

Controlling *Legionella* in Potable Water Systems

Purpose

Use this document to:

1. Help evaluate hazardous conditions associated with potable water systems
2. Implement *Legionella* control measures for potable water systems per ASHRAE Guideline 12-2020
3. Complement existing resources for water management programs (WMP)
4. Support environmental assessments conducted during public health investigations

Key Points

- No single control measure ensures the control of *Legionella* in potable water systems.
- Thermal remediation is not recommended for potable water systems.

Sediment and biofilm, Temperature, water Age, and disinfectant Residuals (STAR) are the key factors that affect Legionella growth in potable water systems

Design

Understanding potable water system design components is critical for *Legionella* control. The following considerations apply to hot and cold potable water systems. They should be evaluated from the point at which water enters a facility system to the point where it leaves the system through a fixture or device.

Design Recommendations

- Use pipe insulation to maintain hot and cold water temperatures throughout the water system.
- Eliminate sections of no- or low-water flow called dead legs.
- Install thermostatic mixing valves as close as possible to fixtures to prevent scalding while permitting circulating hot water temperatures above 120°F (49°C).
- Recognize that low-flow and mechanically complex fixtures (e.g., electronic sensor faucets) can increase the risk of *Legionella* growth.
- Identify water system components that speed the decay of disinfectant residuals (e.g., UV devices, water softeners, carbon filters, heaters).
- Use appropriately sized hot and cold water storage tanks fitted with recirculating pumps to maintain flow and avoid unfavorable temperature gradients.
- Consider installing sampling ports throughout your water system in locations to facilitate water parameter monitoring and WMP validation.



Operation, Maintenance, and Control Limits

Use a WMP to protect building operators, staff, and visitors from exposure to *Legionella* in potable water systems. No single measure can ensure *Legionella* control. A comprehensive WMP allows water system operators to layer a series of complementary control measures to create environmental conditions that prevent bacterial intrusion, growth, and transmission. Develop or refine a WMP with the following guidelines in mind:

- Monitor temperature, disinfectant residuals, and pH frequently based on performance of water management program or *Legionella* performance indicators for control. Adjust measurement frequency according to the stability of performance indicator values. For example, the measurement frequency should be increased if there is a high degree of measurement variability.
- Store hot water at temperatures above 140°F (60°C) and ensure hot water in circulation does not fall below 120°F (49°C). Recirculate hot water continuously, if possible.
- Store and circulate cold water at temperatures below the favorable range for *Legionella* (77–113°F, 25–45°C); *Legionella* may grow at temperatures as low as 68°F (20°C).
- Ensure a disinfectant residual is detectable throughout the potable water system.
- Flush low-flow piping runs and dead legs at least weekly and flush infrequently used fixtures (e.g., eye wash stations, emergency showers) regularly as-needed to maintain water quality parameters within control limits.
- Clean and maintain water system components, such as thermostatic mixing valves, aerators, showerheads, hoses, filters, and storage tanks, regularly.
- Do not presume supplemental disinfection systems will control *Legionella* without an adequate WMP.
 - » Selecting or operating a supplemental disinfection system inappropriately may result in system damage or health hazards (e.g., disinfectant byproducts). Consult with a water treatment professional regarding supplemental disinfection systems. They may require permitting.
- Recognize that point-of-use (POU) microbial filters with an effective pore size of 0.2-microns or less that comply with the requirements of [ASTM F838](#) can provide immediate control at individual fixtures in a water system if integrated into a WMP.
 - » POU filters protect only the connected fixture. Correct location selection is critical to *Legionella* exposure prevention across the water system.
 - » Follow the manufacturer recommendations regarding frequency of replacement and appropriate operating conditions.
 - » POU filters may need to be removed before performing an acute remediation procedure.
- Consider testing for *Legionella* in accordance with Routine Testing for *Legionella* (Page F1).

Remediation

If an outbreak or illness is suspected, test in conjunction with public health in order to:

- Confirm the presence of *Legionella* before performing remediation.
- Confirm elimination of *Legionella* after remediation activities.

If control measures are ineffective, if routine results indicate poor *Legionella* control, or if an outbreak or illness is suspected by the authority having jurisdiction (AHJ), consider the remediation options described below. Note: The public health AHJ determines whether there are associated illness(es) or an outbreak. Choose a remedial treatment procedure after considering the system infrastructure, water quality parameters, and available sampling results. Consult with a water treatment professional as certain procedures should only be undertaken by a professional. **Following a successful *Legionella* remediation procedure, recolonization of the water system is likely unless the underlying conditions supporting *Legionella* growth are addressed.**

- Chemical shock using an elevated level of a disinfectant, such as chlorine, for a limited duration can control *Legionella* in a potable water system. Consult scientific evidence and technical expertise before choosing a specific chemical shock procedure. In addition:
 - » Consider which components of the water system need remediation.
 - » Chemical shock of a hot water system may have improved efficacy if the temperature is lowered.
 - » Chemical shock options may be impacted by regulations (e.g., chemicals allowed into sewer discharge) and may require permitting.
- Thermal shock of water systems is not recommended due to frequent failure and rapid recolonization of *Legionella*.

Table 1. *Legionella* Control Measures for Potable Water Systems

	Water Parameter	Control Measure	Recommendations
S	Sediment and Biofilm	Flushing, cleaning, and maintenance	<ul style="list-style-type: none"> • Flush after an intrusion event (e.g., water main break). • Clean and maintain water system components such as water heaters, mixing valves, aerators, showerheads, hoses, and filters regularly as indicated by water quality measurements.
T	Temperature	Control limits	<ul style="list-style-type: none"> • Store hot water above 140°F (60°C) and maintain circulating hot water above 120°F (49°C). • Store and maintain circulating cold water below the growth range most favorable to <i>Legionella</i> (77–113°F, 25–45°C). Note that <i>Legionella</i> may grow at temperatures as low as 68°F (20°C).
A	Water Age	Flushing	<ul style="list-style-type: none"> • Flush low-flow pipe runs and dead legs at least weekly. • Flush infrequently used fixtures regularly.
R	Disinfectant Residual*	Control limits	<ul style="list-style-type: none"> • Chlorine: Detectable residual as directed by WMP. • Monochloramine: Detectable residual as directed by WMP.

* Disinfectant residual recommendations apply to disinfectant delivered by the municipal water authority. Supplemental disinfection system control limits are not prescribed here and must be dictated by the water treatment professional and water management program.

Resources

- Toolkit for Controlling *Legionella* in Common Sources of Exposure: <https://www.cdc.gov/legionella/wmp/control-toolkit/index.html>
- Toolkit: Developing a Water Management Program to Reduce *Legionella* Growth and Spread in Buildings: <https://www.cdc.gov/legionella/wmp/toolkit/index.html>
- *Legionella* Environmental Assessment Form: <https://www.cdc.gov/legionella/downloads/legionella-environmental-assessment-p.pdf>
- PreventLD Training: <https://www.cdc.gov/nceh/ehs/elearn/prevent-LD-training.html>
- ASHRAE Guideline 12-2020: <https://www.ashrae.org/technical-resources/standards-and-guidelines/guidance-on-reducing-the-risk-of-legionella>