

Develop Legionella Management Plan

BEST PRACTICES FOR PLAN CREATION

Below are best practices for creating a building Legionella management plan.

- ✓ Plans should consider hot water systems, cooling towers, decorative fountains and any other devices or spaces under control of the project where water is recirculated and aerosolized.
- ✓ Before embarking into developing a plan review resources such as the [US CDC Legionella Toolkit](#), [ESGLI guidance](#), and Hong Kong [Code of Practice](#), which can provide assistance to understand the risks and recommended management strategies.
- ✓ Check applicable regulations for Legionella management as documents produced in response to legal requirements may be useful.
- ✓ Large and / or complex buildings can consider hiring a water consultant to prepare a comprehensive plan.

1. Formation of a **team** for Legionella management:

- Include at least the following roles:
 - Building owner
 - Building manager
 - Building engineer
 - Maintenance personnel
 - Plan preparer (who wrote the plan)
 - (If applicable – interiors project) Project owner or office manager
 - (If applicable – interiors project) Project engineer (if different than building engineer)
 - (If applicable) Cooling tower / water heater specialists
 - (If applicable) Water specialist/consultant
 - (If applicable) Tenants' space managers
- Specify backup roles for night shifts, weekends/holidays and vacations
- The list should be periodically updated to reflect changes in vacancy, tenants and staff

2. **Water system inventory** and production of **process flow diagrams**:

- Water system inventory:
 - When the building is existing, consider performing a walk-through of the building. If the project is new, review the plumbing plans.
 - For core and whole building projects, the inventory should reflect all changes in plumbing performed by tenants
 - Confirm/update any fixtures and equipment that propel or stop water (such as pumps and main check valves) in plumbing plans
 - A non-exhaustive list of fixtures and devices that must be present are shown below. In general, all fixtures that may create water mist should be considered:
 - i. Cooling towers
 - ii. Decorative spraying fountains
 - iii. Drinking water tanks (usually located on the rooftop)
 - iv. Fixtures that deliver hot water or a mix of cold and hot water
 - v. Hot water heaters
 - vi. Hot water tanks (sometimes part of the water heater device)
 - vii. Pumps
 - viii. Riser lines
 - ix. Showers
 - x. Spas / steam rooms
 - xi. Warm water pools

- **Process Flow Diagram:**
 - a. The Process Flow Diagram is a simplified schematic drawing that is easy to follow. It represents the flow of water throughout the system and represents the inventoried fixtures.
 - b. The Process Flow Diagram is not meant to be scaled, dimensionally accurate representation of the plumbing system.
 - c. Note: cooling towers and fountains are usually an independent loop within the building's premise plumbing and may be described in a separate diagram

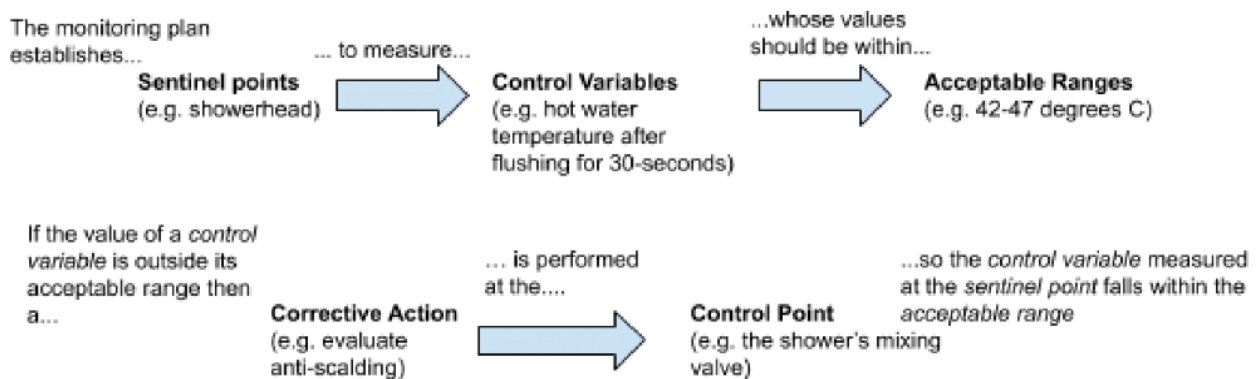
3. Hazard analysis of water assets:

- The main source of risk for Legionella colonization is typically the presence of water without disinfectant at a temperature between 85°F (30°C) and 110°F (43°C), particularly if left stagnant. This water may prompt the development of biofilms that can contain Legionella. The risk analysis should identify where such a situation can occur and propose monitoring and control measures to prevent it.
- Elements that must be considered when conducting a hazard analysis include:
 - Presence of vulnerable populations (elderly, smokers, immunocompromised)
 - Vacancy (e.g., tenant turnover, room occupancy in hotels/hospitals) that may lead to stagnation of water
 - Plumbing modifications that may produce dead legs (i.e., unconnected sections of plumbing where water does not circulate)
 - Usage patterns that may produce temporal water stagnation, like weekends in office buildings or seasonal hotel residencies
 - Any device that recirculates water and may produce mist (water aerosols)
- A non-exhaustive list of questions that a risk analysis should address include the following:
 - Can drift from the building's cooling towers (or from other nearby structures) enter the ventilation system?
 - Are all recirculating waters treated (spas, pools, water fountains, cooling towers, etc.)?
 - Does the project have a recirculating hot water system or residential on-demand heaters near the points of usage?
 - Are there any fixtures that experience limited use?
 - For showers and bathroom fixtures, is water mixed at the source (i.e., right after the heater) or at the point of use (say, at the shower valve)?
 - Are the hot water lines properly insulated?

4 & 5. Monitoring actions for relevant variables, performance limits associated with these variables and corrective actions when variables exceed limits, and identification of critical control points:

- The hazard analysis from #3 above can be used to determine a set of monitoring (control) variables, their appropriate performance limits and actions to ensure the proper functioning of the plumbing system and minimize the risk of exposure to Legionella. It can also be used to determine critical control points.
 - The control variables, performance limits, corrective actions and list of critical control points should be updates on a regular basis.
- **Terms:**
 - **Sentinel (measuring) points:** specific locations where the measuring variables are measured.
 - In the case of the hot water temperature, a sentinel point could be at the hot water return in a recirculating water loop, before re-entering the boiler
 - **Monitoring variables:** measurements that assess the status of the plumbing system and their target ranges at the sentinel points. These are parameters that, when routinely measured, inform the status of the plumbing system.
 - For instance, one variable is the hot water temperature. Another example is the target concentration of residual chlorine in the water of a decorative fountain
 - **Performance limits:** a range of accepted values for each control variable.
 - For instance, the water temperature at the hot water return should not be below 120°F / 50°C. If the measured value of the control value falls beyond the limits, corrective actions are sets of procedures designed to return control variables within the desired range.
 - **Control actions:** sets of procedures designed to maintain the control variables within the desired range. These actions are performed at the **control points**, which may or may not be the same as the sentinel points.
 - For example, in a hotel that experiences extended vacancy, flushing a showerhead on a weekly basis for 5 minutes is an example of a control action.

- **Corrective actions:** sets of procedures designed to return the monitoring variables to the desired ranges if they fall outside the ranges.
 - For example, if the water temperature at the hot water return is below 120°F / 50°C, then the following actions will be performed:
 1. Evaluate the piping for leaks and quality of insulation
 2. Measure the temperature delivered by the hot water heater
 3. Check the heater's settings
 4. Call the boiler specialist
- **Critical control points:** any points in the system where hazards can be prevented, eliminated or adjusted to be within performance limits.
- A graphical explanation, along with common terms used in the trade, is shown below:



6 & 7. Verification, validation & documentation protocols:

- **Verification:** the internal audit to the plan, confirming that all the procedures have been implemented as designed.
- **Validation:** an external audit of the plan. A classic example is testing for Legionella performed by an external party. If the plan is adequate, then the Legionella results should not suggest that the building has issues of Legionella amplification. If that is the case, the contents of the plan must be evaluated and updated to better reflect the system, potential Legionella risks and regular maintenance practices.
- **Documentation:** a record of the plan, regular updates to the plan, and any audits of the plan. Best practices include:
 - a. Including templates for documenting all scheduled actions (monitoring and control) as well as recorded values.
 - b. Documenting if a control variable falls beyond the acceptable range and all subsequent corrective actions.
 - c. Including enough detail for the building engineer to determine overtime whether the selection of control variables and acceptable ranges is adequate.