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Safeguarding Water in Healthcare Facilities

A Guide to ASHRAE 514 Compliance

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Welcome to our white paper focusing on ANSI/ASHRAE Standard 514. In healthcare facilities, occupants are often at higher risk from microbial hazards and their associated dangers. This document discusses Standard 514 with information on risk management tailored to healthcare environments. It outlines minimum requirements and offers informative guidance for the development of water management programs.

Engineers, facility managers, and contractors who specify or install fixtures in healthcare facilities should be aware of the microbial, physical, and chemical hazards included in the new standard – and recommended controls – because some measures to prevent risks can actually make them more likely.

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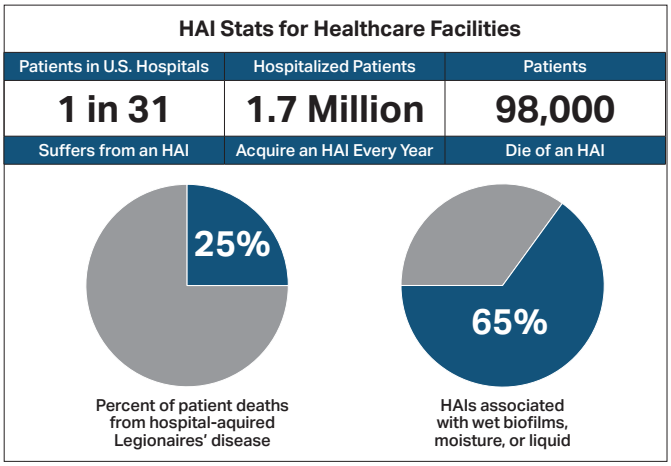
Safeguarding Water in Healthcare Facilities:
A Guide to ASHRAE 514 Compliance

No healthcare facility chooses to become a statistic. Yet every day, 1 out of 31 patients in U.S. hospitals suffers from a hospital-acquired infection (HAI), according to the Centers for Disease Control and Prevention (CDC).[1] That adds up to 1.7 million hospitalized patients annually who acquire HAIs while being treated for other issues—and more than 98,000 die.[2]

Studies estimate that 65% of HAIs are associated with wet biofilms, moisture, or liquid —and HAIs are frequently deadly for patients. For example, Legionnaires' disease is fatal for about 10% of the people who contract it, but that rises to 25% for healthcare-acquired Legionnaires' disease.



Engineers and purchasers who specify plumbing fittings for new construction or renovation in hospitals must manage water risk, whether that's disease caused by Legionella and other pathogens or scalding from high-temperature water. The choice of control measures can prevent disease and injury by streamlining water management plans and testing programs and can directly benefit human health and life.

In 2019, global public health organization National Sanitation Foundation (NSF) International transferred facilitation of NSF Standard 444, *Minimizing Risk of Disease and Injury Associated with Building Water Systems*, to ASHRAE to complete the standard development process and publish it as ASHRAE Standard 514.

To address water risks, the American National Standards Institute (ANSI) and the American Society of Heating, Refrigerating, and Air Conditioning Engineers (ASHRAE) introduced a new standard in July 2023. The standard is referred to as ANSI/ASHRAE 514 or simply ASHRAE 514.

ANSI/ASHRAE 514
Builds on Previous Standards

ANSI/ASHRAE 514: Risk Management for Building Water Systems: Physical, Chemical, and Microbial Hazards

This standard provides a framework for owners and managers to systematically develop water management plans to handle disease outbreaks and hazards that could become public health and safety issues.

The Centers for Medicare & Medicaid Services (CMS) requires water management plans for every type of healthcare facility. Further, ASHRAE 514 creates an industry standard to prevent both illness and injury. A facility manager who chooses not to follow the guidelines could be legally liable if an incident occurs. Becoming familiar with the ASHRAE 514 standard and how to implement it to manage risk is essential.

ASHRAE 514 requires adhering to all elements of ASHRAE 188: *Legionellosis: Risk Management for Building Water Systems*[5] and ASHRAE Guideline 12: *Managing the Risk of Legionellosis Associated with Building Water Systems.*[5] ASHRAE 514 incorporates the same best practices for managing risks associated with *Legionella*—which remains the priority—along with other pathogens.

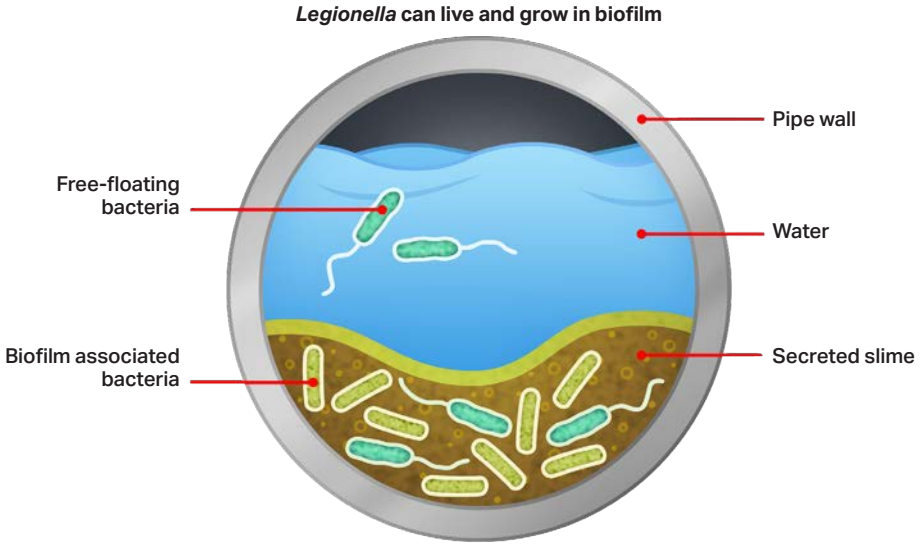


Image courtesy of CDC.gov

But ASHRAE 514 goes beyond ASHRAE 188 to address microbial risk more broadly, as well as physical and chemical hazards found in water systems. In particular, ASHRAE 514 adds testing for a number of waterborne pathogens and antibiotic-resistant bacteria, including *Pseudomonas aeruginosa, Stenotrophomonas maltophilia, Acinetobacter species, Burkholderia cepacia,* and *nontuberculous mycobacteria*.

ASHRAE 514 also addresses physical hazards. For instance, the majority of injuries and deaths involving tap water scalds occur to children under the age of five and senior citizens—and they're particularly vulnerable, because their thinner skin results in deeper burns for the same temperature and exposure time. Adults will suffer third-degree burns if exposed to 150^{0}F water for 2 seconds or 140^{0}F water for 6 seconds. To alleviate risk, the U.S. Consumer Product Safety Commission recommends lowering the water heater temperature to 120^{0}F.

In addition, chemical hazards arise from disinfectants, disinfection byproducts, corrosion products, and chemicals that cause leaching from plumbing materials. These substances can stick to pipes to form biofilms, letting organisms persist for long periods—if they can be removed at all.

Building Water Systems
Prove Ideal for Growing Microbes

Building water systems are almost custom-made for *Legionella* and other waterborne pathogens to thrive.

Not surprisingly, the older the facility, the less likely the Architecture/Engineering/Construction team considered the risk of exposure to HAIs. Typical hospital water systems exhibit a high pipe surface area-to-volume ratio, perfect for forming biofilms that sustain vast microbial populations. Corrosion byproducts and sediment provide a steady source of the nutrients they need. And dead legs – pipes isolated from regular water flow or no longer in use – let water stagnate, giving microbes a perfect place to grow undisturbed.

Similarly, conserving water and saving money with low-flow faucets or water-restriction devices also increases water age and stagnation, which is ideal for incubating pathogens. The longer water remains in a hospital water system, the greater the decline in residual disinfectant that could kill pathogens.

In short, a high pipe surface area-to-volume ratio with dead legs, corrosion and chemical byproducts, and a lower flow rate – all common in hospitals – can set the stage for a disease outbreak. And measures to prevent disease and injury may make them both more likely.

Protective Measures
May Help Microbes Survive

Technology and practices to protect staff and patients can actually contribute to water contamination.

For instance, the use of hand sanitizer instead of hand washing, especially since the COVID-19 pandemic, results in low water use and aged water in the lines and fittings.

Examples that contribute to water contamination include the following:

- **Indirect transmission from supplies** that had contact with contaminated water: bath supplies and linens, inappropriate use of nonsterile water for tasks that warrant higher measures of caution, such as oral/tracheostomy care of ventilated patents and rinsing of respiratory therapy or endoscopic equipment in tap water.
- **Transmission on the hands of healthcare personnel:** failure to perform hand hygiene after contact with a contaminated environment or patients colonized with waterborne organisms, hand washing with contaminated water and splashback from contaminated sink drains.[7]

- The greater **complexity of touchless faucets** relative to manual faucets puts more surface area in contact with water. For more than two decades, researchers have suspected that these no-touch fittings may create conditions that allow *Legionella* and *Pseudomonas aeruginosa* to proliferate, as reported in 2001 in the *Journal of Hospital Infection*.[8]
- Likewise, the **long, flexible hoses** frequently used on hospital showers store and stagnate water, encouraging microbial growth. In addition, modern faucets contain more plastic and elastomeric materials, ideal to grow microbes.

- **Temperature** also plays a critical role. To meet both conservation and safety guidelines, many facilities have implemented technologies to **reduce water flow and temperature**. But low flow means fewer pathogens are flushed away—and, to a point, low temperature keeps more pathogens alive. Although turning down the water temperature to 120^{0}F to avoid scalding saves the energy—and money—needed to heat water, microbes like *Legionella* can survive several hours at this temperature. For instance, at 122^{0}F, 90% of *Legionella* die within 2 hours; at 140^{0}F, 90% are killed within 2 minutes. Only at 160^{0}F are 100% killed instantly.[9]

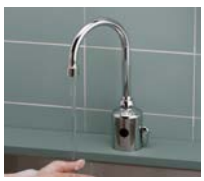
Plumbing Innovations and Advances
Help Prevent Disease and Injury

Measures facility managers can take to keep patients and staff safe from waterborne HAIs:

- **Maintain optimal water temperature and pressure and eliminate dead legs.**
  Legionella and other microbes are right at home in stagnant warm water. So maintain the water at an unhospitable temperature and remove pipes that are never used—or flush regularly if you use them occasionally.
- **Separate hot-water and cold-water lines completely. Install thermostatic mixing valves as close as possible to the point of use to minimize the volume of tempered water sitting in pipe or tubing and prevent scalding.**
  Store hot water at temperatures above 140°F and circulate continuously above 120°F, per the CDC. Use pipe insulation to maintain hot and cold water at desired temperatures throughout the water system.[10]
- **Store and circulate cold water below the favorable temperature range for *Legionella*.**
  Although *Legionella* may grow at temperatures as low as 68°F, they multiply between 77°F and 113°F, according to the CDC.[10]
- **Minimize stagnation in faucets. Stagnant water fosters the growth of biological material that feeds *Legionella* and corrodes water system hardware, creating a haven for bacteria.**
  Advanced fittings provide automatic flush activation set to the desired frequency and duration to prevent stagnation brought on by low use and flow rates. Flushing lets the faucet remove water in low-traffic areas, reducing water age and ensuring complete distribution of chemical treatment.
- **Choose antimicrobial design features and materials.**
  For example, a faucet that uses a laminar flow outlet that does not draw air into the water stream, resulting in a clear, airless flow. The natural protection of materials containing silver prevents growth of a broad range of microorganisms.
- **Prevent stagnation and pooling of water in the shower.**
  Choose automatically draining shower valves and hand spray hoses that remove stagnant water from the system. These work with either a shower head or a hand shower.
- **Select shower heads designed to reduce flow aerosolization.**
  Preventing air from entering the shower head minimizes aerosols that transmit *Legionella*. In addition, silicon valves reduce chlorine oxidization as well as scale and organic sediments.
- **Provide a means to easily remove and disinfect shower heads.**
  Aerators are prohibited. Utilize self-draining showerheads, constructed from metal.

Measures to prevent injuries from scalding include the following:

- **Specify American Society of Sanitary Engineering (ASSE) 1070-certified mixing valves and scald protection.**
  ASSE1070 Standard "Performance Requirements for Water Temperature Limiting Devices" was published in 2004. To reduce the risk of scalding, this industry standard for a temperature-actuated mixing valve limits the maximum temperature to fixtures such as sinks, lavatories, or bathtubs.



- **Choose a touchless faucet with user adjustable temperature control.**
  Users can adjust the faucet to set the preferred mixed water temperature. An integrated ASSE 1070-certified thermostatic mixer can prevent scalding and is a quick, cost effective installation with fewer leak points.

- **Specify ASSE 1016-certified valves for showers and tub-shower combinations.**
  Valves can be pressure-balancing, thermostatic or combination pressure-balancing/thermostatic. In-line thermostatic valves may not be utilized to meet this standard. Valves must provide scald and thermal shock protection for the rated flow rate of the installed shower head. The valve must limit the maximum setting to 120° F and have a maximum temperature limit stop set prior to occupancy. The limit stop must be checked and adjusted seasonally to reflect changes in cold water temperature.

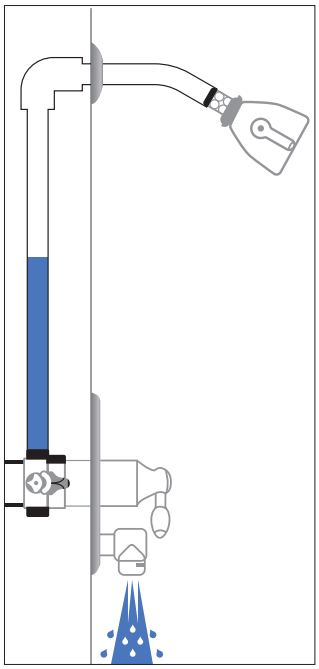
Plumbing Innovations and Advances
Help Prevent Disease and Injury

Select fittings that meet standards and help keep patients and staff safe.

Look for plumbing fittings, shower devices, and water treatment technologies designed to reduce infection rates, prevent scalding, and keep dangerous bacteria from crossing from the hot supply into the cold supply and back into the plumbing system.

For example, HyTronic® Patient Care touchless faucets can reduce common risks in healthcare environments and exceed expectations for water management and patient safety thanks to the following features:

- Automatic conditions-based flushing reduces stagnation and ensures complete distribution of chemical treatment
- Copper tubing inlets lessen the opportunity for waterway bacterial growth
- A low-volume solenoid valve minimizes the amount of stagnant water
- Antimicrobial silver outlet guards against microbial growth
- Angle stops with integral checks prevent potentially dangerous crossflow
- Optional ASSE 1070-certified thermostatic mixing valves provide point-of-use scald prevention with hot water bypass for thermal disinfection procedures



With an Auto-Drain™ shower, the water automatically drains from the system after each use.

Auto-Drain™ Shower Systems remove stagnant water in the column between the shower valve and showerhead in just one minute, helping to stave off HAIs.

These systems are available with a shower valve and hand spray hose that drain automatically when shut off, plus a diverter valve that allows the entire shower fitting to purge stagnant water. Retrofit kits to replace an existing shower hand spray are also available.

It can be specified with Thermostatic/Pressure Balance Valve, or Pressure Balance Valve with either an integrated valve drain or a separate drain valve . Automatic valve drain assemblies in the shower hose and shower valve drain water after each use. This simplifies the draining process and limits the growth of water pathogens. In addition, the Auto-Drain hand-held shower spray with hose includes an integrated hose valve drain to drain the shower hose automatically after each use. This simplifies the draining process and limits the growth of water pathogens.

Codes and Keywords
For Healthcare Facility Water Systems

ANSI/ASHRAE Codes for Water System Risk Management

- ASHRAE Standard 514-2023: Risk Management for Building Water Systems: Physical, Chemical, and Microbial Hazards
- ASHRAE Standard 188-2021: Legionellosis: Risk Management for Building Water Systems
- ASHRAE Guideline 12-2023: Managing the Risk of Legionellosis Associated with Building Water Systems

ASSE Codes for Scald Prevention

- ASSE 1070 Standard, Performance Requirements for Water Temperature Limiting Devices
- ASSE 1016 Standard, Performance Standards for Automatic Compensating Valves for Individual Showers, Tub/Shower Combinations

Keyword Definitions

Aerosolization: Aerosolization is the process or act of converting some physical substance into the form of particles small and light enough to be carried in air. It is critical in Legionellosis, which is most commonly transmitted by inhalation of contaminated aerosols in conjunction with water sprays, jets, or mists.

Antibiotic-resistant bacteria: Germs like bacteria and fungi that develop the ability to defeat the drugs designed to kill them.

Biofilm: Clusters of bacteria attached to a surface and/or to each other and embedded in a self-produced matrix of proteins, polysaccharides, and DNA.

Flushing: Replacing stagnant water in building systems that have had low or no water use with fresh water to reduce the risk of infections.

Hospital-acquired infection (HAI): Also known as healthcare-acquired infection, these originate in a hospital and were not present or incubating at the time of patient admission.

Legionnaires' disease: A serious type of pneumonia caused by *Legionella* bacteria. People can get sick when they breathe in small droplets of water or accidently swallow water containing *Legionella* into the lungs.

Legionella Water Management Plan: A plan to identify hazardous conditions and include steps to reduce the risk and danger of *Legionella* and other microbes growing in a building water system. Per the Centers for Disease Control and Prevention, having a water management program is now an industry standard for large buildings in the United States.

Scalding: Damage to the skin caused by something wet, such as hot water or steam.

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We can help take the hassle out of selecting the right products for your hospital project. With a variety of fittings for every need, we enable engineers, designers, and contractors to improve water delivery throughout the entire facility.

For more information, visit ChicagoFaucets.com, contact us at 847-803-5000 or request a meeting with a +Healthcare product specialist.

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Chicago Faucets, a member of the Geberit Group, is the leading brand of commercial faucets and fittings in the United States, offering a complete range of products for schools, laboratories, hospitals, office buildings, food service, airports, and sports facilities. Whatever your requirements may be, Chicago Faucets offers standard and made-to-order products that are designed to meet any commercial application.

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