


## COVID Challenges Faced by Large Organizations

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1


## Reducing Occupant Exposure Risk to Degraded Water Quality During Building Water System Re-Commissioning



2

### Background


- The temporary shutdown or reduced operation of a building and reductions in normal water use can create hazards for returning occupants
- Building and business closures for weeks or months reduce water usage
- Stagnant water can degrade water quality inside buildings
- Degraded water quality could result in:
  - Growth of opportunistic pathogens such as Legionella,
  - Disinfectant by-products and increased presence of heavy metals (lead and copper),
  - Water that is unsafe to drink or otherwise use for domestic or commercial purposes



3

### Learning Objectives & Learning Level

- Understand that potable water quality degrades over time
- Stagnant water may lead to pathogen growth along with an increase in lead, copper and disinfectant by-products in the building water
- Building owners can minimize the risk of degraded water by managing water quality coming into their buildings and in their building water systems
- Develop water management plans that include testing water quality, working with water suppliers on quality issues, and limiting occupant exposure before entering the building is key



4

## Reducing Occupant Exposure Risk to Degraded Water Quality During Building Water System Re-Commissioning

### Background Information

- Buildings and businesses closed for weeks or months experience reduced water usage, potentially leading to stagnant water and degraded water quality entering building plumbing
- Degraded water quality could result in an increase in growth of legionella, disinfectant by-products and heavy metals (lead and copper), resulting in water that is unsafe to drink
- Building water recommissioning is critically important in schools and college campuses re-opening after the pandemic or even holiday weekends and session breaks






5

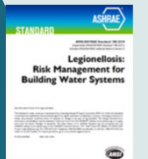
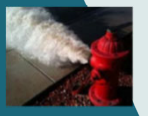

## Reducing Occupant Exposure Risk to Degraded Water Quality During Building Water System Re-Commissioning

### Intent

- To reduce occupant exposure risks associated with degraded water quality in community and building water systems due to stagnant or low water use.

### Requirements


- Develop and implement a water quality plan in accordance with ASHRAE Standard 188-2018 Legionellosis: Risk Management for Building Water Systems
- Communicate water quality to building occupants and steps being taken to maintain it to US EPA Safe Water regulations.
- Contact local government public health and water authorities for further information regarding water quality risks and remediation efforts.

6

## Engage Qualified Water Treatment Professionals

- Independent from the community water supplier
- Could be an engineer, plumber, or certified water technologist (CWT)






7

## Before Re-Occupying a Building that has been Unoccupied for 3 to 4 Days

### Step 1: Address Water Quality from Community Water Supply

- Test first draw of water at the service entrance for discoloration, pH, chlorine, temperature, lead, copper, and legionella bacteria
- If water quality meets state and federal requirements move on to Step 2: Water Quality Inside the Building
- If water quality is poor and below recommended US EPA regulations, notify the Community Water Supplier and request flushing and increased disinfectant residual of the water distribution mains supplying the building

8

## Before Re-Occupying a Building that has been Unoccupied for 3 to 4 Days

### Step 2 : Address Water Quality Inside the Building

- Test water for discoloration, chlorine, lead, copper, and legionella bacteria at various points throughout the Building Water System.
- If water quality is below minimum water quality parameters defined by the local EPA or Safe Drinking Water Act Requirements, thoroughly flush all faucets, showers, toilets and urinals many times to move the water.








9

## Before Re-Occupying a Building that has been Unoccupied for 3 to 4 Days

### Step 2 : Address Water Quality Inside the Building (cont.)

- Refer to resources for step-by-step guidance on starting or restarting the Building Water Systems.
- Consult plumbing guides to determine time required for flushing.
- Consider secondary disinfection of the building potable water supply if flushing does not bring disinfectant levels to code or legionella levels are not reduced.



10

## Before Re-Occupying a Building that has been Unoccupied for 3 to 4 Days

### Step 2 : Address Water Quality Inside the Building (cont.)

POSSIBLE PATHWAYS TO EXPOSURE





11

## Engage Qualified Water Treatment Professionals

### Step 3. Maintain Building Water Systems

- Ensure ongoing maintenance of the Building Water System (BWS) after testing and flushing is complete.
- After the BWS has returned to normal, ensure that the risk of pathogen growth is minimized by regularly checking water quality parameters such as temperature, pH, and disinfectant levels.
- Follow the Water Management Program, document activities, and promptly intervene when unplanned program deviations arise.
- Consider secondary disinfection of the building potable water supply if flushing does not bring disinfectant levels to code or legionella levels are not reduced.



12

### Reducing Occupant Exposure Risk to Degraded Water Quality During Building Water System Re-Commissioning

Credit Documentation/Submittals

- Building water quality management plan
- Test results from community water system
- Test results from building water system
- Documentation of building flushing activities
- Documentation of building disinfection activities, as applicable
- Documentation of qualified independent professional(s) engaged to conduct testing and disinfection activities, as appropriate to the project scope




13

### Reducing Occupant Exposure Risk to Degraded Water Quality During Building Water System Re-Commissioning

Further Information & Resources

- ASHRAE Standard 188-2018: Legionellosis: Risk Management for Building Water Systems
- ASHRAE Guideline 12-2020: Managing the Risk of Legionellosis Associated with Building Water Systems
- CDC Guidance for Reopening Buildings After Prolonged Shutdown or Reduced Operation
- Purdue University Center for Plumbing Safety, Covid-19 Response
- Legionella Risk Management: Tim Keane, COVID-19 and Legionella – Preparations to Consider for Municipal and Building Potable Water Systems
- European Society of Clinical Microbiology and Infectious Diseases, ESGLJ Guidance for managing Legionella in building water systems during the COVID-19 pandemic
- CDC Toolkit: Developing a Water Management Program to Reduce Legionella Growth and Spread in Buildings
- Alliance to Prevent Legionnaires' Disease Covid-19 Resource Guide




14

### Reducing Occupant Exposure Risk to Degraded Water Quality During Building Water System Re-Commissioning

Resources for Community Water System Flushing and Building Flushing

- Integrated Resource Management, Bob Bowcock, Guidance for Community Water Systems Regarding Stagnant Water
- Legionella Risk Management, Tim Keane, "Developing a Building Potable Water System Flushing Program"
- Ron George, CPD, Flushing Bacteria from Stagnant Building Water Piping
- Purdue University Center for Plumbing Safety, Flushing Plans
- ESPRI Institute: Building Water Quality and Coronavirus: Flushing Guidance for Periods of Low or No Use
- ESPRI Institute: Reducing Risk to Staff Flushing Buildings
- ASHRAE Standard 188-2018: Legionellosis: Risk Management for Building Water Systems




15

### Questions?

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16

# Potential Building Hazards & COVID-19 Pandemic

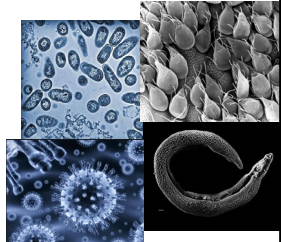
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1

# Waterborne Pathogens

- ▶ Many pathogens of concern:
  - Bacteria
  - Fungi
  - Viruses



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2

# Selected Pathogens of Concern

- *Legionella* sp. (*L. pneumophila*)
- *Pseudomonas* sp. (*P. aeruginosa*)
- *Klebsiella* sp.
- *Mycobacterium* sp. (*M. avium*)

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3

# Other Waterborne Pathogens

- ▶ Bacteria
  - *Escherichia coli* (O157:H7)
  - *Acinetobacter* spp.
  - *Burkholdaria cepacia*
  - *Enterobacter*
  - *Stenotrophomonas Maltophilia*
- ▶ Fungi
  - *Aspergillus* spp.
- ▶ Viruses
  - Norovirus

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4

# How Clean is The Incoming Water?

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5



6





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8



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10

**Guess What We Found?**

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11

**Virulent strains of *Legionella* in a public water distribution system**

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**HYPOTHESIS / PURPOSE**

NYC is a high-density urban area with a large population. The presence of Legionella in the NYC water system is well-documented. The purpose of this study was to determine if Legionella was present in the NYC water system. The hypothesis was that Legionella was present in the NYC water system.

**BACKGROUND**

NYC WATER SYSTEM

The NYC water system is one of the largest in the world. It serves over 20 million people. The water is treated at several plants and distributed through a network of pipes. The water is often stored in large tanks before being distributed.

**METHODS**

100 samples of public water were collected from various locations in NYC. The samples were analyzed for Legionella using a PCR assay. The results were compared to a database of Legionella strains.

**RESULTS**

100 samples were analyzed. 100% of the samples were positive for Legionella. The most common strain was Legionella pneumophila serogroup 1. Other strains included Legionella pneumophila serogroup 2, Legionella pneumophila serogroup 3, and Legionella pneumophila serogroup 4.

**CONCLUSION / SIGNIFICANCE**

The presence of virulent strains of Legionella in the NYC water system is a public health concern. The results of this study suggest that Legionella is widespread in the NYC water system. This finding is significant because it indicates that Legionella is present in the water that is consumed by millions of people in NYC.

**REFERENCES**

Centers for Disease Control and Prevention (2017). Legionnaires' disease. Retrieved from <https://www.cdc.gov/disease/legionnaires-disease/>

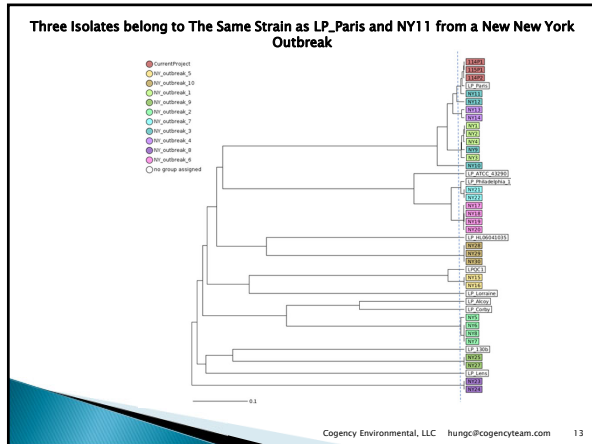
Parham, A. et al. (2014). Legionnaires' disease and risk factors. New York, NY: NYU School of Medicine, Department of Environmental Health Sciences.

NYC Department of Environmental Protection. (2019). NYC water quality report. Retrieved from <https://www1.nyc.gov/assets/doh/downloads/pdf/water/water-quality-report-2019.pdf>

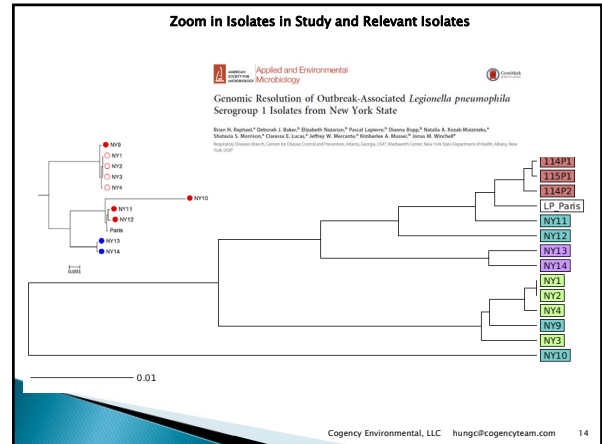
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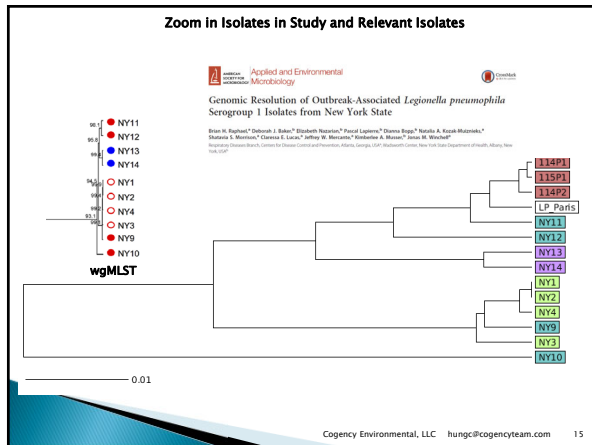
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# Waterborne Pathogen Microbiology

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16

## Modes of Transmission

- ▶ Direct aerosol transmission from water to patients:
  - aerosol from a shower or
  - room humidifier, or
  - Aerator in faucet, or
  - cooling tower, or
  - aspiration while drinking water

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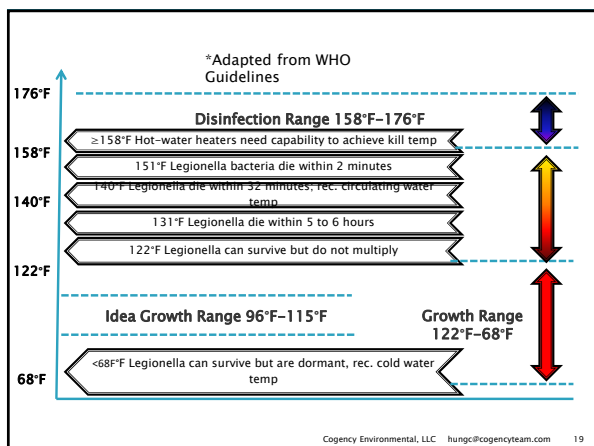
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## *Legionella* Growth Conditions

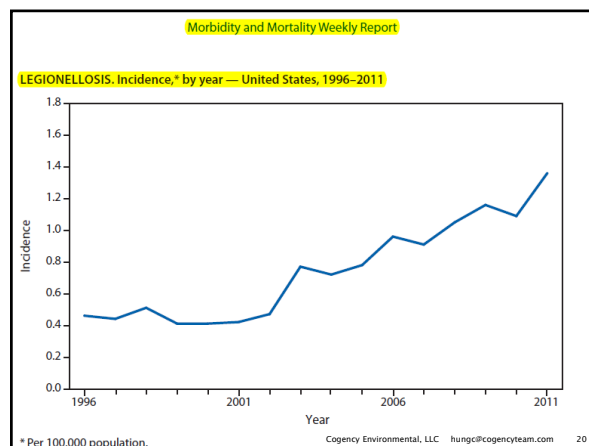
- ▶ Water (potable, industrial, lakes, etc.)
- ▶ Temperature 68–120°F (20–49°C)
  - Ideal growth range 96–115°F (35–46°C)
- ▶ Commensal organisms (amoebae)
- ▶ Biofilms
- ▶ Sediment, scale, algae

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18



19



20

### Legionella pneumophila

- Exposure by:
  - Inhalation of aerosolized *Legionella* contaminated water droplets
  - Aspiration or choking of drinking *Legionella* contaminated water
  - Handling *Legionella* contaminated soil
  - Surgical wounds treated with *Legionella* contaminated potable water
- Causes Legionellosis
  - Legionnaire's disease (LD)
  - Pontiac Fever (PF)

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21

### What is Legionnaires' disease?

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22

### Legionnaires' Disease

- Develops 2–10/14 days after exposure to *legionella* bacteria with an avg. of 5–6 days
- Symptoms (extrapulmonary) include:
  - Headache, muscle pain, chills
  - Fever that may be 104 F (40 C) or higher
  - Cough, mucus and sometimes blood
  - Shortness of breath, chest pain
  - Gastrointestinal symptoms, such as nausea, vomiting and diarrhea
  - Confusion or other mental changes
  - Cardiovascular collapse and death

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23

### Risk Factors/ Susceptibility

- Smokers
- Elderly (Age 50 or older)
- Lung or kidney disease
- Diabetes
- Cancer
- Weakened immune system due to medications or disease

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24

## Legionnaires' Disease

- ▶ Reportable disease (HD, CDC)
- ▶ Incidence tripled from 2000 to 2009
- ▶ Estimated about 18,000 hospitalizations in the US per year
- ▶ Attack Rate (AR = Cases/ Exposed) is <5%
- ▶ Case Fatality Rate approx.30%



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25

## Pontiac Fever (PF)

- ▶ Flu-like symptoms, including:
  - Fever
  - Chills
  - Headache
  - Muscle aches
- ▶ Does not infect lungs
- ▶ Usually clears within 2-5 days



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26

26

▶ Questions?

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27

27