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Plumbing, Piping, Fire Protection, & HVAC System Design Services, Forensic Investigations of Mechanical System Failures, Litigation Support, Code and Standard Consulting, Technical Writing, Training Seminars

PRESS RELEASE

Part 1 of 2

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Flushing Bacteria from Stagnant Building Water Piping

By: Ron George, CPD

Below is a recommended flushing procedure for building owners, property managers, water utilities, health officials, code officials, service contractors, engineers, insurance companies, and interested parties to refer to when recommending or performing flushing operations on build water systems before re-opening buildings for occupancy after a long shut-down.

With the recent Coronavirus events causing many stay-at-home orders and extended vacancy of offices and workplaces, there is a looming, serious issue associated with stagnant water or aging water in the plumbing piping systems of buildings that have not been occupied for long periods of time. Bacteria will grow and flourish in the biofilm of the plumbing system that have been sitting stagnant with ambient temperature or warm water where the water treatment chemicals have been given time to dissipate to levels that will not control bacterial growth. Studies have shown water treatment chemicals dissipate over time, and there are several factors that affect the rate of dissipation, such as pipe material, temperature, and organic contaminants in the water. After the chlorine dissipates, bacteria can grow to high numbers. When Legionella bacteria are aerosolized in water from showers and other fixtures, they can be inhaled into the lungs, causing Legionellosis or Legionnaires' disease. Therefore, it is important to flush stagnant pipes containing bacteria-laden water before re-occupying the buildings that have been vacant for long periods of time.

There are AWWA standards for flushing and disinfecting large public water utility mains, however, there is no standards for flushing and disinfecting plumbing systems within buildings. The ASHRAE 188 Standard establishes criteria for establishing a water management team, which will perform a risk assessment of the building water systems and develop a water management plan. The ASHRAE 188 Standard recommends flushing, but it does not go into details of how the flushing procedure should be done. For emergency disinfection, there are two methods. Chemical and Thermal. Thermal disinfection only disinfects the hot water system and can only disinfect the system if the water heater can reach a disinfecting temperature. Many water heaters are not capable of reaching temperatures high enough to disinfect the entire hot water distribution system when you add the heat loss in the system.

Chemical disinfection requires a professional to administer the disinfectant at levels that will disinfect without getting so high as to be corrosive to the piping system. Many metallic piping systems and a few plastic piping systems can be degraded by excessive chlorine exposure. Chemical disinfection typically requires the building to be licensed as a public water treatment operator and in many cases the State may require licensing and/or certifications for persons performing the disinfection work.

Under normal operating conditions storage type water heaters should be maintained at a temperature high enough to kill legionella bacteria and then utilize a temperature actuated mixing valve Conforming to the standards in the code, (ASSE 1017 or CSA B125.3) to stabilize the hot water delivery temperature. Some organizations have recommended storing hot water in excess of 135 F - 140 F or higher temperatures as needed in the tank to offset heat loss and maintain a minimum hot water temperature a couple of degrees above the Legionella growth temperature of 122 Fahrenheit at the lowest temperature point in the system. Some engineers and guidelines recommend a safety factor or buffer of a couple of degrees and they recommend a minimum temperature of 124 F at the lowest temperature point in the system In systems with circulating pumps, this would require a temperature gauge on the hot water return pipe connection near where it returns to the water heater to assure the entire hot water distribution system is above the Legionella growth temperature. The temperature gauge on the hot water return pipe should be located just before the tee where the hot water return splits to direct the return hot water to the cold water connection of the water heater and the cold water inlet of the mixing valve. This is the lowest temperature point in the hot water system. (See *"Table A - Effects of Temperature on Legionella Bacteria"*.)

Table A – Effects of Temperature on Legionella Bacteria *By: Ron George, CPD*

Temperature	Result
Below 68F	Legionella survives, but will not reproduce
68 F	Legionella will double its population in 8 days
77 F	Legionella will double its population in 3 days
68 F to 122 F	Legionella bacteria growth temperature range[3]
95 F to 115 F	Ideal Legionella bacteria growth temperature range
Above 122F & Below 131 F	Legionella bacteria can survive but will not grow or multiply[2]
131 F	Legionella bacteria dies in 5 to 6 hours[2]
140 F	Legionella bacteria dies in 32 minutes[2]
151 F	Legionella bacteria dies in 2 minutes[2]
158 F +	Legionella bacteria dies instantly (Disinfection temperature)[2]

Notes:

1. This is based on laboratory tests, field conditions may vary due to differences in water quality, insulating properties of biofilm/scale
2. Some types of water heaters are not capable of heating to non-growth or disinfection temperatures.
3. The coolest point in the hot water system (Hot water return pipe) should be a couple of degrees above the highest growth temperature.

Before re-occupying a building that has been unoccupied for more than 4 days, it is recommended to flush stagnant water from the piping system before opening the building to occupants. To minimize the chances of transmission of Legionella bacteria and other microorganisms to humans, flushing water from the plumbing fixtures is the easiest, quickest, and cheapest way to prepare for occupants to return to the building.

The water utility has a duty to deliver safe drinking water to the building service meter according to the safe drinking water act. However, the utilities are allowed fall below the minimum level of quality in the safe drinking water act for three, consecutive 6-month reporting periods while they try to make corrective actions before they must notify the public of a water quality issue. There have recently been efforts to revise these reporting requirements and adjust the list of contaminants in drinking water and require trigger levels when the water utilities must notify their customers of a boil water advisory or other issue. The responsibility for building water safety is the responsibility of the building owner. The drinking water provider has no responsibility for water quality on the building side of the water meter. A water utility should strive to deliver quality water, but we know that the water utilities cannot guarantee safe drinking water because there are often water main breaks, construction, fire events and other disruptions of water main flows that cause turbid water and high bacteria events. For this reason, the building owner has a duty and responsibility to monitor the water quality coming into their building. Therefore, having a

water management plan or water safety plan in place to have a plan for building operators to monitor and react to incoming water quality issues is important.

In the last 3 decades, we have been in a water and energy conservation mode. Water flows have been reduced to levels that are less than 20 percent of flows prior to 1992. The flow velocity in water mains have been reduced to the point where water treatment chemical residuals often dissipate to levels that will not control bacterial growth in the water mains near the ends of larger water distribution systems. The lack of chlorine residuals at the end of distributions systems has caused some water utilities to switch to other water treatment chemicals. When conditions are right, chlorine can dissipate to levels that will not control Legionella bacteria growth in about 5 days.

For these reasons, some utilities have switched to new water treatment chemicals that have caused degradation of gaskets, o-rings, and seals in plumbing systems. The new chemicals also had other issues, when they oxidize, they have a waste by-product that is reported to be a food source for some micro-organisms, like Nontuberculous Mycobacteria (NTM) that are another type of deadly bacteria. Building owners must monitor the incoming water and adjust the water quality as needed by using supplementary water treatment systems. When a building owner is considering a supplementary treatment system, they should consult with a professional to determine if they need licensing, certification and any filters.

Every fixture in the building should be flushed in accordance with these guidelines or until the water treatment chemical residuals reach an acceptable level. If flushing does not improve water quality, contact the water utility and consider contacting a water treatment professional. Following these procedures should prevent thousands of workers from getting sick and dying from Legionnaires disease and other types of waterborne bacteria and illnesses associated with stagnant water.

The recommended flushing procedure attached should be used by building owners, property managers, water utilities, health officials, code officials, service contractors, engineers, insurance companies, and interested parties to refer to when recommending or performing flushing operations on build water systems before re-opening buildings for occupancy after a long shut-down to reduce the risk of illness and death.