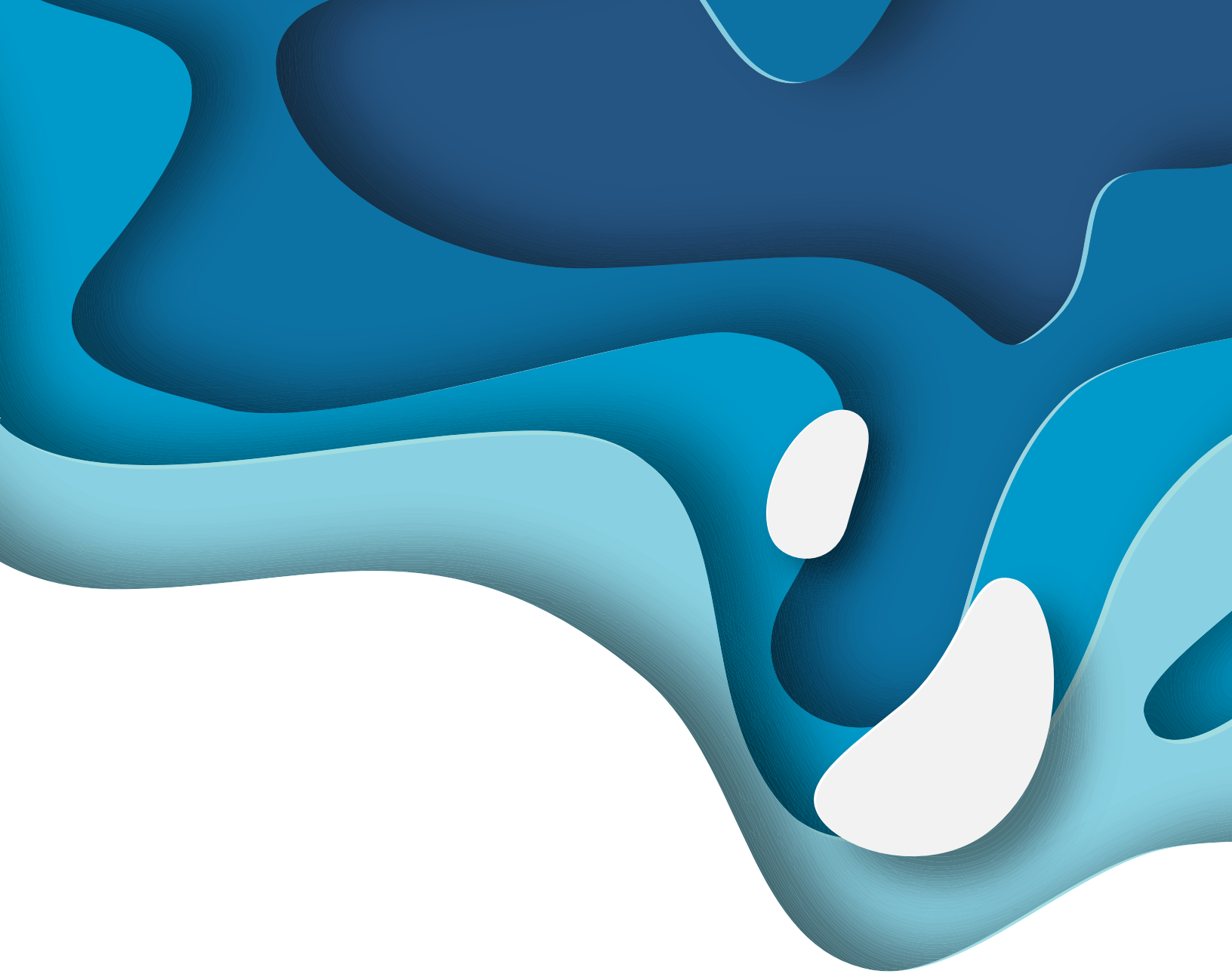

USING WATER QUALITY MONITORING DATA

FOR YOUR BUILDING WATER MANAGEMENT PROGRAM

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astho™ ASDWA Association of State Drinking Water Administrators

OVERVIEW

In order to reduce the risk of opportunistic pathogens, such as *Legionella*, it is important to use water quality monitoring data as part of your building's water management program.

The first stage in developing a building water management program is to establish an understanding of baseline water quality at the point of entry and other select points in the building.

This factsheet outlines how to monitor water quality in facilities to prevent the growth of *Legionella* and other opportunistic pathogens. It discusses important basic water quality monitoring parameters, including temperature, pH, turbidity, and disinfectant residual.

Steps to Developing a Building Water Management Program.

ASHRAE 188 is the existing industry standard for minimizing the risk of legionellosis associated with building water systems. This standard recommends that buildings and facilities test for water quality parameters and consider testing for *Legionella*. However, the standard does not provide details for sampling or test methods, number of sites to test, or how often to test. The Centers for Disease Control and Prevention (CDC) materials discuss water quality monitoring and provide some examples for what parameters should be monitored for in a building. However, CDC does not go into detail on monitoring at the building point of entry to gain an understanding of incoming water quality. There also are not details on how to conduct the monitoring or specifics on what the monitoring results mean in the context of building water quality. Each building will have a tailored plan based in its characteristics.

This factsheet provides basic information regarding baseline water quality monitoring at the building point of entry, which will inform *Legionella*/opportunistic pathogen control strategies. This document should be incorporated into a holistic facility water management program (WMP) that is based on ASHRAE 188 and the CDC *Legionella* Toolkit.

An important aspect of developing and implementing a building WMP is understanding the water quality received by the water supplier at the building point of entry and how the water quality is affected as it is used throughout the building. The following is a five-step process for monitoring water quality that can be used to develop a building WMP.

STEP 1 Parameters that should be monitored.

- Basic water quality can be determined by measuring just a few physical and chemical characteristics of the water. These parameters include, at a minimum: disinfectant residual, pH, turbidity, and temperature.

- These four parameters are routinely measured as part of managing distribution system water quality and are important in managing building water quality.

- You can access specific water quality parameters of interest and their brief descriptions in the bullet points and table below:

Disinfectant Residual

Disinfection is reliable and effective against a wide spectrum of pathogens, including *Legionella*. EPA regulations require a detectable disinfectant residual, but many states have higher residual requirements, such as 0.50 mg/L, so check with your water system or your state water agency on the requirements for minimum disinfectant residual throughout the distribution system. There are three common types of disinfectant used by water systems to protect their distribution system: free chlorine, chlorine dioxide, and chloramines. Water systems use different disinfectants to best fit the source water (i.e., lake, river, or aquifer) quality, distribution system configuration, and cost. For more information on disinfection of drinking water visit CDC's Disinfection with Chlorine & Chloramine web page.

pH

EPA does not regulate the pH level of drinking water, as it is classified as a secondary drinking water contaminant whose impact is considered aesthetic. However, EPA recommends that public water systems maintain pH levels between 6.5 and 8.5.

Temperature

Drinking water temperature can vary throughout the distribution system and may fluctuate seasonally. Temperature ranges that contribute to control of opportunistic plumbing pathogens vary by pathogen. For *Legionella* control, water should be kept below 25°C (77°F) or above 42°C (108°F). Some drinking water in warmer parts of the United States naturally exceeds the lower limit.

Turbidity

For systems that use conventional or direct filtration, EPA mandates that at no time can turbidity go higher than 1 nephelometric turbidity unit (NTU), and samples for turbidity must be less than or equal to 0.3 NTUs in at least 95 percent of the samples in any month. Per EPA, systems that use filtration methods other than conventional or direct filtration must follow state limits, which must include turbidity that remains under 5 NTUs at all times.

Parameter	Why are we monitoring?	Additional resource(s)
Disinfectant residual	Low disinfectant levels can indicate conditions that allow opportunistic plumbing pathogens such as *Legionella* to survive. Maintaining a disinfectant residual at the point where water enters the facility or building may help minimize biofilm growth in plumbing.	CDC's water disinfection web page.
pH	Measuring pH can help determine if the disinfectant present will be effective. Disinfectants work best within a narrow pH range. For example, according to CDC, the antimicrobial efficacy of chlorine declines as pH increases to >7, with significant loss of efficacy at pH >8.	U.S. Geological Survey's pH and water web page. World Health Organization's pH in drinking water background document.
Temperature	Temperature ranges that contribute to control of opportunistic plumbing pathogens vary by pathogen. Water temperatures between 77°F and 108°F promote *Legionella* growth.	CDC's web page on factors that lead to *Legionella* growth.
Turbidity	Turbidity at the point of entry provides a baseline for assessing turbidity in the building. Increases in turbidity in building plumbing indicate a potential problem (e.g., corrosion).	World Health Organization's technical brief on turbidity, water quality, and health. technical brief.

STEP 2 Coordinating with your water provider on utility water quality data.

- If you receive water service from a public water system, contact your water system and let them know you are working on developing a building WMP and that you would like to obtain and understand baseline data on water quality entering the building. You may already have a contact at the water system you can work with to get these data, either through a utility customer service representative or through a facility emergency planning team.

- The utility may provide data from its nearest compliance sampling location(s) to your service connection. The nearest sampling location(s) will have compliance monitoring data that the system must record and report in accordance with the Safe Drinking Water Act. Ask for the historical data from at least the last year to understand seasonal fluctuations, water use changes, and other factors that can affect water quality.

- If you are able to acquire present and historical information for water quality entering the building, it is ideal to establish a frequency for monitoring. If the water system is able and willing, ask if it can install a sampling location outside the building wall and use that location in its existing monitoring plan. (Sampling at least monthly would be ideal, but other frequencies may be more feasible and cost effective.)

STEP 3 Monitoring at the entry point.

- If the water supplier cannot conduct the requested testing, the building owner should evaluate the capital and operational costs for monitoring water quality at the building point of entry. The building owner should consider equipment and reagent costs, the staff time to take and analyze the samples, and time to compile and report the information and implications to management or the water management team.

Disinfectant Residual

If a building can only test for one parameter at the entry point, consider focusing on disinfectant residual, perhaps the most essential water quality indicator. Digital colorimeters are the recommended choice for testing residual, as other methods are less accurate. (Find more information on chlorine residual testing from CDC)

pH

pH can be measured at the sampling site (preferable) or in a laboratory. Building owners should use electronic pH meters that provide a precise measure of pH. For laboratory pH testing, contact your state or local health department for a list of certified laboratories that can test the pH level of your water.

Temperature

Water temperature is measured in the field using a digital or analog scientific thermometer.

Turbidity

Turbidity can be measured at the sampling site (preferable) or in a laboratory. Portable turbidity monitors are available

STEP 4 Determine monitoring locations within the building.

Because many buildings and facilities process water once it enters the building, monitoring water quality inside the building is essential. Additionally, the building itself exerts changes on the water quality due to temperature, materials, stagnation, and operations. Monitoring throughout the building is the first step in developing a building WMP. The recently released National Academies of Sciences, Engineering, and Medicine report, "Management of *Legionella* in Water Systems" recommends water management planning for all buildings.

The building monitoring program will measure the four parameters described from the point of entry throughout the building to distal taps, based on the overall plumbing design and operation. Factors to consider in developing the monitoring plan include:

- Hot- and cold-water lines
- Recirculating systems
- Water processes (e.g., water softeners and heating and cooling systems)
- Ice machines
- Decorative water features
- Cooling towers
- Distal taps (e.g., sinks and showers)

It may be best to monitor water quality weekly at first to develop a baseline and then move to monthly monitoring, depending on how the water quality changes over time. The monitoring data should guide you as you manage building water quality and make operational decisions.

The monitoring plan will be site-specific and depend on the building's size, the complexity of the plumbing, and the type of building. (For example, healthcare facilities with high-risk patients may require more monitoring locations or increased monitoring frequency.) Issues such as seasonality, diurnal and nocturnal changes, and use patterns should be considered when developing the monitoring plan. A monitoring plan should be revised as needed as the facility gains a better understanding of its building water quality patterns through initial and subsequent monitoring.

The monitoring plan is the beginning of building WMP development process. The data developed at this point should be used to understand how water quality changes as it moves throughout the building so that it can be improved.

STEP 5 Further developing the building water management program.

Once you have collected baseline data, it is time to begin the water management planning using the ASHRAE and CDC guidance mentioned previously. Building owners and operators may want to consider bringing in experts to help develop and facilitate the water management planning process.

SUMMARY

When looking to develop a WMP, it is important to understand the water quality at the building point of entry so you can establish the water quality baseline for the building. The basic water quality monitoring parameters used for *Legionella* control in buildings include temperature, pH, turbidity, and disinfectant residual. The five-step process outlined in this document can help building owners and operators begin the process of successfully developing a building WMP.

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