HW loops
  - Several successful American Applications
  - Reagent application controlled against water flow, ORP residual and each reagent pump

Questions?

Mr. Steve Douglas, CWT
Steve_Douglas@Klenzoidinc.com

Mr. Jeff Rudolph, CWT
Jeff_Rudolph@Klenzoidinc.com
References


Allegheny County Health Department, **Approaches of prevention and control of Legionella infection in Allegheny county health care facilities**, Allegheny County Health Department, Jan, 1997.