

# Tips and Recommendations for the Safe and Efficient Flushing of Plumbing Systems in Buildings

The IAPMO Group

As places of business and assembly that have been shut down for many weeks begin to reopen, one of the first things that facility managers, building superintendents, maintenance crews, and business owners should attend to is the safety of building water systems. All water systems in buildings that have been vacant or sparsely utilized for weeks or months must, at a minimum, be flushed prior to being put back into service such that the stagnant water is safely discharged into the building sanitary system and replaced with fresh utility water. The following tips and recommendations will help with conducting the flushing process in a safe and efficient manner.

**Water stagnation:** When water is not drawn through a plumbing system or other building water system over an extended period of time, the water becomes stagnant. Stagnation supports the accelerated growth of many harmful microorganisms, such as Legionella, that can cause great harm to building occupants. Just as with the coronavirus, those who are at the greatest risk of becoming ill from such microorganisms are the elderly and those who are immunocompromised.

**Seek professional help:** When working on building water systems, unforeseen problems can present themselves, resulting in severe water damage. Therefore, it is highly recommended that the flushing process be performed by registered plumbing professionals. For large and complex buildings, consult a plumbing engineer or registered professional familiar with the building water systems in order to determine a detailed flushing plan for flushing all water systems.

**What this document addresses:** The paper provides recommendations on how to safely and efficiently flush a building's plumbing system when reopening after closure from the COVID-19 pandemic. It also provides tips to minimize aerosol generation. Reducing aerosols during the flushing process can help protect the workers doing the flushing from microorganisms in the stagnant water and reduce surface contamination from the flushing process.

**This document does not address building water system disinfection treatments:** Many building water systems will require disinfecting treatments in addition to flushing. This is particularly important if any disruption of supply pressure occurred or is suspected while the building was shut down. Pressure disruptions can dislodge biofilms and particulates, including lead, which can get trapped in aerators and filters and reduce water quality and spike lead levels. It is highly recommended that building owners and facility managers contact their health departments, and where called for, seek the services of water system treatment professionals to determine whether and how to best disinfect building water systems. Keep in mind that there are cost and efficiency benefits to flush and disinfect building water systems at the same time. Because many thousands of buildings will likely need to reopen regionally in a short period of time, it may be a good idea to contact your health department and secure the services of a water system treatment professional well in advance of reopening.

## **Flushing Tips and Recommendations**

**Prior to starting:** Read the recommendations below completely before starting work. It's highly recommended that the person overseeing the flushing process contact the appropriate water utility prior to beginning. It will be important to first verify that fresh utility water is available in close proximity to the building's incoming water supply line. This is especially important for buildings in large industrial complexes where many buildings have been closed or operating at low occupancy levels. In addition, check with the water utility regarding the chlorine residual level that should be expected in fresh utility water at your building.

It is also recommended that the local health department be contacted to discuss the building and the flushing process, especially in large, complex buildings. If available, utilize health department data sheets to document the flushing process.

**Protect water system rehabilitation personnel:** Persons flushing building water systems should be advised to take precautions and must be provided with appropriate personal protective equipment (PPE) to protect against stagnant water aerosols, water containing high chemical levels and the possibility of scalding from hot water. Consult OSHA and local health department guidance for the type of PPE that is recommended for the type of building being worked on. Use of NIOSH approved N-95 type respirators is recommended.

The following equipment will be needed:

- A high-quality digital chlorine meter/test kit
- A digital thermometer for measuring water temperature
- Anti-vandal tools for removing aerators and supply stop covers (check with the appropriate manufacturers)

**Important – Sewer gases, floor drains and traps:** If an overwhelming smell of sewer gas is detected in the building or when entering bathrooms that have been unused for long periods of time, it is likely that floor traps or fixture traps have run dry. It may be possible, while very rare and only in extreme instances, that turning on exhaust fans under such conditions could cause an explosion. Play it safe! If high concentrations of sewer gases are suspected in the building, evacuate the building and contact the local fire department to assess the condition.

Ensuring that there are no dry traps in the plumbing system is a critically important first step. Building sanitary systems harbor many waterborne microorganisms, and dry traps and floor drains can provide a pathway for those pathogens to enter the building. Go through the building and slowly pour clean water into floor drains and sinks to make sure that traps are fully restored. Remember, sanitary systems have been implicated in the spread of the coronavirus, so any dry trap provides a potential pathway for exposure to the virus and other harmful microorganisms.

**Know which products are installed in the building:** It will be important to know which specific plumbing products, fixtures and fittings are installed in the building prior to beginning. Look for markings on plumbing fixtures and fittings that detail manufacturer and the flush volumes per flush on toilets and urinals, and the flow rate. (Flush volumes are typically shown in close proximity to the manufacturer's logo, and faucet flow rates are typically found embossed on faucet aerators.) Contact the manufacturer of those products to seek guidance regarding their specific flushing recommendations. Always follow manufacturer instructions. Be careful not to overlook features such as break rooms, kitchen sinks, coffee makers, ice machines, carbonated drink dispensers, dishwashers, executive bathrooms, hair washing stations and church baptistries.

**Exhaust fans and water heating systems:** After verifying that all floor drains and fixture traps have been restored, go through the building and turn on available exhaust fans in rooms that have plumbing fixtures and fixture fittings (toilets, urinals, showers, faucets). Turn all water heaters and boilers off and allow the water to start to cool. If the building has a hot water circulation system, allow it to continue to circulate water.

**Potential for sanitary system blockages:** It's possible that solid waste in the sanitary building drain has dried out and solidified. This can result in blockages during the flushing process or after the building reopens. Never leave a room unattended while the flushing process is ongoing.

**Tips for reducing splashing and reducing aerosols:** When flushing toilets, always close the toilet seat lid. If the toilet does not have a seat lid, utilize a non-porous, rigid, flat device such as a piece of rigid plastic that covers the toilet bowl. This will help reduce aerosols resulting from flushing the toilet. A plastic trash can lid may work well for this

purpose. Do not attempt to make the cover airtight, as some air will be required to get into the toilet bowl to allow the toilet to flush. Clean the flat device with a disinfecting cleaner after each use.

When flushing urinals, consider covering the urinal with a plastic trash bag to trap aerosols if numerous, repetitive flush activations are required. For sinks and showers, consider using a plastic trash bag with a hole cut out at the center of the bottom of the bag just large enough to slip over the showerhead or the faucet outlet and tape it in place. Make sure that the trash bag cannot block the fixture drain outlet.

**Flushing times and cycles:** Consult a plumbing professional to determine the number of flushes and flush times required to remove the stagnant water from the water supply lines. This will be based on plumbing system size and geometry, and the flush volumes and flow rates of the installed fixtures and fixture fittings (faucets and showerheads).

**The flushing process:** It is important to conduct the flushing process in the sequence detailed below. This will result in discharging contaminated hot water without running it through the entire plumbing system to the greatest extent possible, and then getting fresh water to distal sections of the plumbing system safely and efficiently.

1. **Start on the basement — or lowest — level of the building** at the fixture closest to the incoming flow of water. This will flush the water service line(s), bring fresh utility water into the building and completely flush the hot water system. Utility sink or floor sink faucets, such as those found in basements or janitor closets, typically have higher flow rates to facilitate the fast filling of buckets, etc. This makes them ideal for beginning the flushing process. If a service sink or floor sink is not available, go to the sink closest to the incoming flow of water.
  - **Service sink, floor sink or sink closest to incoming flow of water:** Remove the faucet aerator, if applicable. Open the sink faucet's cold water valve first to the highest flow rate possible without creating excessive splashing. Ensure that the sink drain can handle the flow of water without backing up and overflowing the sink. Using a digital thermometer to check water temperature, flush until the water temperature stabilizes. Turn off the cold valve and repeat the above process with the hot water valve. Flush the hot water system until the temperature reaches the same temperature as the cold water. This may take considerably longer depending on the volume of water in the hot water system. Take care to avoid scalding. Clean and replace the faucet aerator.
  - **Check for residual chlorine:** Using an approved digital chlorine testing kit, check for the presence of residual chlorine in the water from both the cold and hot water valves. If residual chlorine is not present, continue to flush until a chlorine residual that reflects the expected chlorine residual advised by the water utility is determined. If, after additional flushing, residual chlorine is still not present, contact the water utility to report the lack of residual chlorine in the building after extensive flushing. Inquire about the residual chlorine levels and how to remedy the problem. It is important to verify the presence of residual chlorine before proceeding.
2. **Continuing on the lowest floor:** Proceed to the bathroom, shower room, break room or other room containing water using fixtures on the lowest level that is farthest away from the incoming source of water.
  - **Toilets and urinals:** Flush toilet and urinal supply lines first, if applicable. Start with the fixture that is farthest away from the incoming flow of water and work back towards the incoming flow of water. Consult a plumbing professional to determine the number of flushes required to remove the stagnant water from the water supply lines. This will be based on the plumbing system's size and geometry and the flush volumes of the installed fixtures.

- **Showers and faucets:** After flushing the toilet and urinal lines in bathrooms, fresh water should be relatively close to the remaining fixtures in the cold water lines. Using the appropriate tool, remove the aerator from faucets. Flush the cold water lines first. Ensure that the sink drain can handle the flow of water without backing up and overflowing the sink. Using a digital thermometer to check water temperature, flush until the water temperature stabilizes. Repeat the above process to flush the hot water line. Take care to avoid scalding.
  - **Test for residual chlorine:** Using an approved chlorine testing device, check for the presence of residual chlorine at several bathroom locations. Be sure to test the location farthest away from the incoming flow of water. Additional flushing is required until a chlorine residual is determined at all outlets. If, after additional flushing, residual chlorine is still not present, contact the water utility to report the lack of residual chlorine in the building after extensive flushing. Inquire about the residual chlorine levels and how to remedy the problem.
  - Clean and replace aerators. Remove, clean and replace showerheads. Check all fixtures for proper functionality.
3. **Repeat step 2 for each bathroom, shower room, break room or other room containing water using fixtures.** Work from the farthest away fixture back towards the incoming flow of water and go up one floor at a time.

#### Additional Tips

The following tips may be especially helpful in large buildings to more quickly and safely flush vertical risers and long fixture branches. These tips can reduce the number of repetitive flushes, further reduce the generation of aerosols, and help reduce long flush times.

**Toilets:** Water lines servicing toilets can be quickly and safely flushed without excessive repetitive flush activations. For example, it is possible to carefully remove a toilet tank flapper or temporarily disable a flushometer-valve to provide for a run-on condition. This will flush cold water lines directly into the sanitary drain quickly and efficiently, and will also reduce the generation of aerosols. It is not recommended to put flushometer-valves servicing urinals into a run-on condition due to small trap diameters in urinal fixtures, which could result in overflows.

**Electronically operated faucets and flushometer-valves:** Some electronic faucets and flushometer-valves can be programmed or set to better facilitate flushing.

Check with the appropriate manufacturers to determine if the above options are appropriate for their products and follow their instructions.

**Post-flush:** Ensure that the presence of residual chlorine has been verified at various points of the building, concentrating on the fixtures farthest away from the incoming flow of water. Where residual chlorine is not verified, additional flushing of those fixtures will be required.

Return the hot water system(s) to normal operating temperatures. Ensure that the plumbing system is balanced and working properly.

**Other building water systems:** It is important to also remember all other water systems in a building, such as water reuse systems, decorative water features such as fountains, and landscape irrigation systems. Follow manufacturer recommendations for disinfecting all water systems after periods of non-use. Also remember to flush any outdoor toilet or shower facilities and hose bibs.

**Schools and day care centers:** It is particularly important to clean water cooler/fountain filters and aerators in schools and day care centers. Any disruption of supply pressure that may have occurred while the building was shut down can dislodge particulates, including lead, which can get trapped in aerators and filters, spiking lead levels and reducing water quality.

**Water treatment systems and drinking water filters:** If there are water treatment or filtration products used in the plumbing system, such systems may need to be regenerated, flushed or require filter replacement. Consult and follow manufacturer flushing and disinfection procedures and recommendations.

**At-risk populations:** For all buildings serving immunocompromised, high-risk populations, consider testing for Legionella at least seven days prior to reopening the building. Water samples for testing should be collected after flushing the water system.

**Building water safety management plans:** Water is essential to life, but it is also an efficient carrier of disease. The COVID-19 pandemic reminds us just how critically important proper design and maintenance of building water systems are toward protecting public health. **While the COVID-19 pandemic social distancing requirements remain in effect, IAPMO joins with the U.S. CDC in encouraging building owners and facility managers to review and consider establishing a building water safety management plan** as detailed in ASHRAE 188-2018 – *Legionellosis: Risk Management for Building Water Systems* and having water teams trained and certified to ASSE International’s Series 12000 Standard – *Professional Qualifications Standard for Infection Control Risk Assessment for All Building Systems*. Finally, the 2021 Uniform Plumbing Code contains a new Appendix N – *Impact of Water Temperature and the Potential for Scalding and Legionella Growth*. We encourage readers to review Appendix N. The 2021 UPC and all IAPMO codes and standards, are available for review, free of charge, at <https://www.iapmo.org/ibu/publications/read-uniform-codes-online>.

**Other Important Details:** Remember to flush water lines and clean the filters leading to coffee makers, ice makers, dishwashers, clothes washing machines and water fountains/coolers. Clean coffee makers and ice makers and run for a minimum of three cycles, discarding the water and ice. Contact the manufacturers of carbonated beverage machines and follow their flushing and disinfection instructions. In hair salons, special care should be taken to thoroughly flush and clean hand-held showerheads and hoses. Be sure to flush all outdoor utilities and hose bibs.

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