Water Quality in Building Premise Plumbing

CHES SCISS
Canadian Healthcare Engineering Society
MARITIME CHAPTER
Société canadienne d'ingénierie des services de santé
CHAPITRE MARITIME

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Solutions today
Tomorrow IN mind

Agenda

- Introduction
- Building Water Quality
- Legionella
- Standards/Guidelines
- Water Management Plans
- Legionella Testing
- Legionella Control Methods

INnovative Solutions

Our diverse team of over 400 employees is committed to providing technical excellence and exceptional service.

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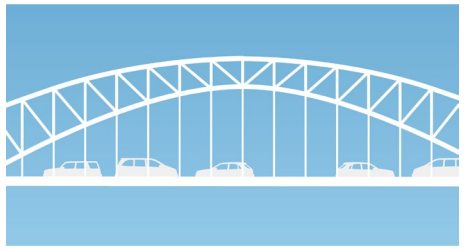
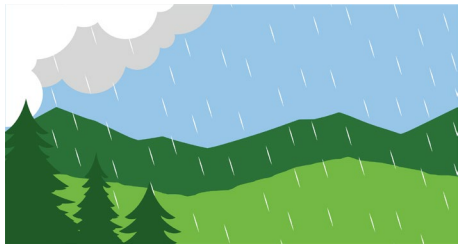
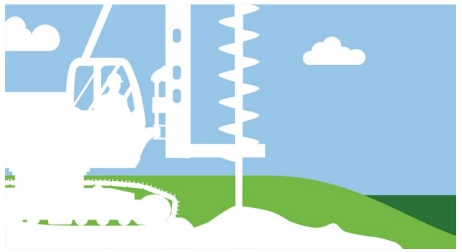
Buildings


Bridges


Climate Resilience


Coastal


Environmental

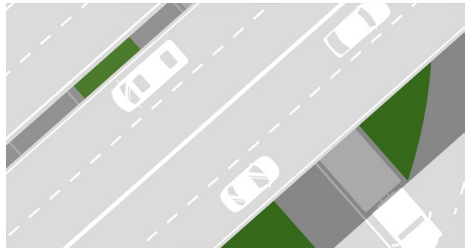

Geotechnical

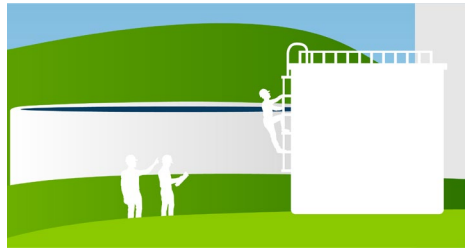

Industrial


Municipal


Ports & Marine


Sustainability


Transportation


Water

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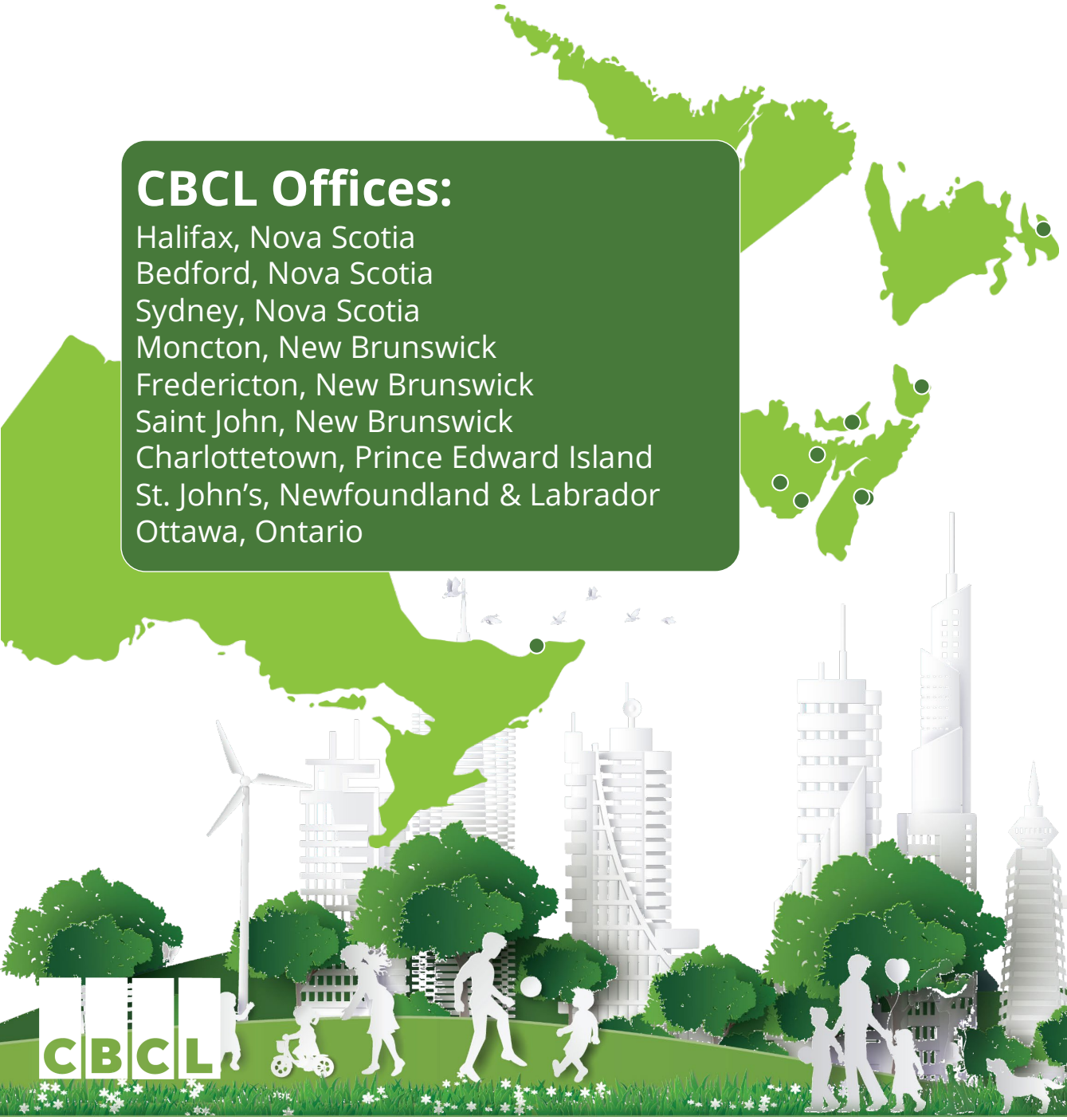

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CBCL has 12 offices in five provinces. Our diverse team of over 400 employees is committed to providing technical excellence and exceptional service.

Building Water Uses

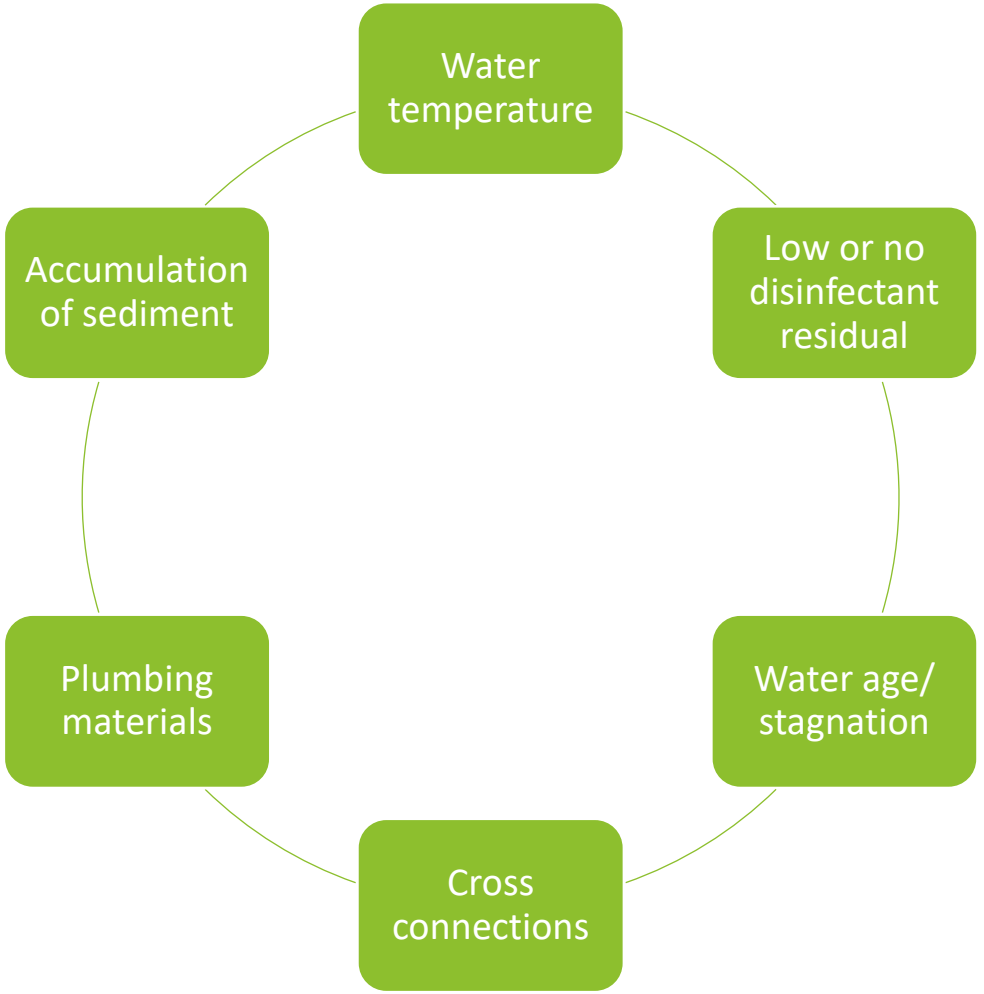
Potable water

- Drinking water
- Shower/baths
- Clinical
- Dialysis
- Pools/hot tubs

Non potable

- Cooling water towers
- Heating
- Fountains/Pools

Factors Affecting Water Quality in Premise Plumbing



Water Quality in Premise Plumbing

Issues	Examples	Details
Disinfection By-Products (DBPs)	• Trihalomethanes (THMs)	• Cancer causing
	• Haloacetic Acids (HAAs)	• Cancer causing
Opportunistic Pathogens in Premise Plumbing (OPPs)	• Legionella pneumophila	• Severe pneumonia • 20% mortality
	• Naegleria fowleri	• Brain-eating amoeba • 98% mortality • Associated with warm waters
	• Pseudomonas aeruginosa	• Lung, ear, and skin infections • Colonize hospital taps
Metals Release	• Lead	• Physical and mental development
	• Copper	• Generally non-toxic but high concentrations may indicate corrosion issues

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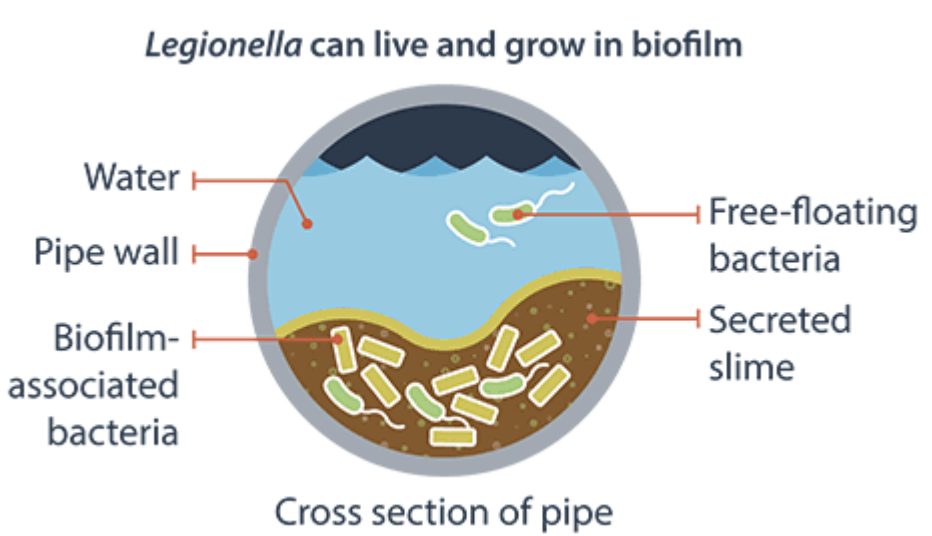
Legionella

- Optimal growth temperature is between 25-45°C
- Aged plumbing systems with dead-ends host stagnant water and corroding pipes, which promotes the growth of biofilm
- Biofilms shield legionella from treatment and promotes rapid recolonization
- Large campuses with low-flow areas and long residence times lead to greater depletion of disinfectant residual



https://www.cdc.gov/legionella/wmp/overview/growth-and-spread.html

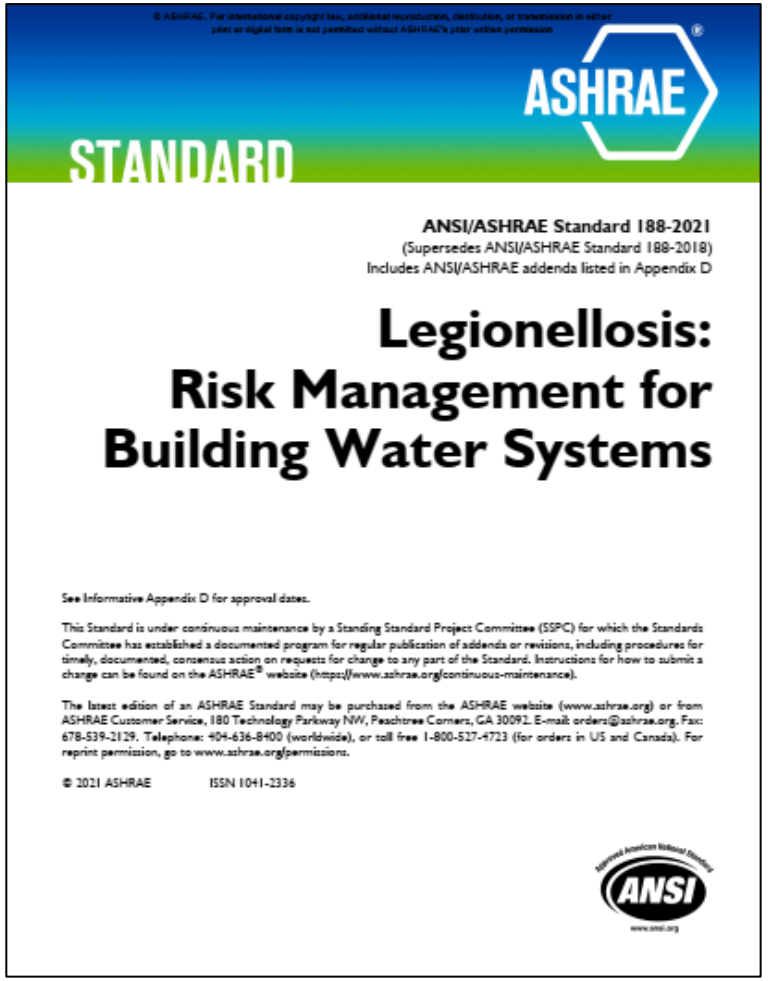
Legionnaire's Disease

- Serious type of pneumonia caused from Legionella bacteria
- Discovered after outbreak in 1976 at a Philadelphia convention of the American Legion
- Bacteria is aerosolized so people breathe in small, contaminated water droplets

https://www.cdc.gov/legionella/about/history.html#f1

ASHRAE - Standard 188-2021

- Legionellosis: Risk Management for Building Water Systems
- Establishes minimum legionellosis risk management requirements for building water systems
- Standard includes requirements for water management plan



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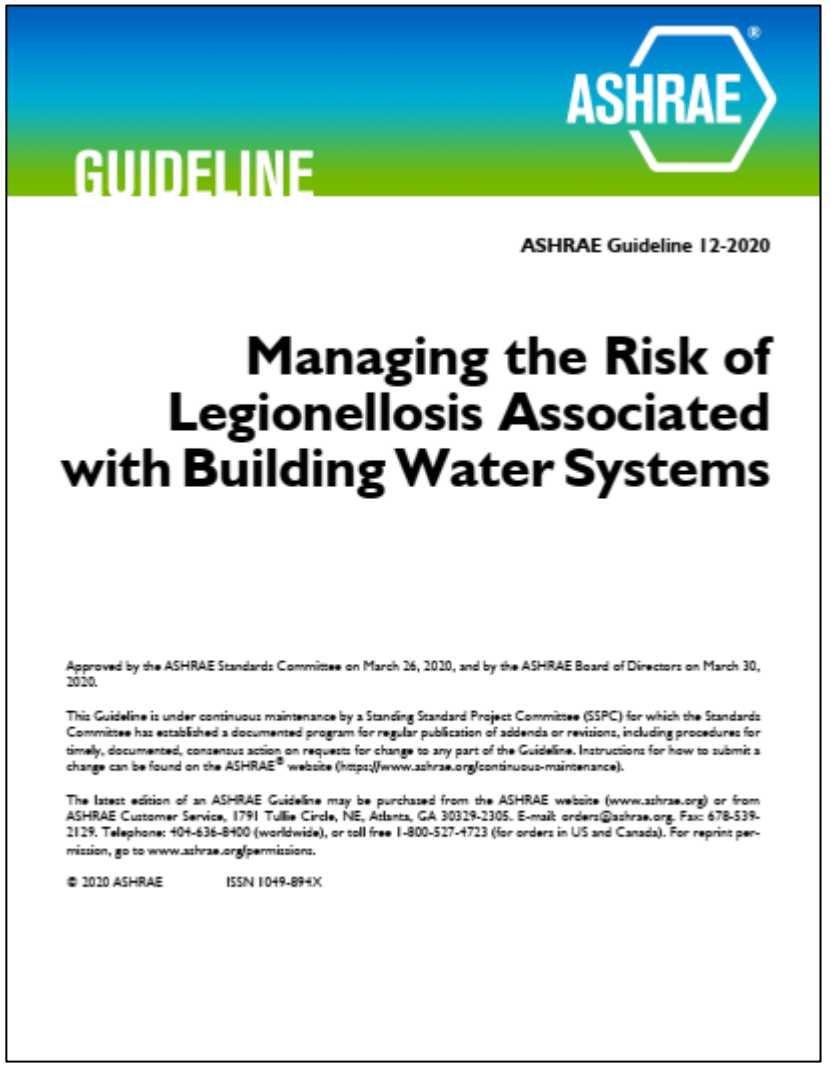
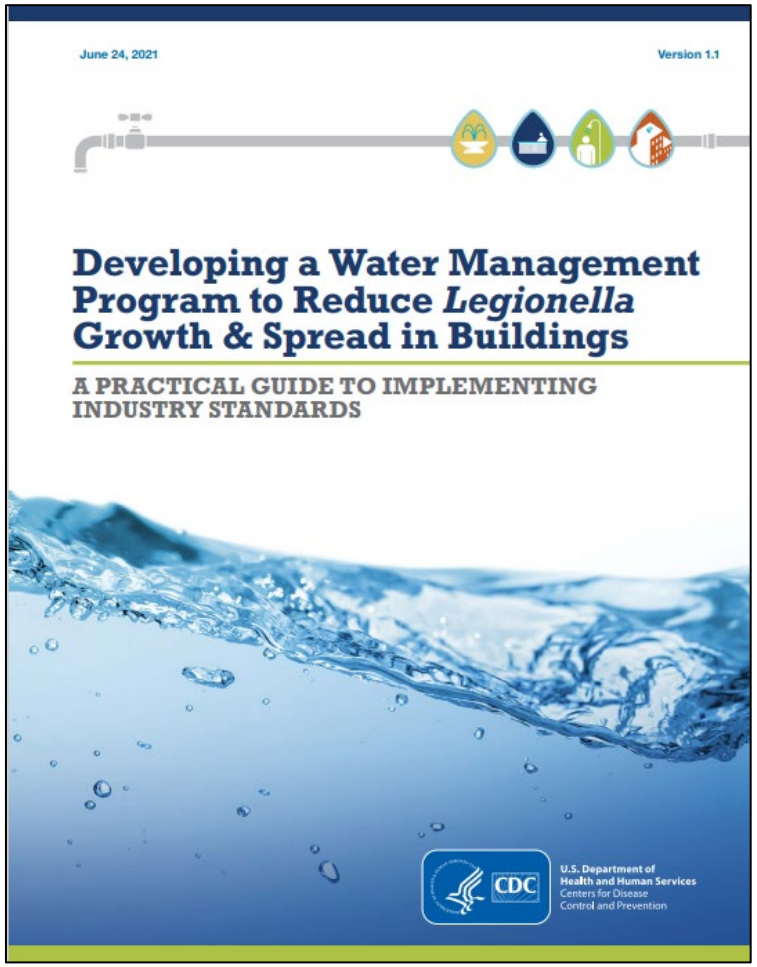
ASHRAE- Guideline 12-2020

- Managing the Risk of Legionellosis Associated with Building Water Systems
- Guidance document for implementing ASHRAE Standard 188
- Provides additional background and context for implementing Water Management Plan



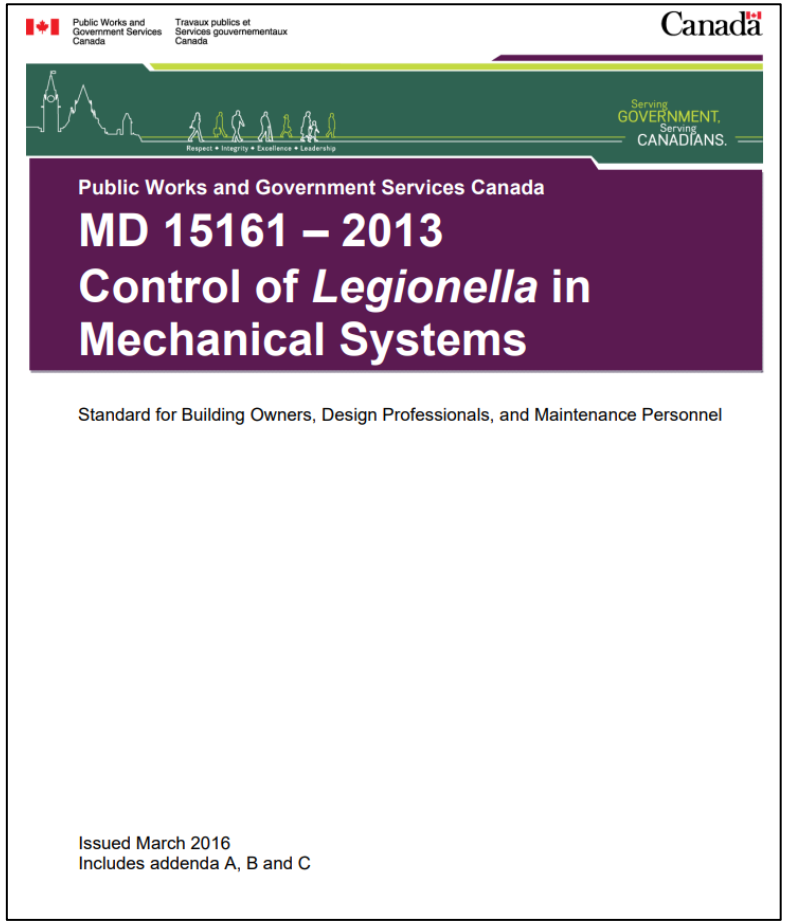
CDC – Development of Water Management Program

- This toolkit provides guidance to help develop, implement, and evaluate a Legionella water management program to reduce the risk of Legionella growth and spread in buildings



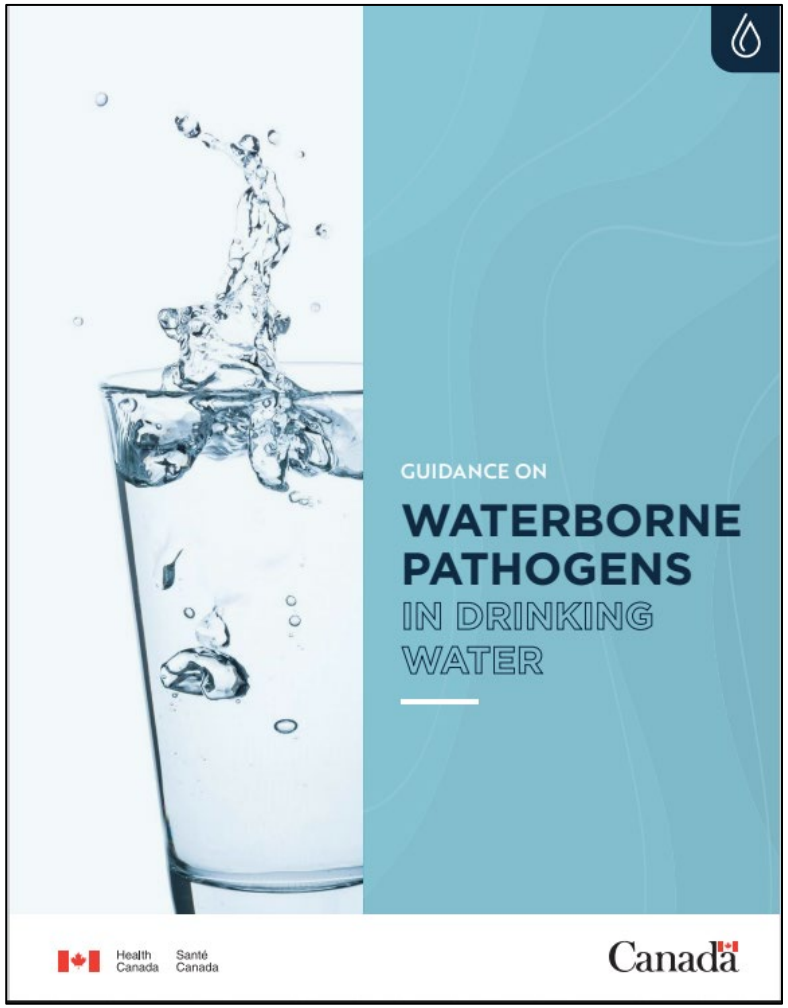
PWGSC- Control of *Legionella* in Mechanical Systems

- Provides the minimum requirements for design, operation, maintenance, and testing to prevent Legionella outbreaks in building water systems
- Key water systems with greatest potential for Legionella amplification:
  - Cooling Towers
  - Open Water Systems
  - Humidifiers
  - Domestic Hot Water Systems

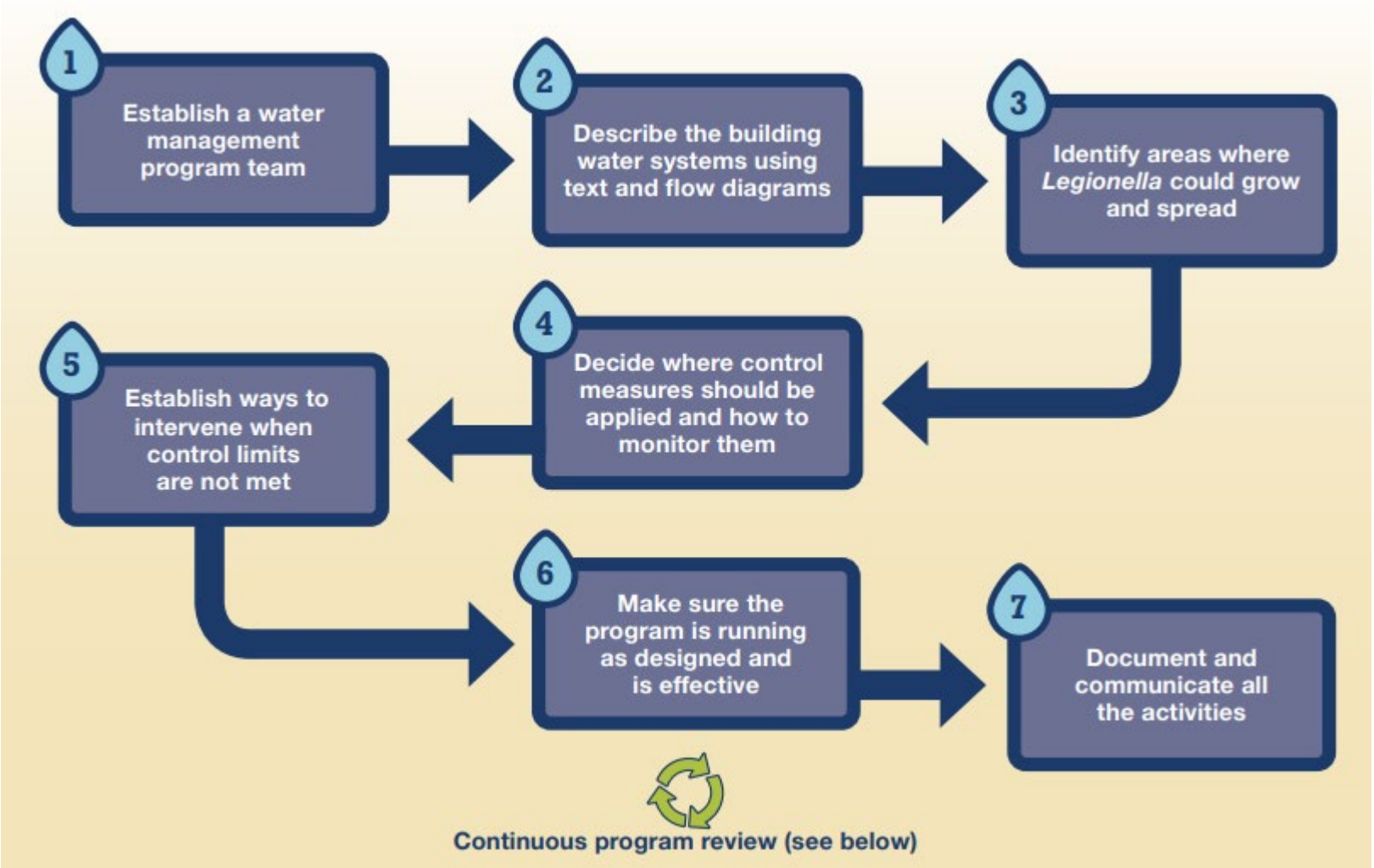


Health Canada- Guidance on Waterborne Pathogens in Drinking Water

- Guidance document that describes
  - Opportunistic pathogens
  - Health effects,
  - How pathogens are transmitted
  - Best practices to ensure safe drinking water



Development of Water Management Program

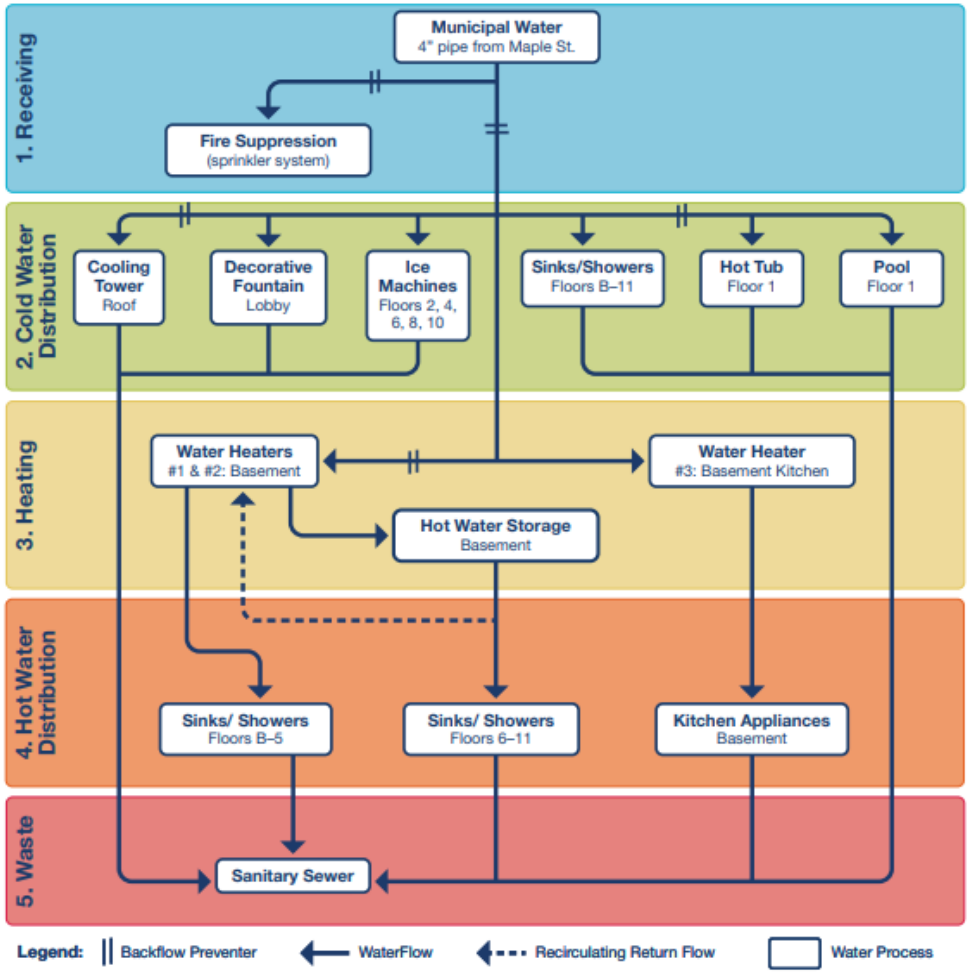


https://www.cdc.gov/legionella/downloads/toolkit.pdf

WMP - Identify Program Team

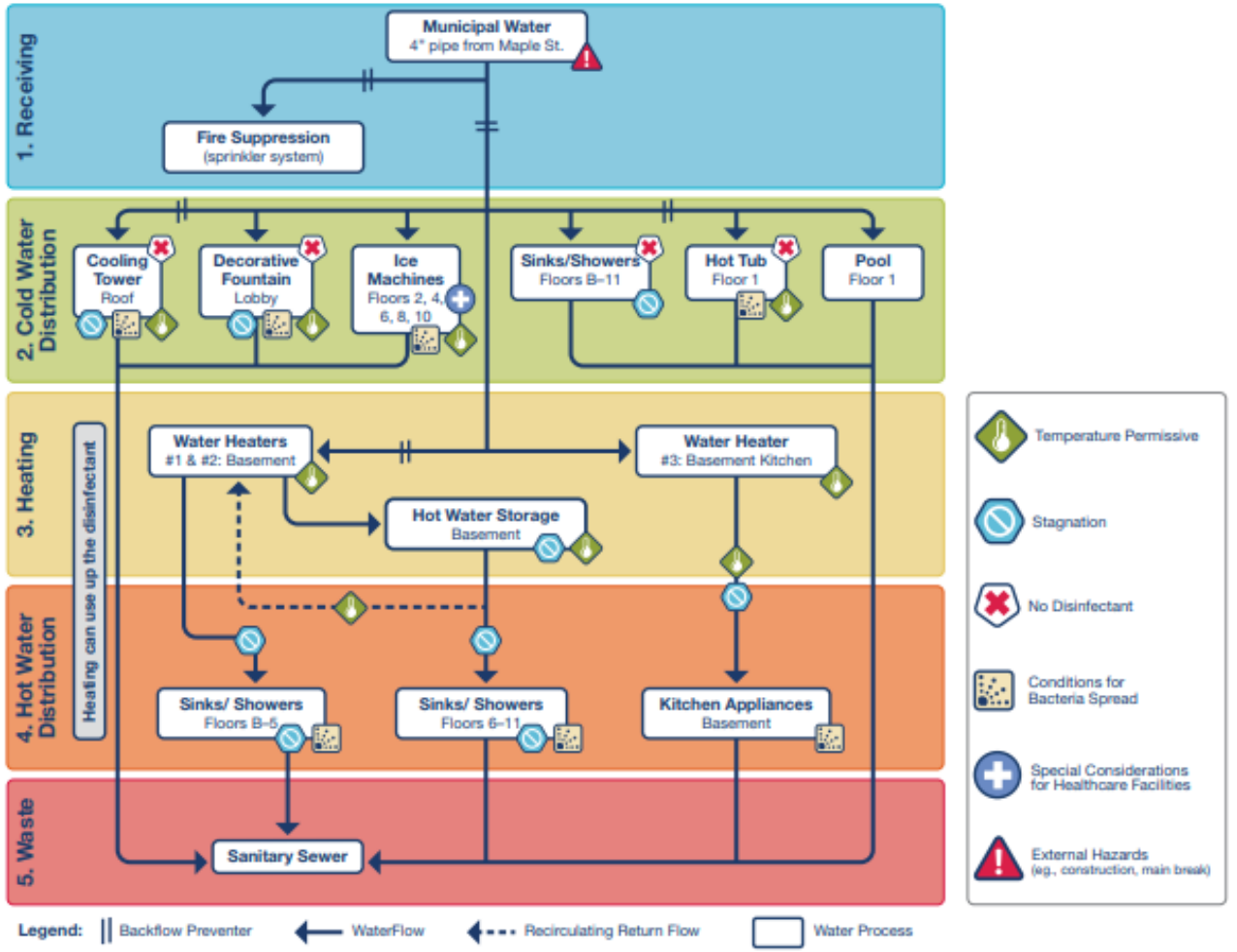
https://www.cdc.gov/legionella/downloads/toolkit.pdf

WMP- Describe the Building Water Systems



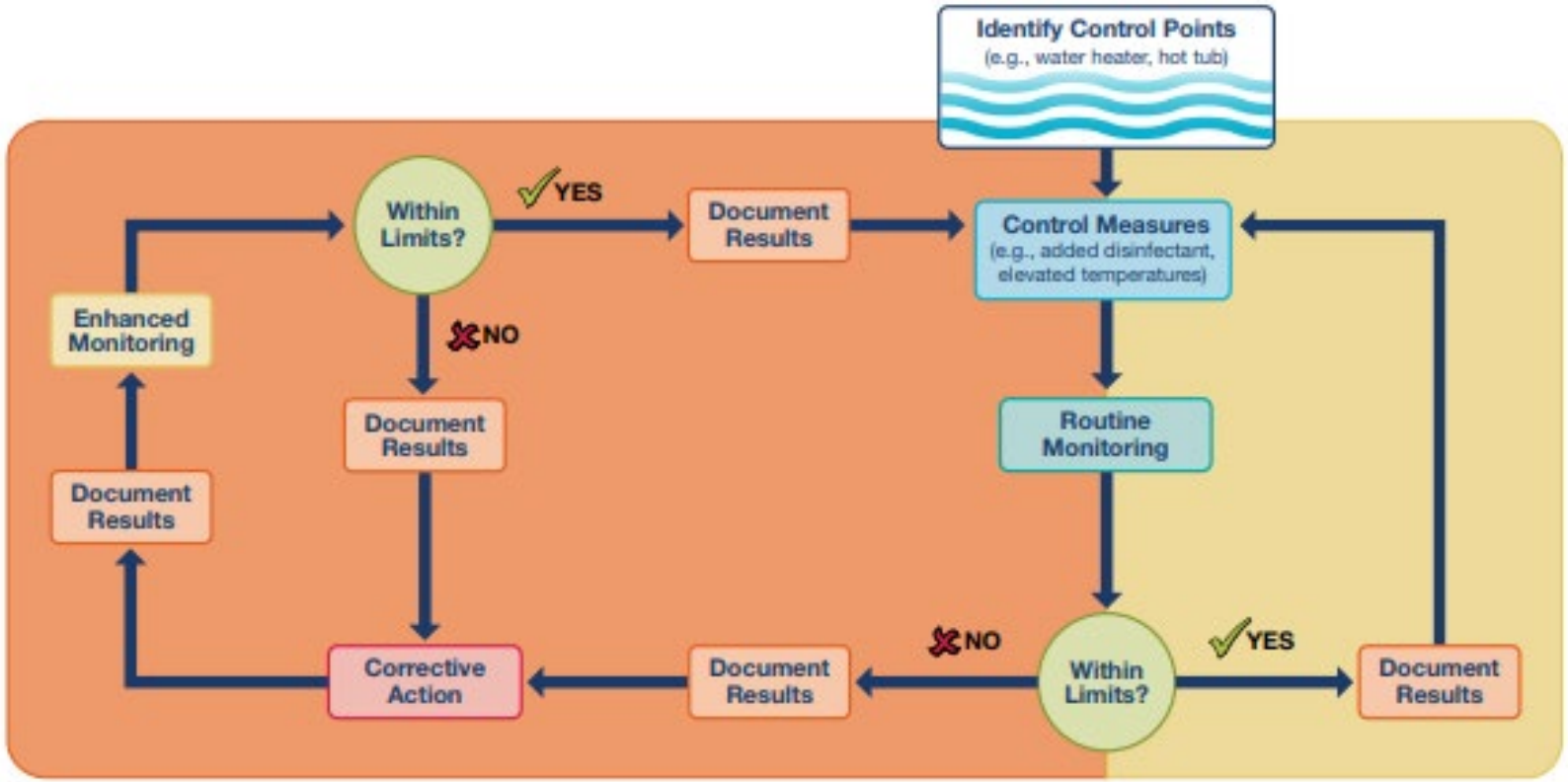
https://www.cdc.gov/legionella/downloads/toolkit.pdf

WMP- Identify where Legionella Could Grow/Spread



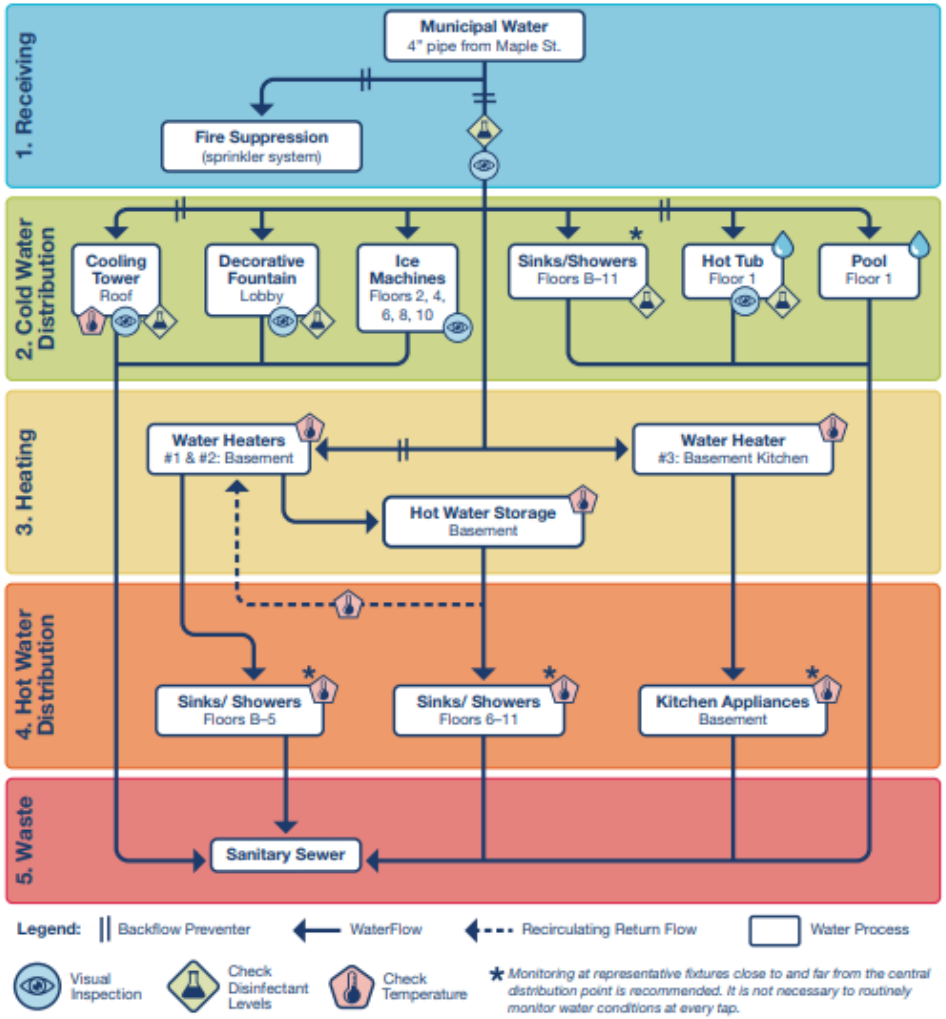
https://www.cdc.gov/legionella/downloads/toolkit.pdf

WMP- Control Measures & Corrective Actions



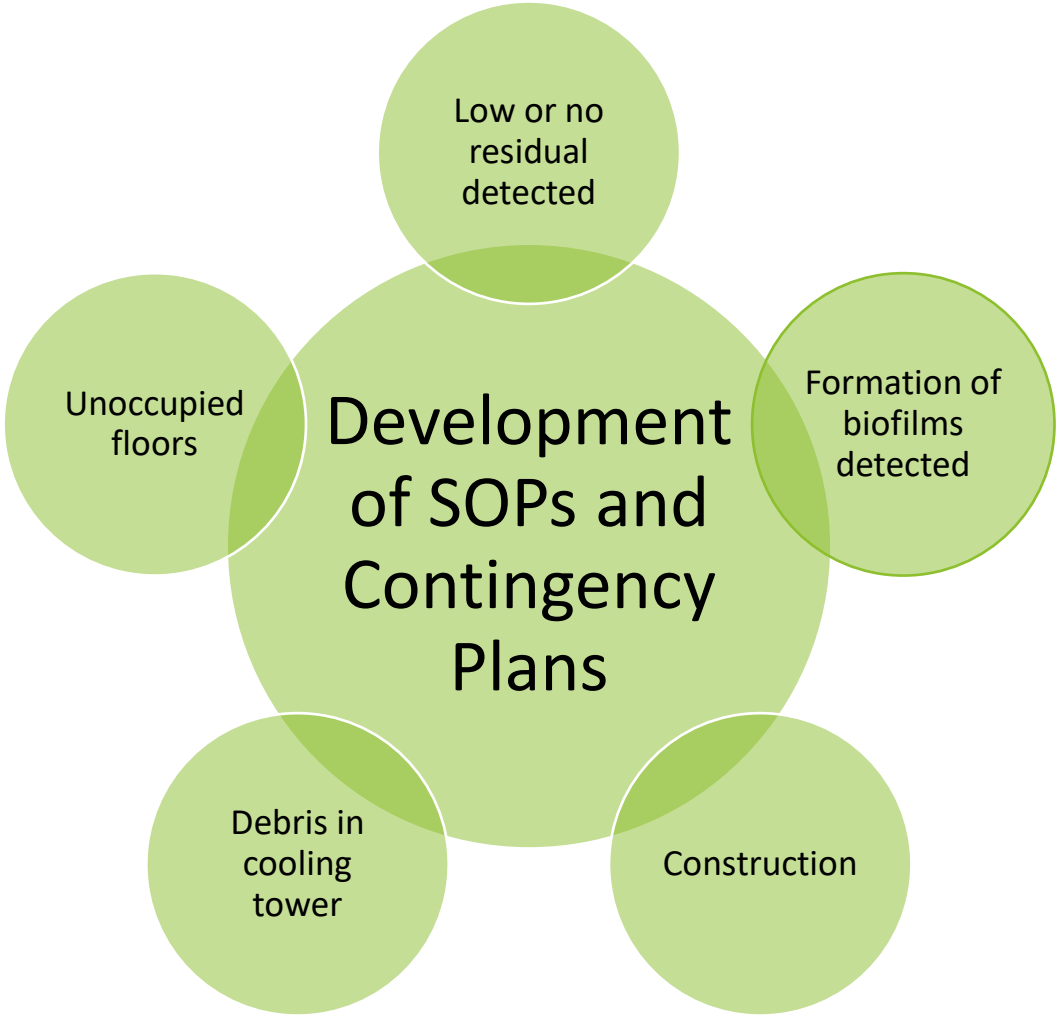
https://www.cdc.gov/legionella/downloads/toolkit.pdf

WMP- Monitoring Control Measures



https://www.cdc.gov/legionella/downloads/toolkit.pdf

WMP- Establish Corrective Actions for Control Measures



https://www.cdc.gov/legionella/downloads/toolkit.pdf

WMP- Is the Program Running as Designed?

- Are we doing what we said we would do?
- Is the program actually working?
- Validation of program – Environmental Sampling

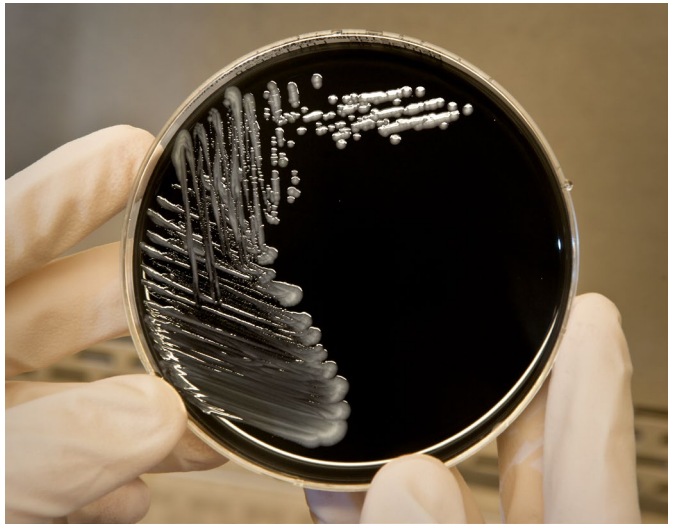
- Documentation and communication

https://www.cdc.gov/legionella/downloads/toolkit.pdf

Legionella Testing Methods

Culture Testing

- The gold standard for Legionella testing
- Analysis takes **7-14 days**
- Quantitative results (CFU/mL) allow interpretation of data as it relates to source strength



https://www.cdc.gov/legionella/images/materials-bacterium.jpg

qPCR Testing

- Analysis performed in **1-2 days**
- Quantitative PCR (qPCR) testing can provide information on the quantities of Legionella DNA present (GE/mL)

https://www.luminultra.com/blog/category/solutions/legionella/

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Legionella Action Levels

MD-15161 Legionella Culture Test Result Action Levels (Total Legionella Pneumophila – LP_{TOT})			
System Type	**Level C1 (Green) (CFU/mL)**	**Level C2 (Orange) (CFU/mL)**	**Level C3 (Red) (CFU/mL)**
Cooling Towers	$LP_{TOT} < 10$	$10 \leq LP_{TOT} \leq 1000$	$LP_{TOT} > 1000$
Open Water Systems	$LP_{TOT} < 10$	$10 \leq LP_{TOT} \leq 1000$	$LP_{TOT} > 1000$
Humidifiers	$LP_{TOT} < 1$	$1 \leq LP_{TOT} \leq 100$	$LP_{TOT} > 100$
Domestic Hot Water Systems	$LP_{TOT} < 10$	$10 \leq LP_{TOT} \leq 100$	$LP_{TOT} > 100$

PWGSC - Control of Legionella in Mechanical Systems

MD-15161 qPCR Test Result Action Levels (Legionella DNA – Alive and Dead)			
System Type	**Level Q1 (Green) (GE/mL)**	**Level Q2 (Yellow) (GE/mL)**	**Level Q3 (Orange) (GE/mL)**
Cooling Towers	$LP_{TOT} < 10$	$10 \leq LP_{TOT} \leq 100$	$LP_{TOT} > 100$
Open Water Systems	$LP_{TOT} < 10$	$10 \leq LP_{TOT} \leq 100$	$LP_{TOT} > 100$
Humidifiers	$LP_{TOT} < 10$	$10 \leq LP_{TOT} \leq 100$	$LP_{TOT} > 100$
Domestic Hot Water Systems	$LP_{TOT} < 10$	$10 \leq LP_{TOT} \leq 100$	$LP_{TOT} > 100$

PWGSC - Control of Legionella in Mechanical Systems

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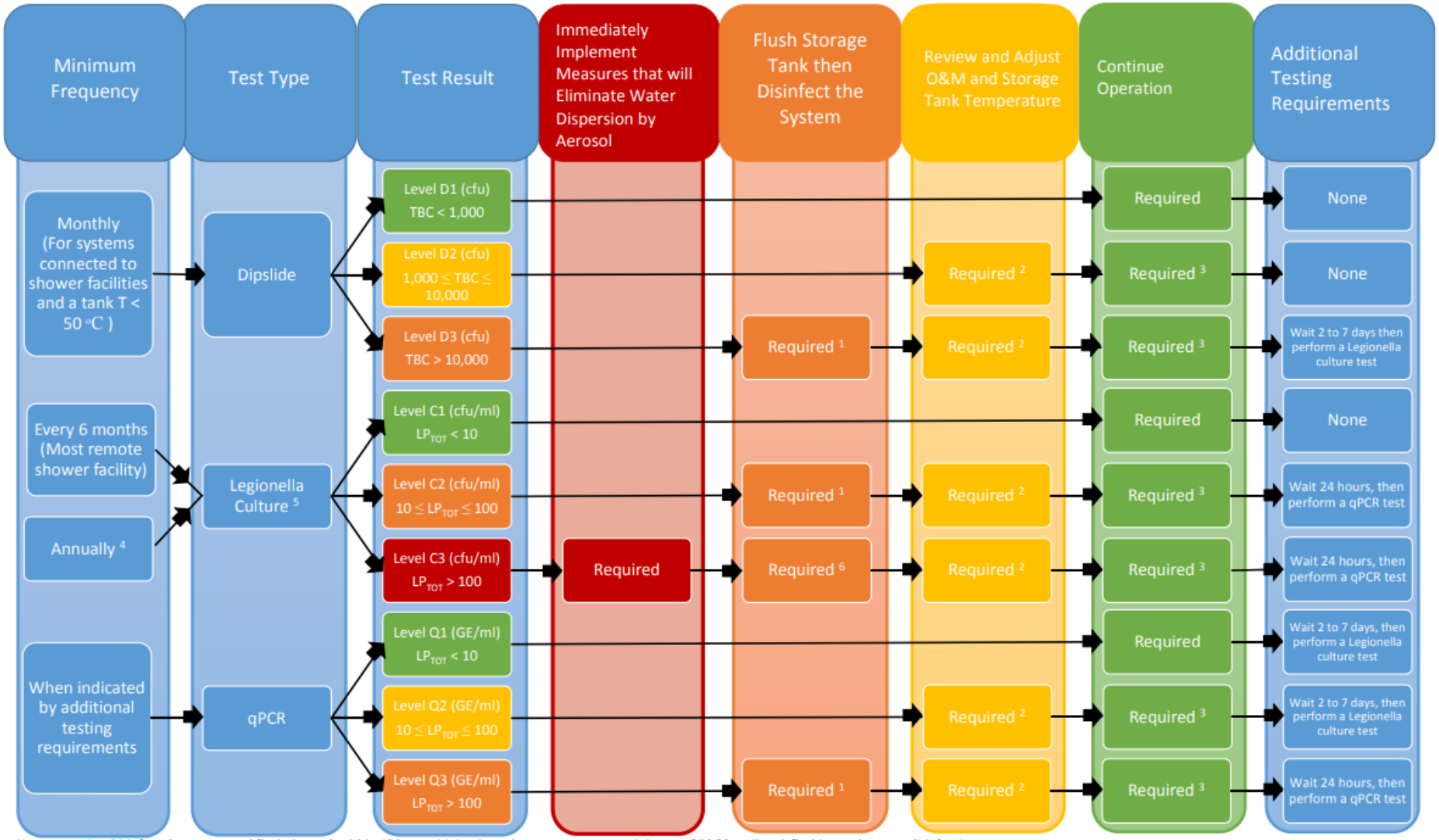
Domestic Hot Water Systems Bacterial Test Protocol

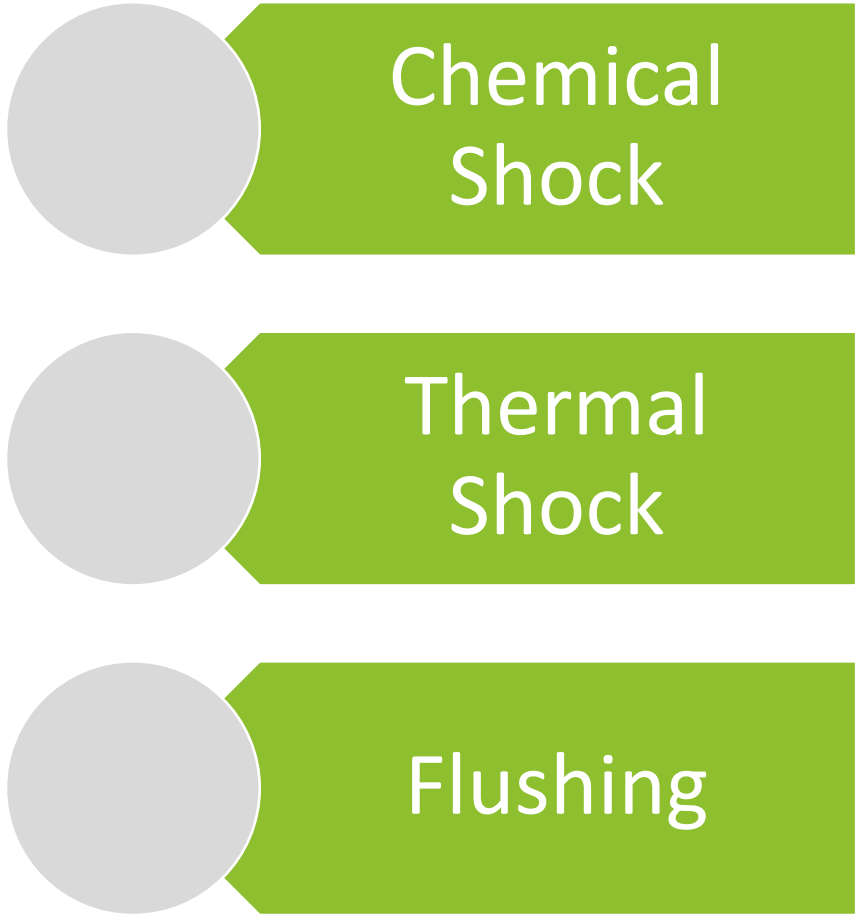


Notes:
1. Disinfect the system and flush the tank within 48 hours. Maintain tank temperature at a minimum of 50 °C until tank flushing and system disinfection.
2. If the storage tank temperature is less than 60 °C then the storage tank temperature is to be adjusted to 60 °C where the system is equipped with measures to prevent scalding at the point of use.
3. With adjusted O&M and storage tank temperature.
4. Most remote fixture for systems with a storage temperature below 50 °C that serve multiple areas in a building and are not connected to showers.
5. Refer to MD-15161 clause 6.4.27 when there is interfering flora in the test result.
6. Clean the storage tank in accordance with manufacturer's recommendations and disinfect the system.

Legionella Control Methods

- Temperature Control
- Supplemental Disinfection
- Filtration
- Flushing
- Recirculation
- Cleaning and Maintenance

Legionella Remedial Actions



Questions?

Melissa Fraser
mfraser@cbcl.ca

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