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MassDEP Building Flushing Information

This information may be useful for Public Water Systems and large and small facilities or homes on a public water system after buildings have been shut down or used less frequently

General comments:

As buildings have been shut down or used less frequently, water quality in the buildings may become degraded due to stagnation. **It is always a good practice to flush all water supply lines in a facility after a prolonged closure to ensure that fresh water is in the system.** This guidance provides a general roadmap for how to flush stale stagnant water from homes and other buildings and get the plumbing system water quality back to pre-stagnation conditions and ensure that your water system is safe to use after a prolonged shutdown. *Please note:*

During the COVID-19 pandemic State of Emergency, social distancing protocols must be followed by facility staff while performing steps to return service to homes and other buildings as well as while engaging with residents.

Workers involved with flushing should be properly equipped with personal protective equipment (PPEs) to prevent exposure to splash/aerosols and follow all workplace safety measures. See Massachusetts' Reopening: Sector Specific Protocols and Best Practices at https://www.mass.gov/info-details/reopening-mandatory-safety-standards-for-workplaces.

What is flushing?

The purpose of building flushing is to replace all water inside building piping with fresh water. Flushing involves opening taps before the facility is open and letting the water run to remove water that has been standing in the interior pipes and/or the outlets. It also helps any disinfectant in chlorinated water to work more effectively to kill bacteria and inactivate viruses.

Knowledge of the volume of water associated with plumbing components (e.g., lengths and diameters of piping) and the rate of water flow from a tap is very useful in determining appropriate flushing times. Be aware that adequate flow is necessary to effectively flush lines; therefore, open a sufficient number of taps to obtain maximum flow rate.

Planning is important because it may be necessary to flush water to the ground surface outside to avoid potentially overloading the wastewater disposal system. In addition, it is important to avoid creating a cross-connection when flushing. A cross-connection is any actual or potential connection between the public water supply and a source of contamination or pollution. See the MassDEP Cross Connection Program Manual at https://www.mass.gov/doc/cross-connection-control-program-manual/download and MassDEP Cross-Connection Control: A Best Practices Guide for Small Systems at: https://www.mass.gov/service-details/cross-connection-control-a-best-practices-guide-for-small-systems.

What happens in a building water system while it is out of use

- When the water is not used, any disinfectant in the water has dissipated. Without the disinfectant, microorganisms could have grown in pipes, fixtures, and tanks.
- Stagnant or standing water can cause conditions that increase the risk for growth and spread of *Legionella* and other biofilm-associated bacteria.
- Potentially harmful substances such as disinfection byproducts (DBPs) could form.
- The built-up protective scale on pipes, which supports corrosion control, could become destabilized. Without the protective scale, plumbing materials like lead or copper can dissolve or shear off as particles and end up in the drinking water.
- Mechanical equipment such as cooling towers, boilers, and pumps may not have received any routine maintenance.
- Backflow preventers may have missed test cycles.

How to prepare the building for re-occupancy

- The building water system begins at the meter where water enters the building and includes all plumbing, storage, and fixtures, from building entrance to the last tap.
- The best action is to flush the entire building, including all water-using appliances such as ice machines and dishwashers. Flushing clears out the stagnant water and replaces it with fresh water from the municipal or main supply.
- If staff are available to flush now, they should begin periodic flushing right away. Periodic flushing results in less deterioration of water quality in the building and a faster recovery to normal conditions.
- Inspect mechanical equipment such as cooling towers, boilers, pumps, backflow preventers, etc., and determine if there are any issues regarding their function.
- Other recommended actions:
    - Clean showerheads, faucets, and other fixtures that can produce aerosols that people could inhale.
    - Follow start-up inspection and maintenance guidance from manufacturers of any point-of-use or whole building water treatment systems.
    - If required, collect water samples for analysis at a Massachusetts certified laboratory. For example, public water systems that are required to follow start-up procedures must collect and analyze start-up bacteria samples. For information on seasonal start-up procedures see:
        - MassDEP information and forms needed by seasonal non-community public water suppliers when starting up their system https://www.mass.gov/service-details/seasonal-start-up-information-certification-and-checklist-for-non-community-systems

        - To locate a Massachusetts certified laboratory see https://www.mass.gov/certified-laboratories

- Buildings with specific at-risk populations - **like schools and childcare programs** - should flush prior to opening the building. Stagnant water can contain elevated levels of lead and copper. Detailed information on this can be found at:
    - Reducing Lead and Copper in School and Child Care Facility Drinking Water Before Re-Opening: https://www.mass.gov/info-details/massdep-covid-19-resources-for-water-suppliers-and-wastewater-operators#water-supplier-resources-
    - MassDEP Fact Sheet – Flushing: A Short-Term Solution to Reduce Lead and Copper https://www.mass.gov/media/1584926/download.

- The U.S. Centers for Disease Control and Prevention (CDC) has developed a worksheet to identify buildings at increased risk for Legionella growth and spread. Legionella can grow in many parts of building water systems that are continually wet, and certain devices can then spread contaminated water droplets. This worksheet includes questions to help access if your building or certain devices within the building need a water management program to reduce the risk of Legionella growth and spread.
    - This worksheet is available at: https://www.cdc.gov/legionella/wmp/toolkit/wmp-risk.html.
    - The following CDC link contains NIOSH recommendations to prevent exposure to Legionella in the workplace: https://www.cdc.gov/niosh/docs/wp-solutions/2019-131/pdfs/2019-131.pdf?id=10.26616/NIOSHPUB2019131.

- If there is concern that the building may be susceptible to contamination from pathogens like *Legionella*, the facility should follow the CDC Guidance for Building Water Systems to help minimize the risk of Legionnaire's disease and other diseases associated with water, given that water has likely become stagnant in many buildings, such as those that have been vacated by businesses while social distancing measures are in place. The guidance recommends an eight-step process before reopening a building, which includes flushing the water system and maintaining the water systems. More information on this is located at:
  CDC Guidance for Building Water Systems**:** https://www.cdc.gov/coronavirus/2019-ncov/php/building-water-system.html.

- You may also review the following guidance on *Legionella*:
    - If applicable, check American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) Standard 188 that established minimum legionellosis risk management requirements for building water systems at http://www.prowaterfl.net/wp-content/uploads/2012/08/Legionellosis-Risk-Management-for-Building-Water-Systems.pdf.
    - MassDEP guidance on Legionella available at: https://www.mass.gov/info-details/legionella-update-for-public-water-suppliers.
    - In most cases, flushing buildings with water that has normal amounts of disinfectant (the chlorine already in the municipal or main water supply) is sufficient for cleaning the water system. However, if disinfectants are used in flushing, their use must follow all standards and requirements. Disinfectants such as chlorine are dangerous to handle and can cause serious damage to plumbing system components if used improperly.

- It is not necessary to add a disinfectant for flushing. Stagnant water should be flushed and replaced with fresh water from the main distribution line or water source.

How to flush a residence or small building

Please note: Many homes have maintained service or even increased water use as residents stay and work at home. These homes do not need to be flushed. When homes are returned to service after an extended period of discontinued service, an adult should be present in the home to ensure that the meter works, leaks are identified and repaired, wastewater piping is intact, and the building's plumbing is flushed.

Flushing instructions provided to occupants will vary depending on the structure. However, for an appropriate and thorough flushing process, recommended key elements include:

1. Prepare for flushing:
    - Remove faucet aerators from all faucets and showerheads where possible and replace them after flushing is completed. Their removal will allow water flowrate to be faster and limit the amount of sediment to become trapped during flushing.

    - Remove point-of-use (POU) filters and replace them after flushing. This will limit the amount of sediment that could have been trapped during flushing and could be a potential source of contamination. Some types of water treatment devices may need to be disinfected or replaced before being used. Check with the manufacturer for details.

    - After all aerators/POU filters are removed, start flushing by opening the water faucets on each floor of your home, moving from the lower levels to the higher levels of your house.

2. Flush household and building water lines, including:
    - Interior and exterior faucets
    - Showers
    - Water/ice dispensers
    - Water treatment units
    - Water heaters may need to be flushed to remove any stagnant water.

3. Detailed guidance for specific situations as follows:
    - **Cold Water Faucets**: Run until the water feels cold, one minute or more, before drinking, brushing your teeth, or using for food preparation. If you have a single-lever faucet, set it to run the cold water first.
    - **Hot Water Faucets:** To clear hot-water pipes and water heaters of untreated water, change all faucets to hot water and flush for at least 15 minutes for a typical household 40-gallon hot-water tank and 30 minutes for an 80-gallon hot water tank or larger. Hot water is then safe to use for washing hands, dishes, pots and pans, etc. Never use water from the hot faucet for drinking, rinsing your mouth, or cooking.
    - **Dishwashers:** After flushing hot water pipes and water heaters, run the dishwasher empty one time.
    - **Humidifiers:** Discard any water used in humidifiers, continuous positive airway pressure (CPAP) machines, and oral, medical, or health-care devices. Rinse the device with clean water.

- **Food and baby formula:** Discard baby formula and other foods prepared with water prior to the shutdown.
- **Refrigerator water-dispensing machine:** Flush water dispensing machine for at least five minutes before using it for household purposes. For more information, refer to manufacturer specifications.
- **Ice cubes:** Empty automatic ice dispensers of ice made prior to shut down and run through a 24-hour cycle. Discard this ice to assure purging of the icemaker's water supply line.

The American Water Works Association (AWWA) (as of April 3, 2020) posted recommendations for returning homes to service. Those recommendations are found at: https://www.awwa.org/Resources-Tools/Resource-Topics/Coronavirus#10681543-shutoffs-and-return-to-service-guidance.

How to flush a large building/facility

As per the CDC (https://www.cdc.gov/legionella/wmp/index.html), large complex plumbing systems like those used in hotels, hospitals, retirement communities, and public buildings are most often associated with *Legionella* growth. Parts of a water system with insufficient circulation or lukewarm temperature can provide the ideal environment for *Legionella* and biofilm-associated bacteria growth. Stagnant water can also lead to low or undetectable levels of disinfectant such as chlorine.

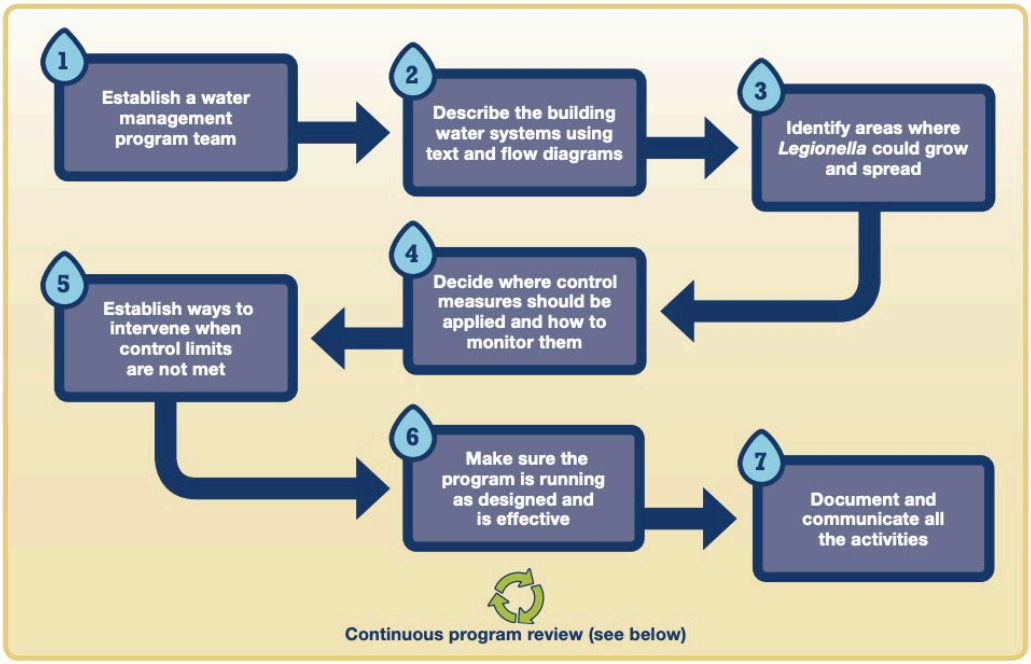
A single flush may not bring the building water system back to normal operation and re-establish good water quality. Depending on the building configuration and equipment, it may require an initial flush to remove low-quality water and any accumulated contaminants, and then follow-up flushes that may bring the building back to pre-COVID-19 water quality. The longer service is interrupted, the more the required level of effort for restoration.

Experience in flushing and maintaining buildings has shown that there are some general principles for an effective flushing strategy.

1. **Planning**

   Before flushing, sketch out the building water system to the best of your ability and identify:
   - the water supply
   - zones or branches with a common water supply (e.g., a branch to a wing of a building or a set of branches served by the same riser)
   - the faucet nearest the starting point of the zone and the most distant faucet or use for each zone
   - water heaters and recirculating heated water loops appliances and water-using features (e.g., hot tubs)
   - any on-site water treatment systems

   The CDC recommends that a facility develop a comprehensive water management program (WMP) for its water system and all devices that use water. Developing and maintaining a water management program is a multi-step, continuous process. The following key steps should be considered while developing a WMP. For more information on this, see https://www.cdc.gov/legionella/downloads/toolkit.pdf.

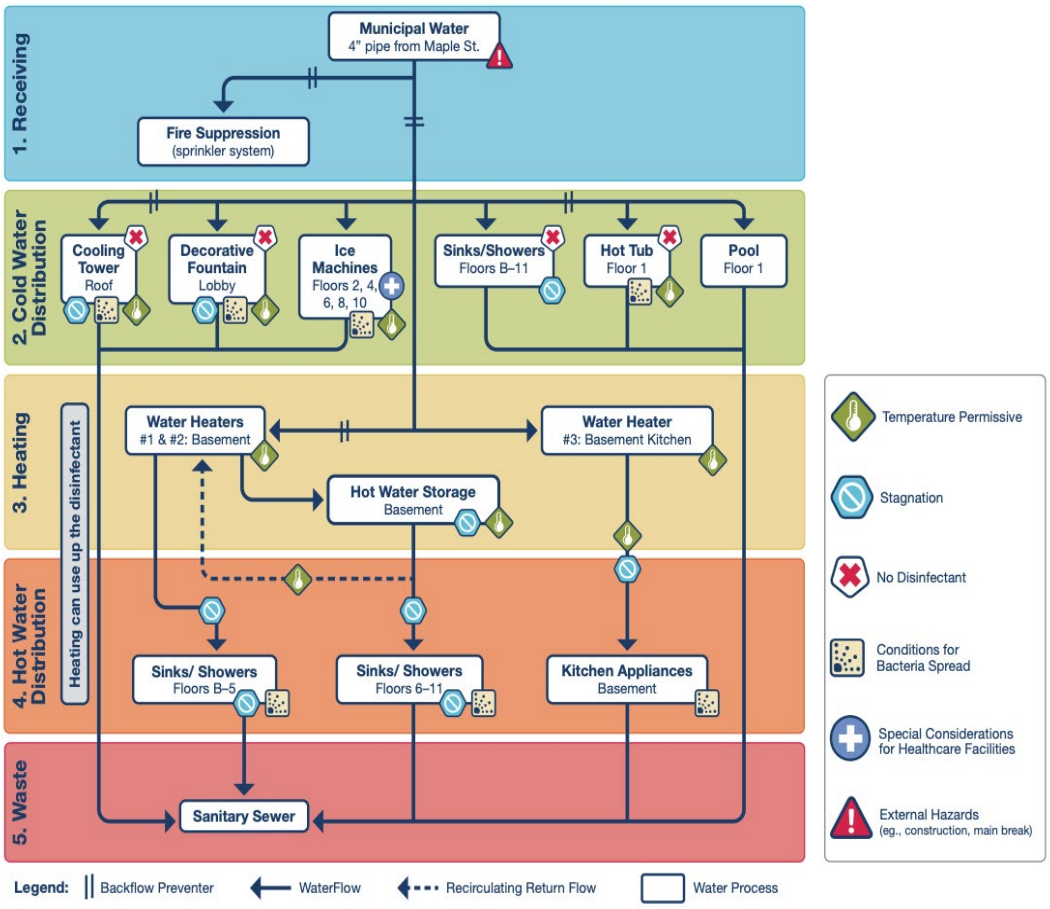


Parts of the water system that are most important to flush, because they have the greatest opportunity to impact human consumption, include:

- faucets used for drinking water or food preparation
- drinking fountains
- ice machines and refrigerators with ice makers
- showers
- kitchen sink sprayers
- water features that generate aerosols (fountains, spas, etc.)
- parts of the water system that are used by children, and
- components of the water system used by elderly people and other susceptible people.

The following is a process flow diagram for a building to help you understand how your water system is interconnected and where potentially hazardous conditions could occur in building water systems.

Example: Schematic Drawing of a Building Water System (The flow diagram is for illustrative purpose only, and is not intended to be relevant to all buildings.)



2. Initial flushing and cleaning. The initial flush clears out contaminants that accumulated during stagnation and draws in fresh, high-quality water to the piping. Cleaning of fixtures removes contaminants from the complex internal structures at the point of discharge. Complete the following initial flushing and cleaning steps before resuming normal building operation:

- Clean fixtures
    - Clean showerheads
    - Some buildings have water treatment systems like point-of-use filters and water softeners. Those treatment systems need to be cleaned, flushed and maintained as part of bringing the building back into use, according to manufacturer's specifications.
- Clean all decorative water features, such as fountains
    - Be sure to follow any recommended manufacturer guidelines for cleaning
    - Ensure that decorative water features are free of visible slime or biofilm
    - After the water feature has been re-filled, measure disinfectant levels to ensure that the water is safe for use
- Before flushing, it is recommended to remove faucet aerators (screens) from all water taps and clean of any sediments built up on the aerator. For deposits that are difficult to remove,

soak the aerator in white vinegar for a few minutes and scrub with a brush; replace if in poor condition. Reattach all faucet aerators on each faucet after flushing is completed.

- Flushing may need to occur in segments (e.g., floors or individual rooms) due to facility size and water pressure.
- Flushing should proceed unidirectionally, that is, from the service entrance to the periphery of the plumbing system (distal points).
- Flush hot and cold water through all points of use (e.g., showers, sink faucets). Begin flushing at the tap in the basement or the lowest floor, moving up to each floor by opening the tap wide. Do not shut off any faucets as you proceed through the building opening more faucets. Be sure to include any laundry tubs and utility sinks. Continue flushing until the furthest final tap on the top floor is flushed for at least 5 minutes and the cold-water temperature at the final tap is steady.
- **Turn off all the faucets in the order that you opened them** (beginning in the basement and moving up to the top floor).
- Building water systems 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:
    - Hot water storage (some buildings have more than one type of heating system and hot water storage)
    - Hot water recirculating loop(s), humidifiers, ice machines, dishwashers
    - Ultrapure water storage (membrane filtration)
- Ensure that hot tubs/spas are free of visible slime or biofilm before filling with water. Perform a hot tub/spa disinfection procedure before use. Guidance is available from CDC at: https://www.cdc.gov/legionella/downloads/hot-tub-disinfection.pdf.
- Ensure that all cooling towers and basins are free of visible slime or biofilm before use and maintained per manufacturer's guidelines and industry best practices. If the tower appears well-maintained, perform an online disinfection procedure. Guidance on disinfection procedures is available from the Cooling Technology Institute: http://www.cti.org/downloads/WTP-148.pdf.
- Be sure to flush, clean, and disinfect safety equipment, including fire sprinkler systems, eye wash stations, and safety showers, according to manufacturer's specifications.
- Ensure that all maintenance activities of water heaters are carried out according to the manufacturer's instructions or by professionals if your manufacturer recommends draining the water heater after a prolonged period of disuse.
- Ensure that all maintenance activities of onsite water treatment systems are carried out according to the manufacturer's instructions.

Additional Resources

- MassDEP Water Main Flushing FAQ for consumers: https://www.mass.gov/media/1840601/download
- MassDEP COVID-19 information for Public Water Systems: https://www.mass.gov/info-details/massdep-covid-19-resources-for-water-suppliers-and-wastewater-operators

- Reducing Lead and Copper in School and Child Care Facility Drinking Water Before Re-Opening: https://www.mass.gov/info-details/massdep-covid-19-resources-for-water-suppliers-and-wastewater-operators#water-supplier-resources-
- MassDEP Fact Sheet – Flushing: A Short-Term Solution to Reduce Lead and Copper https://www.mass.gov/media/1584926/download.
- Water Research Foundation guidance for premise plumbing flushing: https://www.waterrf.org/system/files/resource/2019-05/4572.pdf
- Journal of Water & Health research article on flushing practices: https://iwaponline.com/jwh/article/17/2/196/65542/Analysis-of-building-plumbing-system-flushing
- CDC
    - Resource to develop a water management plan: Toolkit: Developing a Water Management Program to Reduce Legionella Growth and Spread in Buildings
    - Guidance information for healthcare facilities, hospitals: https://www.cdc.gov/legionella/wmp/healthcare-facilities/federal-requirement.html
    - Healthy Water System repair and recovery: https://www.cdc.gov/disasters/watersystemrepair.html
    - Emergency Water Supply planning for Health care facilities: https://www.cdc.gov/healthywater/emergency/ewsp.html
- US EPA Maintaining or Restoring Water Quality in Buildings with Low or no Use Guidance: https://www.epa.gov/sites/production/files/2020-05/documents/final_maintaining_building_water_quality_5.6.20-v2.pdf
  Checklist:
  https://www.epa.gov/sites/production/files/2020-05/documents/final_checklist_for_maintaining_building_water_quality_5-6-2020.pdf
- AWWA flushing guidance related to lead service line: https://www.awwa.org/Portals/0/files/publications/documents/standards/C810-17-LookInside.pdf
- AWWA and IAPMO guidance on Responding to Water Stagnation in Buildings with Reduced or No Water Use:
  https://www.awwa.org/Portals/0/AWWA/Government/20201001FrameworkforBuildingManagersFINALDistCopy.pdf

For Questions or Information:
Contact MassDEP Drinking Water Program at program.director-dwp@mass.gov.

For Specific Questions about your Public Water System:
Contact your MassDEP Regional Drinking Water Program. See https://www.mass.gov/massdep-contacts-service-center.