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Legionella: Don't Assume

By Matthew R. Freije, Member ASHRAE

Investigators suspected a cooling tower in a densely populated area of Edinburgh, Scotland, was the source of *Legionella* that sickened more than 100 people between the end of May and mid-July of this year, three of whom died. Later in July, 21 people contracted Legionnaires' disease from a hot tub on display in a store in Stoke-on-Trent, England. Two of them died days later. Ten people who stayed at or visited a downtown Chicago hotel between mid-July and mid-August contracted Legionnaires' disease, three of whom have since died. And, as of early September, the case count in an outbreak in Quebec—which has been blamed on cooling towers—was up to 176, with 11 deaths.

The outbreaks were reported by the media but most cases of Legionnaires' disease occur one at a time, without news coverage. In fact, only about 10% of hospital-acquired cases are detected at all, according to the Centers for Disease Control and Prevention, in Atlanta (CDC). The percentage of cases detected is even lower among those acquired outside of hospital stays.

What nearly all cases have in common—whether part of an outbreak or sporadic—are incorrect assumptions. Most facility operators have heard about Legionnaires' disease associated with building water systems but many falsely assume that *Legionella* control measures are unnecessary since they have not been mandated by law, or do not apply to their particular building because of its age, design, young and healthy occupants, location, or water supply. Others implement measures, but ineffective ones, based again on false assumptions.

Legionnaires' disease can be prevented only by taking effective steps to control *Legionella* bacteria in water systems.

Avoid false assumptions about *Legionella* control, including these four pertaining to plumbing systems:

1. Don't assume new piping systems are resistant to *Legionella*. Many old plumbing systems are actually less prone to *Legionella* than new systems, probably because most old systems are simpler and have relatively less total surface area (e.g., in piping and valves) on which biofilm can develop. Of four buildings on a hospital campus that have been tested for *Legionella* monthly for about three years, the newest building has presented the biggest challenge. High *Legionella* positivity and concentrations were found at a cancer hospital despite having been in operation only three years. Another hospital, only three years old, required chemical disinfection because of *Legionella*.

Fairly recent outbreaks of Legionnaires' disease associated with new plumbing systems include a hospital in Ohio and a hotel in Miami.

Newer buildings are not always more prone to *Legionella* growth, though. On another campus where nine buildings

were tested for *Legionella* four times a year for several years, the results were mixed regarding building age.

2. Don't assume that *Legionella* problems are rooted in water heaters. In most plumbing systems, piping presents a more difficult *Legionella* challenge than vessels.

For a new building, selecting water heaters less prone to *Legionella* growth may be a good idea, but replacing water heaters or storage tanks in an attempt to solve a *Legionella* problem is rarely practical or effective because it does not address the biofilm throughout the plumbing system.

The same logic applies to other plumbing system components: Efforts to pinpoint a *Legionella* problem to a single piece of equipment in a plumbing system are usually unsuccessful, at least based on sound evidence. Some waterborne pathogen problems may very well be associated with a particular device or location in a system (e.g., *Pseudomonas* in a tub drain), but *Legionella* is generally a system-wide issue.

Legionella problems are more likely to be solved by evaluating the design, operation, and maintenance of the entire plumbing system, identifying conditions that promote *Legionella* growth and transmission, and then methodically taking prudent steps to minimize those conditions. Testing for *Legionella* will help in determining whether additional measures are needed.

3. Don't assume that the cold water system is *Legionella*-safe. Monthly test results have shown the cold water systems to be more prone to *Legionella* than the hot water in some buildings, particularly at ice machines and drinking fountains.

A building's domestic cold water may not always be cold. Incoming water temperatures may exceed 75°F (24°C) during the summer in many parts of the United States. Even if the water enters the building below 68°F (20°C), its temperature may increase significantly as it flows in pipes along sun baked walls, in ceilings, or

in pipe chases, or because of hot water infiltration at janitor sinks, bed pan washers, shower valves, or other cross connections. Cold water is not generally recirculated, so stagnation can be another factor, especially in buildings that are vacant on weekends.

4. Don't assume that a disinfection system will control *Legionella* from the moment you turn it on. Thankfully, current disinfection technology combined with proper operation and maintenance can sufficiently control *Legionella* in nearly all plumbing systems. However, these technologies will not control *Legionella* immediately. Sometimes it takes a few months. Moreover, vigilant maintenance is a must—in the entire plumbing system as well as the disinfection equipment itself—to ensure that the equipment is operating, that it is producing the required dosage, and that the disinfectant is flowing throughout the system.

Simple as that sounds, it often does not happen. In July and August alone, disinfection systems at one hospital were found to be off during *most* of the vendor's weekly inspections. Some weeks the unit was off because of a failed part—electric cell, analyzer sample chamber, temperature switch, fitting, tubing, solenoid valve, low-flow alarm, GFI outlet. At other times it was off because the facility personnel or a contractor turned it off and forgot to turn it back on. Sometimes it was off for no apparent reason.

The flushing procedures assigned to hospital environmental services (housekeeping) crews has also been crucial. To control

Legionella, the disinfectant must flow throughout the system.

Another reason not to assume performance is that *Legionella* is sometimes found at a few outlets even when disinfection equipment is well maintained and the piping adequately flushed, particularly in large plumbing networks. In hospitals, the best solution is usually to install filters (validated for ≤ 0.2 micron) on those faucets and showers.

Those are only four. The list of assumptions could go on. Perhaps the best summary is simply, "Don't assume," which is the essence of the verification step required by the HACCP water plans proposed in ASHRAE 188P (see "What's Proposed in *Legionella* Standard," *ASHRAE Journal*, May 2012).

The HACCP approach does not tolerate assumptions. Implementation of a *Legionella* HACCP water plan's control measures must be verified. And, the overall effectiveness of a plan in accomplishing its objective—to prevent Legionnaires' disease by controlling *Legionella*—must be validated.

Had *Legionella* control been validated rather than assumed, the recent Legionnaires' cases and deaths reported in the media, as well as hundreds of others that went undetected, could very likely have been prevented.

Matthew Freije is the founder and president of HC Info and the instructor for the online training program Preparing to Develop a Legionella HACCP Water Plan. ■



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