

Good Healthcare Starts With Clean Water

Current methodologies offer a multistage approach to reducing waterborne pathogens and therefore hospital-acquired illnesses from contaminated water.

by Jim Lauria

With all the debate going on about healthcare, from the halls of Congress to coffee shops across the United States, it is easy to overlook the most fundamental component of ensuring that the healthcare system serves its patients — clean water.

Just listening to the rhetoric surrounding insurance plans highlights plenty of reasons hospitals and other healthcare facilities must pay attention to their water. Politicians talk about the cost of healthcare, which starts with clean water. Maintenance in today's sprawling healthcare facilities must be managed well to ensure smooth and profitable operations, and highly sensitive medical equipment must be serviced with extremely high-quality water. Patient health itself is compromised by waterborne pathogens, a threat that is worse today than it has been in years.

Hospital-Acquired Illness

Healthcare-acquired infections, or HAIs — infections contracted in a hospital — occurred in 5% of all acute care hospitalizations, according to a paper in the March/April 2001 issue of *Emerging Infectious Disease*; another article in *Archives of Internal Medicine* estimated twice that rate. Calculations in *Emerging Infectious Diseases* attribute 26,250 to 70,000 deaths annually in the United States to hospital-acquired bloodstream infections, making HAIs between the 4th and 13th leading cause of death in the nation.

HAIs run the gamut from wound infections to respiratory pneumonia, and there is a broad array of pathways through which pathogens can reach patients. But waterborne diseases such as legionnaires disease — with a mortality rate ranging from 5% to 30% — can be among the direst. Unfortunately, plumbing in many hospitals is the ideal breeding ground for such bacteria.

Breeding Ground

One high-profile and virulent pathogen favored by the

hospital environment is *Legionella pneumophila*, the bacterium that causes Legionnaires disease.

“The hospital system, by design, is the highest-risk environment for cultivating and growing the *Legionella* pathogen,” warns Tim Keane, consulting engineer with Legionella Risk Management Inc. in Chalfont, PA. “Healthcare facilities, by code, are required to keep hot water at a temperature at which bacteria will reproduce, including Legionella.”

“Healthcare facilities now have a tremendous amount of stagnant distal sites as a result of the increased efforts to provide comforting surroundings,” Keane adds. “There are a lot more single-bed rooms, more sinks in private and public areas, and showers in all rooms, even where patients are so sick they’ll never use them. Piping in new facilities is typically grossly oversized, specifically because of all the distal sites. We want a flow rate of 3 ft to 5 ft per second to minimize potential for biofilm growth. *Legionella* is a parasitic bacterium and requires a host such as biofilm or human lungs to survive. Many newer healthcare facilities have less than 1 foot per second water velocity during their peak demand periods. This approaches stagnant flow conditions at all times.”

The domestic water supply system often adds loads of sediment and scale minerals from aging city water supply mains into the perfect brew of slow-moving, 85°-to-120° hot water backing up behind scores or hundreds of underused faucets, showerheads, and valves. Deposits inside pipes and fixtures create breeding grounds for bacteria and other pathogens, Keane notes.

“People need to take



Removing suspended solids helps deny bacteria a beachhead in hospital plumbing systems, eliminating a key breeding ground.

some offset protocols to reduce the risk,” he said. “Healthcare facilities are increasing the use of [high-efficiency particulate air] filtration to better control airborne pathogens while designing more effective air-handling systems. They should take increased efforts for delivering safe potable water as more designs are increasing the risk for bacterial growth in these piping systems.”

Another serious factor impacting water quality, especially in new buildings, is water-saving “green” efforts, notes Keane, who refers to new buildings with water-conservation-oriented plumbing systems that inadvertently increase the risk for bacterial growth as “*Legionella*-Enabled Engineering Design buildings.”

Multistage Filtration

Legionella and other bacteria breed in the biofilm and scale that builds up in plumbing systems. Deposits of larger solids provide a beachhead for these breeding grounds.

Taking a multistage approach to water treatment is important, as is minimizing solids in the potable water system, which can impact overall risk reduction, Keane said.

“Anything that holds solids — a basket filter, a media filter, a very low-flow aerator, or even a medium-flow multidisc faucet restrictor — can be a breeding ground for bacteria,” he cautions. “I’ve been involved in several cases where I found the filter or faucet flow restrictor was a critical root cause of a *Legionella* problem in potable water systems. According to news reports, the recent EPIC Hotel Legionnaires disease outbreak in Miami is one good example of an outbreak linked to a media filter in potable water.”

Keane often specifies an automatic self-cleaning screen filter at the domestic water system’s point of entry. The systems can be specified to deliver a degree of filtration as fine as 10 μ . When a set pressure differential is reached between the dirty and clean sides of the screen, a cleaning valve automatically opens to atmospheric pressure, drawing water and filter cake into revolving scanner nozzles. The nozzles focus the backwash force on a small area of screen at a time, efficiently removing trapped particles. The nozzles travel down the cylindrical screen in a spiral pattern, ensuring that the entire surface is cleaned during each cycle. The entire self-cleaning process is accomplished without interfering with filtration or breaking the

integrity of the closed system.

The result is the thorough and frequent removal of solids from the system — preventing a host for the buildup of bacterial populations — without relying on maintenance, chemicals, or a large amount of back

flush water. Keane said, “While many water-saving devices and strategies significantly increase the risk for *Legionella* propagation, these filters and their extremely low back flush volumes are an excellent water-saving device that can also reduce the risk of bacterial growth.”



Automatic self-cleaning screen filters continually remove trapped particles, avoiding buildup that could harbor bacteria.

Critical Points

Downstream, membranes and cartridge filters protect delicate machinery as needed, freed from the task of

having to waste expensive, fine consumables on suspended particles. Keane also favors chlorine dioxide-generating systems for shocking bacterial populations and subsequent residual disinfection.

The multistage approach also includes an assessment of critical hazard points and frequent maintenance of the plumbing system and implementation of a risk management plan as required by the Joint Commission Environment of Care Standard, Keane said.

The Business Of Operations And Maintenance

Fighting HAIs — and the lawsuits that can arise from it — has a profound impact on hospital budgets. But even day-to-day operations can significantly affect the cost of healthcare and the profitability of a hospital operation.

Maintenance staff salaries may not hold a candle to physician incomes, but paying employees to clean out hundreds of sink aerators and showerheads after city utility repairs or after the use of a nearby fire hydrant flushes sediment throughout the domestic water system is costly nonetheless, and so is replacing valves and fixtures eroded by water laden with abrasive solids.

In a hospital, there’s even more at risk than sinks and showers.

“If you do point-of-entry filtration, you’re going to, No. 1, protect equipment like reverse osmosis filters and other very critical equipment in labs and hospital facilities,” notes Bob Fitzgerald, owner of Environmental Products of Texas in McKinney, TX. “By keeping solids out of hot water heating equipment, you’re also not going to have as many problems with hot water tank failures.”

Cooling towers have challenges of their own, notes

Fitzgerald. Easily choked with sediment and debris from the air, cooling towers can quickly become inefficient at heat exchange and highly efficient breeding grounds for bacteria.

The use of biocides in cooling water is an important tool for controlling bacteria.

Filtration improves the efficacy of biocides and may help reduce the amount of biocide needed to treat water with a high number of total suspended solids or to replace chemicals flushed during a blowdown to eliminate dirty water.

Removing solids also reduces energy costs dramatically. According to the *Carrier System Design Manual*, the addition of just 1/10 of an inch of scale on a cooling tower's heat exchanger surface can increase energy demand by more than 10%.

To optimize efficiency in cooling tower applications, Fitzgerald recommends a sidestream filtration system capable of handling up to 30% of the cooling system's flow.

Green Concepts

Adopting efficient, effective methods to ensure clean water — both potable and cooling water — in health-care facilities is consistent with the growing interest in green building design principles. For instance, the Green Healthcare Construction Guidance Statement from the Green Guide for Healthcare underscores the importance of protecting the immediate health of building occupants, the health of the surrounding community, and the health of the global community.

It is also good for healthcare as a whole.

"We're dramatically increasing risk in potable water system design," Keane said. "It's incumbent upon us to do something to offset the risk. And when you look at cost, it's extremely low cost to implement these methodologies." ■

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