San Francisco
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Services of the San Francisco Public Utilities Commission

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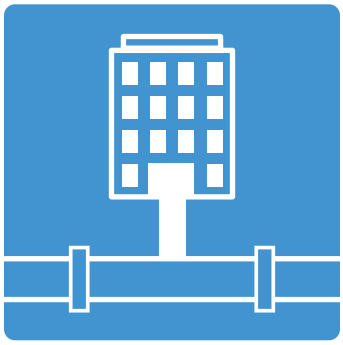

Flushing Guidance for Building Water Systems Following Extended Shutdown

San Francisco Public Utilities Commission
Water Quality Division

During normal building operations, water usage by building occupants keeps water within building pipes fresh. When buildings are vacant for extended periods, stagnant water can deteriorate and develop water quality issues. These issues can be aesthetic, creating taste and odor problems or water clarity problems, or they can be health-related due to bacterial growth from the loss of a disinfectant residual in the water or from leaching of metals (e.g., lead) from the plumbing. This guidance provides tips for safely returning building water systems to service after San Francisco's shelter-in-place period.

Flushing brings in disinfectant from the municipal system that can help control biological growth. The longer service is interrupted, a commensurately greater level of effort is needed for water quality restoration. Flushing guidance is divided into two sections: (1) guidance for all buildings and (2) additional guidance for large buildings. Large buildings are defined as buildings of 40 or more feet in height (i.e., 4 or more stories). This guidance is based on recent information from American Water Works Association (AWWA), Environmental Science, Policy & Research Institute (ESPRI), and Centers for Disease Control and Prevention (CDC). Due to rapidly changing information during COVID-19, all guidance will be updated as appropriate.

Guidance for All Buildings

SFPUC has identified the following flushing guidance for all buildings that have experienced significant shutdown periods. If you are not familiar with your building's plumbing, consider hiring a plumber to assist you with flushing.

1. Inspect and map out your facility's water system, including location where water enters the facility and all water-related devices and connections (e.g. drinking fountains, toilets, showers, irrigation systems, water heaters, water treatment devices, kitchen and bath faucets, hose bibs, eye washes, etc.).
2. Remove, isolate or bypass devices like treatment units, cooling systems, irrigation systems, etc.
3. Take steps to prevent backflow or the siphoning of contaminants into plumbing (e.g., close valves separating irrigation systems from building plumbing, disconnect hoses attached to faucets, etc.).
4. Make sure that all drains are open to prevent flooding.
5. Organize flushing to maximize the flow of water. Open several outlets simultaneously to flush the service line and then flush outlets individually starting near where the water enters the facility.
6. Run water through all outlets (e.g., hose bibs, faucets, showerheads, flushometers, etc.), while removing aerators when possible. Typical durations in existing protocols range from 10 to 30 minutes for each outlet.
7. Flush the cold water lines first and then the hot water lines. Also make sure to drain and flush all systems or appliances that store water (e.g., hot water tanks). For small buildings, the hot water tank can be drained directly; otherwise, it can require up to 45 minutes to fully flush a typical 40-gallon hot water tank. You can detect if flushing was adequate when the hot water tap runs cold.
8. Flush until air is purged from lines and discolored/cloudy water dissipate (typically entrained air will give water a whitish, milky appearance).
9. Replace all point-of-use filters, including the filters in refrigerators.
10. Ensure hot water storage tanks are set at temperatures that prevent the growth of *Legionella* bacteria (at least 120°F and ideally >140°F). Also, when applicable, follow all other *Legionella* prevention guidance that have been identified by CDC, such as decorative fountain cleaning, hot tub maintenance, and cooling tower maintenance (see CDC link, below).
11. Maintain records of flushing details, such as dates/times of flushing, approximate volume of water flushed, the sequence of flushing steps, and a list of appliances, tanks, and treatment systems that were cleaned/flushed. If another round of flushing is needed at a future date, records could help optimize the flushing process for your building.

Additional Guidance for Large Buildings

SFPUC recommends the following additional guidance for large buildings (≥ 40 feet in height or ≥ 4 stories). These guidance were adapted from ESPRI.

- Large building managers should plan ahead to ensure flushing is completed prior to re-opening the building for occupancy. Flushing times and the need for follow-up flushing will depend on building size and building age. To complete flushing, it could take a couple of days to a week.
- Typically, a single flush cannot bring a large building water system back to normal operation and re-establish good water quality. Flushing requires an initial flush to remove low quality water and contaminants and then follow-up flushes that may bring the building back to normal occupancy water quality.
- Flushing should be conducted in phases (e.g., one floor at a time) to avoid problems with drainage capacity and to ensure efficient flushing as follows:
  - o For each floor, flushing should proceed from the water service entrance to the periphery of the plumbing system.
  - o Flush zone-by-zone, flushing zones progressively outward from the supply. The first zone to flush is the zone nearest the supply.
  - o In each zone, flush the cold water plumbing first and then the hot water plumbing second.
- Some buildings have water treatment systems, such as filters at the building water supply. Those treatment systems need to be cleaned, flushed, and maintained as part of bringing the building back into use.
- Large buildings have a variety of places where water is stored. At a minimum, they should all be identified, drained, and flushed with clean cold water, after the building cold water service is properly restored. These include, but are not limited to:
  - o Drinking water (cold water) storage
  - o Hot water storage
  - o Hot water recirculating loop(s)
  - o Humidifiers
  - o Cooling towers
- A best practice for a flushing program would be to take measurements of temperature and/or chlorine at cold water taps. The temperature of water entering the building (e.g., from a backflow preventer) can be compared to the water temperature from building taps. Similar temperatures, from the main to the taps, would indicate that fresh water has reached the taps. Similarly, disinfectant (chlorine) measurements and comparison can be conducted at cold water taps to verify that fresh drinking water has replaced stagnant water in the building plumbing.

How does building closure impact water quality?

Cold water pipes have a disinfectant residual which prevents bacterial growth. During extended building shutdowns, the cold water within building pipes will lose its disinfectant residual due to natural degradation processes. Without a disinfectant residual, there is an opportunity for bacterial growth. In addition, long contact times between stagnant water and pipes can cause undesirable leaching of pipe materials, such as lead solder in older plumbing and fixtures.

Hot water systems are typically maintained at elevated temperatures (a minimum of 120°F and ideally greater than 140°F), which minimizes warm-water bacteria, such as *Legionella* that thrive between 77°F to 108°F (CDC, ANSI/ASHRAE).

If hot water systems are not maintained at optimum temperatures, there is a potential for growth of *Legionella* bacteria, which is an inhalation concern wherever water is aerosolized (e.g., air conditioning systems, fountains, showers, etc.).

Water reuse?

In most cases, the water that is flushed will enter the sewer system. However, building managers should consider opportunities to use some of the stagnant water for a beneficial purpose, such as landscape irrigation or cleaning sidewalks.

References

American Water Works Association (AWWA), April 2020 – Notice on returning homes to service
www.awwa.org/Resources-Tools/Resource-Topics/Coronavirus#10681543-shutoffs-and-return-to-service-guidance

ANSI/ASHRAE, 2019 – Standard 188-2018, Legionellosis: Risk Management for Building Water Systems
www.ashrae.org/technical-resources/bookstore/ansi-ashrae-standard-188-2018-legionellosis-risk-management-for-building-water-systems

Centers for Disease Control and Prevention (CDC), May 2020 – Guidance for Building Water Systems
https://www.cdc.gov/coronavirus/2019-ncov/php/building-water-system.html

Environmental Science, Policy & Research Institute (ESPRI), April 2020 – Building Water Quality and Coronavirus: Flushing Guidance for Periods of Low or No Use ***esprinstitute.org/coronavirus-building-flushing-guidance***

Water Research Foundation (WRF), May 2019 – Flushing Guidance for Premise Plumbing and Service Lines to Avoid or Address a Drinking Water Advisory ***www.waterrf.org/system/files/resource/2019-05/4572.pdf***

Still have questions?

If you still have questions on building flushing guidance, please contact SFPUC Water Quality Division at ***(650) 652-3100***, Monday to Friday, 8 am to 5 pm, or by email at ***quality@sfwater.org***.