



The Future Is Flushing

Key to Safe Hospital Water

The benefits of flushing premise plumbing systems were catapulted into the spotlight when buildings were shut down and had low occupancy during the height of COVID-19. Facility managers and building owners initiated flushing protocols to combat bacterial growth, particularly Legionella. It would also rid of other waterborne pathogen proliferation caused by water stagnation, biofilm, and old water age due to the lack of water flow through the piping and fixtures.

The benefits of flushing extend beyond the COVID-19 era, however. Flushing water lines is one of the best non-chemical treatments to increase the quality and safety of water while reducing the risk of Legionella, Pseudomonas, and other waterborne pathogens.

In the International Journal of Hygiene and Environmental Health's recently published study, *Hot Water Plumbing in Residences and Office Buildings Have Distinctive Risk of Legionella Pneumophila Contamination*, major risk predictors were found to be size of building and water age, indications of how important constant water flow and flushing protocols are.



The study states that researchers believe a building's water age — the time the water circulates throughout the plumbing before being used — can determine water quality. The study explains, "With increasing water age, the disinfectant concentrations reduce, allowing microbial and biofilm colonies to grow and pipe corrosion to occur." Researchers added, "...complex plumbing systems and greater water age are possible reasons for the greater frequency of L. pneumophila contamination in office buildings." Hospitals were not directly studied for this publication, but they are at high risk for Legionella because they normally have complex plumbing systems and are large spaces, often with more than 100,000 square feet.

As shown in the study, flushing protocols should be continued beyond the COVID-19 era. Under normal occupancy and operation, many facilities have overall poor and inconsistent water circulation. Even if water circulation is acceptable, water may not be reaching fixtures in rooms with low usage or at dead legs. This often results in stagnation, biofilm proliferation, and the inability for chemical supplemental disinfection to reach and be effective throughout the system and at distal water outlets.



Flushing provides the best solution to combat these issues. Keeping water flowing under a regimented schedule helps keep a hospital and its patients safe. There are eight key reasons a flushing regimen is crucial to the success of a water management plan:

1. Waterborne pathogens pose a high risk to patients, staff, and visitors.
2. Waterborne pathogens pose a high risk to a hospital's financial and fiduciary duties.
3. Flushing is complementary to all Legionella risk mitigation solutions.
4. Flushing is a safe waterborne pathogen risk mitigation action that increases water quality
 - Flushing has no negative operational or facility effects caused by chemical treatment.
 - Flushing has no negative effects on patient experience.
5. Flushing can be environmentally friendly.
6. Industry flushing best practices have been established and accepted, giving facilities a standard protocol to follow.
7. Standards, guidelines, and regulations recommend or require flushing.
8. Plus, implementing a successful flushing program is easier with our connected solutions.



Waterborne Pathogens Pose High Risk to Patients, Staff, and Visitors

From admittance to discharge, a hospital's number one responsibility is keeping patients safe and healthy — and water safety falls under this duty.

- Legionella and other waterborne pathogens are inherently in plumbing systems. The American Medical Association states, "Perhaps the most overlooked, important, and controllable source of nosocomial infections is hospital water."²
- The World Health Organization states that 10 out of the 12 bacteria that pose the greatest risk to human health are attributable to water.³ Although Legionella outbreaks often lead the headlines, other pathogens also pose a great risk.
- New waterborne disease contributors and proliferators have emerged, including aging plumbing infrastructure (municipal and facility), increasing chlorine-tolerance, and the increase of biofilm and the ability of pathogens to find protection within it. This has led to approximately 7.15 million waterborne illnesses annually, resulting in over 100,000 hospitalizations and \$3.33 billion in direct healthcare costs.⁴

Waterborne Pathogens Pose High Risk to Hospitals

Hospitals have a fiduciary responsibility to not only keep patients safe but to be financially responsible. Responsible, effective prevention of waterborne hospital acquired infections (HAIs) can lower the risk of them and increase return on investment (ROI) by warding off Legionella outbreaks and emergency remediation. It can also improve patient outcomes, patient satisfaction, and environment of care.



- HAIs lead to longer length of stay (LOS), which drives up non-reimbursable costs. The average LOS for patients without an HAI is roughly five days. Average LOS increases to 17 days for patients with an HAI, and 42% of patients with an HAI are readmitted within 30 days.⁵
- There are an estimated 70,000 Legionnaires' disease cases each year. The Centers for Medicare and Medicaid Services found that the average cost to treat a Legionella case is \$86,000.
- Hospitals are continually under the jurisdiction of various governmental programs that financially reward or penalize based on HAI rates, readmissions, and patient satisfaction scores. For example, one-third of U.S. hospitals have been penalized at least once since the onset of the HAC Reduction Program.⁶
- Legionella outbreaks and pursuant lawsuits have led to increasing judgments and settlements up to \$6.4 million.
- Emergency Legionella remediation often includes costly activities such as installing point-of-use filters, initiating superheating, and implementing hyper-chlorination, in addition to requiring innumerable labor hours from facility, infection prevention, environmental services, and administration teams.

Flushing Is Complementary to all Legionella Risk Mitigation Solutions

There are numerous solutions a hospital can incorporate to reduce the risk of Legionella and other waterborne pathogens. The solutions deployed most frequently include chemical supplemental disinfection, primarily chlorine, monochloramine, and chlorine dioxide. Copper silver ionization is also proven to be effective. Point-of-use filters are often activated, particularly during outbreak remediation.

Each of these solutions have pros and cons, and hospitals must evaluate each to determine which, if any, is the right solution for their specific facility and patients. No matter which solution is chosen, flushing water to reduce water age and stagnation is effective for improving water quality. If a hospital chooses chemical supplemental disinfection or copper silver ionization, flushing aids in the continual distribution of the chemical and ions to distal points. By reducing water age and stagnation, flushing effectively makes it easier for other solutions to be effective.

However, if a hospital chooses not to deploy a supplemental solution, flushing serves as a successful way of keeping water circulating, which results in reduced stagnation and water age. This improves overall water quality while minimizing environments that promote biofilm and pathogen proliferation.

Flushing Is a Safe Waterborne Pathogen Risk Mitigation Action That Improves Water Quality

No Negative Operational and Facility Effects Caused by Chemical Treatment

All supplemental disinfection methods (chlorine, chlorine dioxide, monochloramine, and copper silver ionization) can be effective in reducing the risk of Legionella. However, each can have potentially hazardous side effects.

Chemical supplemental disinfection methods have led to corrosion in pipes, plumbing materials, and water-bearing equipment. This has resulted in pinhole leaks, floods, and massive damage in terms of remediation, inoperable areas, and loss of revenue.

Dr. Janet E. Stout stated in *Puzzled by Legionella*, the resource and study guide developed to prepare for the ASSE 12080 certification exam, "The decision to apply supplemental disinfection for long-term control of Legionella growth can be challenging. While you don't want to put occupants in your building at risk for Legionellosis, operating and maintaining long-term (continuous) disinfection involves capital and ongoing costs. In addition to price, other considerations include potential damage to the plumbing system and exposing the building's occupants to the disinfectant and disinfection byproducts."⁷



Unlike supplemental chemical disinfection, flushing offers an environmentally friendly and non-toxic option that aids in Legionella and waterborne pathogen risk mitigation. The act of flushing water through the piping system adds no chemicals to the water or chemical byproducts that release oxidizing agents into the plumbing system.

Flushing causes no harm to the plumbing infrastructure — no corrosion to equipment or pinhole leaks in piping, which is common with chemical supplemental treatments.

No Negative Effects on Patient Experience

In addition to operational and facility benefits, flushing does not generate the potentially negative patient experience that chemical treatment can.

Poor patient satisfaction scores can directly impact Medicare reimbursements and lead to possible penalties. Each year, Medicare cuts payments by one percent for hospitals that fall into the worst-performing quartile. In 2022, Centers for Medicare & Medicaid Services (CMS) will cut payments from 764 hospitals based on patient injuries and infections.⁸

“Research on how the physical environment affects health outcomes began in the 1980s. More than 600 studies have linked the hospital-built environment to factors such as patient satisfaction, stress, health outcomes, and overall healthcare quality,” American Hospital Association (AHA) explains. “Place, or the physical environment of a hospital, is the third component to AHA’s patient satisfaction approach. Creating a comfortable place for patients to get well again is integral in ensuring that they will leave the hospital with a positive outlook.”⁹

As stated previously, flushing does not lead to pinhole leaks, which could be disastrous for patient rooms, treatment rooms, and operational suites. In addition, flushing does not change the taste, odor, or smell of water, which could contribute to a negative patient experience and satisfaction score. Flushing can directly increase patient satisfaction by improving the hospital-built environment through clean, safe, and correct temperature water, which reduces the risk of Legionella while also preventing scalding.

Flushing Can Be Environmentally Friendly

Flushing water through a plumbing system as a conservation effort may seem contradictory, but it doesn’t have to be. By implementing smart and connected sensors, flushing can be scheduled to activate as needed based on occupancy fluctuations, room turnovers — even outlet-by-outlet usage.

In comparison to chemical supplemental disinfection, flushing does not have harmful effects on piping and equipment. Therefore, flushing can extend the life of water-bearing equipment, limiting the need to replace equipment early or too often. Additionally, flushing does not require on-going consumables. These benefits can support a hospital’s sustainability and environmental goals.

Beyond its financial advantages and positive impact on the environment, flushing is a “no-harm” solution that can directly improve a hospital’s sustainability and wellness efforts. It can help ensure buildings are fully operational and contribute to energy efficiency that aligns with building climate resilience and environmental stewardship. It helps a hospital become a public partnership for sustainability and a healthy structure for human occupancy.

Energy and water conservation improvements aligned with patient and staff satisfaction directly contribute to improved patient outcomes and staff retention.



Industry Flushing Best Practices

The most common best practice utilized by hospitals is flushing each outlet (faucets and showers) five minutes on both the cold and hot lines. Some facilities choose to flush the cold side for five minutes and flush the hot until it reaches the maximum temperature (as designated in their water management plan), and then flush for an additional two minutes. There are variances in how often to flush. Many hospitals and other facilities have implemented a weekly flushing protocol. This practice does not consider occupancy or outlet usage.

Other facilities choose to flush based on occupancy. Often this would take place at the time of room turnover. Facilities with connected sensors have the ability to monitor the exact usage of each outlet and can implement flushing at specific outlets when usage has been low or obsolete over predetermined times, as outlined in their water management plan.

No matter what flushing schedule a hospital adopts, a central key to success is the requirement to document all activity. All details of the plan should be documented, including the schedule, flushing time requirements for both hot and cold water, outlets to be flushed, and in the case of flushing based on inactivity, the definition of inactivity.

Once the protocol has been documented in the water management plan, ongoing documentation of activity must be recorded. Data to be recorded includes who conducted the flushing, how the flushing was activated, which outlet was flushed, the time of the flushing, and how long the hot and cold water at the outlet were flushed. Accurate documentation provides three essential benefits for the hospital:

1. It serves as proof of compliance for the Joint Commission, CMS Mandate, and other organizations having jurisdiction.
2. It provides defensible evidence in the event of an outbreak.
3. It can protect the employee(s) administering the flushing.



HOW TO FLUSH

Flush each faucet and shower five minutes on both the cold and hot lines

Some facilities choose to flush the cold side for five minutes and flush the hot side until it reaches the max temperature (as noted in their WMP) and then an additional two minutes

WHEN TO FLUSH

Weekly flushing protocol on all outlets regardless of outlet usages

Flushing protocols based on occupancy; often flushing at room turnover

Utilize connected sensors to flush specific outlets based on individual outlet usage as stated in a WMP



HOW TO DOCUMENT	
THE PROTOCOL/PLAN	THE ACTIVITY
All details of the flushing plan and activity should be documented	All activity should be recorded
The overall schedule	Who conducts the flushing
Flushing times required for both cold and hot water sides of each outlet	How the flushing was activated
For flushing based on inactivity/usage- the definition of inactivity	The outlet flushed
	Time of the flushing
	How long hot and cold-water lines were flushed

Standards, Guidelines and Regulations

There are numerous standards, guidelines, regulations, and authorities that require or recommend flushing on a regular basis and during construction and commissioning.

The Joint Commission

The Joint Commission water management standard EC.02.05.02 that went into effect January 1, 2022, requires health facilities covered by the standard to include a plan for building and system areas where water may become stagnant.

World Health Organization

The World Health Organization states that prevention of Legionnaires’ is dependent on applying control measures, including, “reducing stagnation by flushing unused taps in buildings on a weekly basis.”

New York State Department of Health

New York State Department of Health’s (NYSDOH) *Prevention and Control of Legionnaires’ Disease Environmental Guidance and Engineering Measures* states in the “Environmental Health Information Related to Legionellosis in Healthcare Facilities” that, “Flushing is a control measure used to help address several possible deficiencies, including aged water and poor disinfectant residual. Flushing also may help remove sediment and turbid water from the potable water system. Typically, the method would include sequentially opening taps in an impacted zone, floor or building for the time necessary to purge the old or turbid water from pipes. The protocol may also involve fixtures, tanks, or other areas and components. Effective flushing for a focused location can take several minutes while whole-building flushing may take many hours. Duration is dependent upon the size of the system, pipe, and component size, flow rates and the total volume of water to be flushed.”

VHA Directive 1061

The Veterans Health Administration (VHA) directive 1061 requires that irregularly used or low-flow fixtures must be flushed at least twice per week to prevent stagnation, and there must be a policy and procedure in place, as well as documentation of execution to ensure compliance.



The VHA defines flushing as, “the process of opening outlets such that hot- and cold-water flow out of the outlets for a specific amount of time to provide water with improved biocide, temperature, and chemical composition to the piping system.” The directive states that the purpose of flushing is to, “prevent stagnating conditions in pipes which could result in tempering of water temperature, dissipation of biocide, and establishment of favorable conditions for Legionella growth. Regular flushing of hot and cold water at outlets (e.g., sink taps, showers), particularly those not in routine use or experience low water usage, is necessary to ensure that engineering controls are maintained at sufficient levels to mitigate Legionella growth in the water distribution systems and at fixtures.”

ASHRAE 188

The American Society of Heating, Refrigerating and Air-conditioning Engineers (ASHRAE) 188 does not require an on-going flushing regimen but does require commissioning for new construction and renovation. This entails a complete flush at construction that typically occurs at least three weeks prior to beneficial occupancy.

Connected solutions have been created that make implementing a successful flushing program easy.

Technology is a hospital’s water management plan’s best friend. By deploying auto-flushing devices, a hospital can conduct an efficient and effective flushing program that leads to improved water quality, reduced risk for Legionella and other waterborne pathogens, and a successful, compliant, and defensible water management plan. Other benefits of connected auto-flushing devices include:

They reduce time and labor. A manual flushing program can be an expensive and time-consuming activity, often the responsibility of the environmental services team or the facilities team, which are both heavily burdened with other responsibilities, labor shortages, and labor turnover.

Consider a 300-room hospital with two outlets per bed (sink and shower). If each room was flushed once a week, with thirty minutes allocated per room for flushing and traversing the building at a \$15/hour labor rate, the hospital would have wasted 7,800 man-hours at an annual cost over \$100,000. If the labor rate is \$30/hour, the cost increases annually to \$230,000. At \$50/hour, the annual cost rises to almost \$400,000.

Over a ten-year span, the hospital would have wasted 78,000 man-hours and at \$30/hour, spent \$2.3 million. Connected auto-flushing devices remove the need for an employee to manually flush each outlet. The facility team can remotely activate the agreed-upon flushing protocol.

They help make meeting compliance and passing inspections easier. By deploying a connected auto-flushing program, a hospital benefits from flushing activity data being automatically available and uploaded into a water management plan and BIM system.

Having a record of all flushing activity readily available can aid in passing Joint Commission and CMS Mandate inspections. Water management plans as described by the Joint Commission and CMS Mandate require that control limits be set, and that verification occurs. Connected auto-flushing devices can provide proof that flushing protocols are being conducted in accordance with the hospital’s stated plan.

They aid in defensibility. Accurate records of auto-flushing serve as proof of a hospital’s proactive approach to mitigating Legionella and waterborne pathogen risks. This helps protect the hospital in the event of an outbreak or potential lawsuits.



Summary

Flushing should be a critical component in all hospital water management plans. It is a key activity that can improve water quality and reduce the risk of Legionella and other waterborne pathogens.

Each hospital must evaluate multiple organizational and building characteristics, including history of Legionella, plumbing infrastructure design and age, and overall risk when deciding on supplemental disinfection. Flushing is complementary to all supplemental disinfection and should be included in a water management plan, regardless of supplemental disinfection decisions. However, a hospital should be aware that flushing does have limitations. Currently, the industry is working on publishing studies about the effectiveness of flushing, but there is little published data at the time of this document's publication.

The industry agrees that flushing improves water quality, reduces water age, increases the circulation of disinfectant, and can aid in temperature regulation — which can reduce Legionella and other waterborne pathogens.

Foremost, flushing increases patient safety. Hospitals should activate industry best practices and utilize auto-flushing devices. This ensures a hospital's flushing program most effectively reduces the risk of poor water quality, meets current requirements, standards, and guidelines, and provides a record of flushing activity for defensibility needs.

References

- ¹ Donohue, Maura J., Ministry, Jatin H., Tucker, Nicole, Vesper, Stephen J. (August 2022). Hot water plumbing in residences and office buildings have distinctive risk of Legionella pneumophila contamination. *International Journal of Hygiene and Environmental Health*. (114023).
- ² Anaissie, Elias J., Penzak, Scott R., Dignani, M. Cecilia. (2002). The hospital water supply as a source of nosocomial infections: A plea for action. *Archives of Internal Medicine*, 162(13), 1483-1492.
- ³ (2017). WHO publishes list of bacteria for which new antibiotics are urgently needed. www.who.int/news/item/27-02-2017-who-publishes-list-of-bacteria-for-which-new-antibiotics-are-urgently-needed
- ⁴ Collier, Sarah A., Deng, Li, Adam, Elizabeth A., Benedict, Katharine M., Beshearse, Elizabeth M., Blackstock, Anna J., Bruce, Beau B., Derado, Gordana, Edens, Chris, Fullerton, Kathleen E., Gargano, Julia W., Geissler, Aimee L., Hall, Aron J., Havelaar, Arie H., Hill, Vincent R., Hoekstra, Robert M., Reddy, Sujana C., Scallan, Elaine, Stokes, Erin K., Yoder, Jonathan S., Beach, Michael J. (2021). Estimate of burden and direct healthcare cost of infectious waterborne disease in the United States. *Emerging Infectious Diseases*. 27(1): 140-149.
- ⁵ The impact of healthcare-associated infections in Pennsylvania. (2010). *Pennsylvania Health Care Cost Containment Council (PHC4)*.
- ⁶ Preeminent hospitals penalized over rates of patients' injuries. (2020). *Kaiser Health News*.
- ⁷ Stout, Dr. Janet E. (2020). *Puzzled by Legionella? A Guide to Understanding Detection, Prevention, and Water Management*.
- ⁸ CMS cuts payments to 764 hospitals over patient complications. (2022). *Becker's Hospital Review*.
- ⁹ Heath, Sara. (2016). How hospital environments affect patient satisfaction levels. <https://www.patientengagementhit.com/>