Water Management Best Practices During And After Low or No Occupancy

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At the time of this column's writing, public buildings across the country and around the world had been closed or were seeing low to no occupancy. Many states had issued "shelter in place" directives,[1] and millions of Americans were working from home. The hospitality industry was hit particularly hard, seeing steep declines in occupancy[2] and a rash of closures.

A few months later as you're reading this, buildings around the world are either still closed, seeing low to no use or are being reopened to the public. During shutdowns and closures, and as buildings return to normal use, it is critical that facility owners, engineering and maintenance personnel and water treatment professionals adhere to water management best practices. Water can become stagnant in these buildings without adequate maintenance during periods of low or no use, and stagnant water can pose a significant public health risk, as it contributes to the growth and proliferation of harmful bacteria.

Water stagnation causes several issues. Ordinarily, disinfectant levels in public drinking water can manage harmful bacteria in the distribution system and even help slow or stop its growth in buildings. However, during times of water stagnation, disinfectants can dissipate, leaving building systems vulnerable to increased pathogen growth. Biofilm can also accumulate, and naturally occurring bacteria can begin to multiply and proliferate throughout the system.[3] Similarly, hot- and cold-water temperatures can also contribute to bacterial proliferation if they drift toward levels that provide conditions for growth.

Bacterial proliferation in building water systems presents a real public health threat. The most dangerous waterborne bacterial pathogen in the United States today, measured by infections and deaths, is *Legionella pneumophila*.[4] It is the primary causative agent of Legionnaires' disease, a respiratory infection

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that is fatal in 10%–33% of cases.[4,5] When its growth in building water systems is not controlled, the bacteria can be distributed in aerosolized water from common fixtures, such as showers, ice machines, fountains, and even toilets and taps. Inhaling bacteria-contaminated droplets can lead to Legionnaires' disease. Legionnaires' disease is already a significant health concern, and reported cases in the U.S. have increased six-fold between 2000 and 2018.[4] Proper water management during low or no occupancy is critical to ensuring stagnant water does not lead to a spike in cases as the population returns to work and travel.

Good water management is possible while buildings aren't experiencing normal use. At the time of this column's writing, governments had taken steps to designate water treatment professionals and other personnel servicing water systems as essential personnel, exempt from staffing reduction requirements. Absenteeism is a major concern in the water industry,[6] so it is understandable if maintenance procedures or the frequency with which those procedures are run needs to be flexible. Even with this flexibility, water maintenance staff and engineers who pragmatically follow best practices can take certain steps to maintain public health and avoid exposure to waterborne bacteria in buildings.

According to ANSI/ASHRAE Standard 188-2018 and the CDC Toolkit, there are four fundamental ways to keep building water safer during normal operations and when the building is experiencing low or no occupancy:[7,8]

1. Keep cold water cold.
2. Keep hot water hot.
3. Keep water moving.
4. Keep the entire system clean.

L. pneumophila grow at a wide range of temperatures, but they grow best at 85°F–108°F (29°C–42°C).[9] Therefore, it is critical to follow ASHRAE guidelines to store hot water at or above 140°F (60°C), deliver hot water at or above 124°F (51°C), and store cold water at or below 68°F (20°C).[10] While these are straightforward guidelines to follow under normal circumstances, it may be tempting to some operators to set back water temperatures while the building is not in use. This could create public health risks—hot water supply temperature should be set as high as practical and allowed and cold water should be monitored for any increase in temperature that may approach 68°F (20°C). These are the easiest controls to put in place prior to considering addition of any secondary disinfectant.

Stagnant water reduces disinfectant levels and the efficiency of the disinfectant to reach all areas of the building. To maintain proper disinfectant residuals and temperature, water should be kept moving through the system. Flushing should be performed regularly, ideally weekly.[11] According to the Environmental Science, Policy, and Research Institute (ESPRI), "Flushing clears out the low quality water that accumulated during low use and replaces it with high quality water from the municipal supply. The fresh water will help mitigate the problems…that emerged while the water was stagnant."[11]

Maintaining the cleanliness of fixtures, especially those that can produce aerosols, like shower heads, will also mitigate exposure to *L. pneumophila*. Having cleaning procedures in place for water-aerosolizing fixtures can help reduce exposure.

These simple actions can help maintain higher water quality during a shutdown and help mitigate the risk posed by *L. pneumophila*. In many cases, testing for *L. pneumophila* to validate that these actions are working properly may also be appropriate, especially if these practices cannot be adhered to strictly due to staffing concerns. Building owners and engineers should follow ASHRAE Standard 188-2018 when identifying test providers, including working with an accredited laboratory.[8]

Many buildings may not have had the staff or resources to maintain proper temperature or flushing procedures during shutdown or periods of low occupancy. In this case, following proper recommissioning steps is critical to ensure the building can be safely reoccupied. ESPRI suggests that a single flush, especially of a complex building water system, may not be sufficient to reestablish water quality.[11] Ongoing flushing is required, and the longer service is interrupted, the greater the level of effort required for restoration.

The Water Research Foundation (WRF) recommends several consecutive weeks of ongoing flushing for a

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large building,[12] so returning a building to service requires significant lead time and planning. An initial flush should include cleaning fixtures at all points of use, including faucets, shower heads, drinking fountains, ice machines, showers and water features that generate aerosols.[11] Additional flushing should continue until water quality is back to normal.[11] When bringing a building back online after a prolonged period of low to no use, it is helpful to validate that flushing and other remediation actions are working by testing for the presence of *L. pneumophila*. As stated above, it is important that testing is performed by an accredited laboratory.[10]

Specific actions for maintaining appropriate temperatures, flushing, and general control of *L. pneumophila* will depend on the building itself. Buildings that have a water management program (WMP), based on the ANSI/ASHRAE Standard 188 seven-step principles, will be able to implement these best practices faster and with less effort than those without. ASHRAE Standard 188, the only ANSI-accredited standard for creating a WMP, requires WMPs to have procedures for building shutdown, restarting from a shutdown condition, and flushing. Any building that still does not have a WMP that adheres to ASHRAE Standard 188 should take steps to implement one as soon as possible.

Maintaining good water quality, and therefore public health, is top of mind across the globe. It is critical for building owners, operators and water treaters to ensure that building water stagnation does not contribute to increased risk from *L. pneumophila* and Legionnaires' disease. There are several water management best practices to follow while public buildings have low or no occupancy. Adhering to these best practices improves overall public health and serves to mitigate the risk of waterborne pathogens in building water systems.

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