



Guidance for Building Flushing After Periods of Low or No Use

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The Rhode Island Department of Health's (RIDOH) Center for Drinking Water Quality offers this guidance for owners of large and small buildings who need to flush their distribution and plumbing effectively after periods of low or no use.

In buildings or areas within the distribution system that have been shut down or used less frequently, water quality may be negatively impacted because the water has been stagnant in the plumbing. Bacteria and other harmful contaminants are more likely to be present in stagnant water. This guidance document details how to flush stagnant water from houses and other buildings. Flushing will get the water quality back to pre-stagnation conditions. **If the facility or building area has been closed or not used for longer than three (3) days, it is best practice to flush all water supply lines to ensure that fresh water is in the system.** However, you can perform flushing anytime during periods of low use caused by building closure, seasonal variation, construction, and so forth. Public water systems (PWSs) are required to maintain a copy of their flushing plan as a part of their Operations and Maintenance Manual.

To maintain water quality in a building at all times, building owners and operators should implement a water management program (WMP) that follows industry recommendations, such as the most recent American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) 188 standards, or similar. Each building is different, so you may need to tailor the flushing protocol accordingly.

Please note: If your building or facility has been closed or unused for weeks or months, the United States Environmental Protection Agency (EPA) has developed a [checklist](#)¹ that you can use to help reopen your building.

I. Flushing Overview

Purpose of Building Flushing

The purpose of building flushing is to replace all water inside the building piping with fresh water. A single flush will most likely not bring water in the building back to normal operating water quality standards. The flushing process involves opening taps and letting the water run to remove any stagnant water from the interior pipes and the outlets (faucets, showers, hose bibs, etc.) before reopening the facility. Flushing also helps the disinfectant in chlorinated water to work more effectively to kill bacteria and inactivate viruses. The longer water has been sitting stagnant in the lines, the greater the level of effort is needed to bring the system back into service.

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. It is not necessary to add disinfectant for flushing; however, if adding disinfectants, follow all standards and

¹ https://www.epa.gov/sites/production/files/2020-05/documents/final_checklist_for_maintaining_building_water_quality_5-6-2020.pdf

requirements. Disinfectants, such as chlorine, are dangerous to handle and can cause serious damage to plumbing system components if used improperly.

Why a Building Needs to Be Flushed

- When a building isn't used, the disinfectant that was present in the water in pipes and storage areas may have dissipated (broken down). Without adequate levels of disinfectant, microorganisms can grow in pipes, fixtures, and tanks.
- Potentially harmful substances such as disinfection by-products 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 small particles and end up in the drinking water.
- Mechanical equipment such as cooling towers, boilers, and pumps may have missed routine maintenance.
- Backflow preventers may have missed regularly-scheduled test cycles.

Special Considerations for Risk of *Legionella* and Other Biofilm-Associated Bacteria

- Stagnant or standing water can cause conditions that increase the risk for growth and spread of *Legionella* and other biofilm-associated bacteria.
- If there is concern that the building may be susceptible to contamination from pathogens like *Legionella*, the facility should follow the Centers for Disease Control and Prevention (CDC) Guidance for Building Water Systems to help minimize the risk of Legionnaire's disease and other diseases associated with water. The [guidance recommends an 8-step process before reopening a building](#),² which includes flushing and maintaining the water system.
 - [According to the CDC](#),³ large and complex plumbing systems like those used in hotels, hospitals, retirement communities, and public buildings are most often associated with *Legionella* growth.
 - CDC recommends that a [facility develops a comprehensive WMP](#)⁴ for its water system and all devices that use water.
- If applicable, consult the ASHRAE standards that established [minimum legionellosis risk management requirements for building water systems](#).⁵
- RIDOH's website also has [information and guidance about Legionnaire's disease](#).⁶

Staff Safety Precautions

- All staff who are directly involved in the flushing should wear personal protection equipment (safety goggles, rubber gloves, protective eyewear, N-95 facemasks, etc.) as applicable to avoid exposure to generated aerosols that may pose a health risk.
- Follow appropriate regulations and policies for worker safety and health for buildings that have been closed or unoccupied for an extended period.

² <https://www.cdc.gov/control-legionella/php/guidance/building-water-system.html>

³ <https://www.cdc.gov/control-legionella/php/wmp/index.html>

⁴ <https://www.cdc.gov/control-legionella/php/toolkit/wmp-toolkit.html>

⁵ <http://www.prowaterfl.net/wp-content/uploads/2012/08/Legionellosis-Risk-Management-for-Building-Water-Systems.pdf>

⁶ <https://health.ri.gov/diseases/respiratory/?parm=65>

II. General Flushing Guidance

1. Prepare for Flushing

It is helpful to know the volume of water associated with plumbing components (e.g., lengths and diameters of piping) and the rate of water flow from a tap to determine appropriate flushing times. Understanding that obtaining this information is not always possible, this document provides guidance for how to adequately flush the building's interior pipes without it. Be aware that adequate flow is necessary to effectively flush lines; therefore, open all taps to obtain maximum flow rate.

Planning is important because it may be necessary to flush water to the ground surface outside to avoid 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. For example, a cross-connection can occur between the PWS distribution system and irrigation systems, fire sprinkler systems, or other piping systems that receive PWS drinking water. PWSs should review their existing *Cross-Connection Control Plan* regularly to ensure accuracy and that no hazardous conditions are present.

Tasks to complete during the preparation stage

- If the building receives water from a PWS, contact the water supplier for assistance. The supplier may be able to provide system specific information and guidance regarding any water quality issues impacting your facility. Additionally, the PWS may offer support with site-specific water quality testing.
- Develop a unidirectional flushing (UDF) plan or review the existing UDF plan. UDF is used to create a flow from the point of entry to the periphery of the plumbing system (distal points).
 - All multi-service PWSs may need to review existing UDF plans and increase the frequency and/or duration of flushing.
 - Smaller PWSs without UDF plans may need to perform additional flushing in combination with the steps outlined below. Smaller PWSs should document what they do and keep the record on site for future reference and use.

Special considerations for buildings used by at-risk populations

- At a minimum, if water is being served to at-risk populations (such as in child care centers, schools, or health care facilities), consider reviewing additional guidance prior to opening the buildings. Information about [Lead in Schools Flushing \(3Ts\)](#)⁷ and [Guidance on Restoring Water Quality No/Low Use](#)⁸ is available on EPA's website.

2. Initial Flushing

Depending on the building configuration and equipment, an initial flush to remove low-quality water and accumulated contaminants may need to be followed by additional flushes to improve water quality. The longer service has been interrupted, the greater effort required to restore water quality. This principle applies to buildings of all sizes. The building's water system begins at the point it connects with the PWS and water enters the building. It includes all plumbing, storage, fixtures, and appliances that use water (dishwashers, ice/beverage machines, etc.).

⁷ https://www.epa.gov/sites/production/files/2018-09/documents/flushing_best_practices_factsheet_508.pdf

⁸ https://www.epa.gov/sites/production/files/2020-05/documents/final_maintaining_building_water_quality_5.6.20-v2.pdf

Tasks to complete during the initial flush

- Inspect mechanical equipment such as cooling towers, boilers, pumps, backflow preventers, etc., and determine if there are any issues regarding their function.
- Remove aerators prior to flushing faucets.
- Remove and clean fixtures, including showerheads, before flushing starts.
- Flush zone by zone. Zones are branches of the building's water system that have a common source or are served by a common riser.
 - Flush the zone nearest the building's water supply first.
 - Flush zones progressively outward from the supply to the far end.
 - Be sure to include every patient room, restroom, food-service area, etc.
- In each zone, flush the cold water plumbing first and the hot water plumbing second.
- Flush continuously for at least 10 minutes.
- Flush all drinking fountains by running water continuously for at least 10 minutes.
- Flush all equipment and appliances connected to the water lines according to the manufacturer instructions.
- Inventory filters on equipment to determine if new filters are needed. Replace filters as needed.

3. Preparing for Occupancy:

In addition to flushing, RIDOH recommends:

- Clean showerheads, faucets, and other fixtures that can aerosolize any contaminants from the stagnant water.
- 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 RIDOH-certified laboratory. PWSs that are required to follow seasonal start-up procedures must collect and analyze start-up bacteria samples. Information on seasonal start-up procedures is posted on RIDOH's website.
 - [Information for seasonal non-community public water suppliers when starting up their system](#)⁹
 - [Find a RIDOH-certified laboratory](#)¹⁰
- Be sure to take additional measures for specific pieces of equipment, including:
 - **Water Softeners (if applicable):** Run water softeners through a regeneration (flush) cycle.
 - **Cold Water Faucets:** Run for a minimum of 10 minutes or more. If you have a single-lever faucet, set it to run the cold water first.
 - **Hot Water Faucets:** To clear stagnant water out of hot water pipes and water heaters, once all the cold water piping in the building has been flushed, turn on all hot water faucets. 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. After this, hot water is 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 before using it to wash dishes.
 - **Humidifiers:** Discard any water used in humidifiers, Continuous Positive Airway Pressure (CPAP) machines, and oral, medical, or healthcare devices. Rinse the device with clean water (or follow manufacturer recommendations for flushing and cleaning).
 - **Refrigerator water-dispensing machine:** Flush water-dispensing machine for at least 10 minutes before using it for household purposes. For more information, refer to

⁹ <https://health.ri.gov/drinking-water-quality/public-water-system-compliance-revised-total-coliform-rule>

¹⁰ <https://health.ri.gov/find/labs/privatewelltesting/>

- manufacturer specifications.
- **Ice cubes:** Empty automatic ice dispensers and discard any ice made prior to shut down. Run the ice machine through a 24-hour cycle. Discard the ice from this first cycle to assure purging of the icemaker's water supply line. You can also follow manufacturer recommendations for flushing/cleaning.
- **Drinking Fountains:** Run drinking fountain continuously for 10 minutes. Replace filter if applicable.

III. Flushing Small Buildings/Homes

This section details the considerations and the process for small buildings or houses that are returned to service after an extended period of discontinued service, such as seasonal homes that are part of a year-round PWS. Ensure that the meter works, leaks are identified and repaired, wastewater piping is intact, and the building's plumbing is properly flushed. Flushing instructions provided to occupants may vary depending on the individual structure.

1. Prepare for flushing

- Remove aerators (screens) from all faucets and showerheads, where possible, so that the water flows faster, and they don't trap sediment.
- Remove point-of-use filters so that sediment doesn't get trapped in the filter during flushing. Afterward, replace the old filter with a new filter. Some types of water treatment devices may need to be disinfected or replaced before being used; follow the manufacturer instructions.

2. Initial flushing and cleaning

The initial flush clears out any contaminants that accumulated during stagnation and draws in fresh water to the building plumbing. ***Always follow manufacturer guidance when cleaning/flushing individual components connected to building plumbing. This helps ensure proper flushing and limits the chance of damaging components.***

- Flush the faucets in your home or building one floor at a time. Start with the lowest level and move up to the top floor.
- Turn on (open) all water faucets (inside and outside) and showerheads and let the water run for at least 10 minutes.
- In addition to faucets, flush water/ice dispensers, water heaters, and any other appliance that uses water.
- As applicable, clean (descale and disinfect) system components prior to returning to service. This may include water storage tanks, pressure tanks, water softeners, mixing valves, and safety features (eye wash station, safety showers, etc.). Fixtures such as point-of-use filters, faucets, and showerheads should also be cleaned. Refer to manufacturer instructions for specific flushing and cleaning guidance.
- Refer to the [recommendations from the American Water Works Association](https://www.awwa.org/wp-content/uploads/responding-to-water-stagnation-in-buildings.pdf)¹¹ in the *Responding to Water Stagnation in Buildings with Reduced or No Water Use* resource.
- Reinstall and/or replace any aerators or filters that were removed before flushing and cleaning.

IV. Flushing Large Buildings and Facilities

This section details the considerations and the process for large buildings that are returned to service after an extended period of discontinued service, including hotels, malls, and office buildings. Ensure

¹¹ <https://www.awwa.org/wp-content/uploads/responding-to-water-stagnation-in-buildings.pdf>

that the meter works, leaks are identified and repaired, wastewater piping is intact, and the building's plumbing is properly flushed. Flushing instructions may vary depending on the structure and design of premise plumbing, but there are some general principles for an effective flushing strategy.

[According to the CDC](#),¹² large complex plumbing systems like those used in hotels, hospitals, retirement communities, and public buildings are most often associated with growth of *Legionella* bacteria. Parts of a building with insufficient air circulation or lukewarm temperature can provide the ideal environment for *Legionella* and biofilm-associated bacteria to grow. When the water in a building is stagnant any disinfectant, such as chlorine, already in the water breaks down and can no longer effectively disinfect the system.

1. Prepare for Flushing

- Before flushing, sketch or draw the building water system, to the best of your ability, and identify:
 - Where the water enters the building (source);
 - Zones or branches with the same water supply (a branch to a wing of a building or a set of branches served by the same riser);
 - Faucet that is closest to the starting point of the zone and the faucet/appliance/fixture that is the farthest from the starting point of the zone;
 - Water heaters, recirculating heated water loops, and water-using features (hot tubs); and
 - Any on-site water-treatment systems.
- The parts of the water system that are most important to flush are those that are used for drinking, preparing food, or bathing. They include:
 - Faucets used for drinking water and/or food preparation;
 - Drinking fountains;
 - Ice machines and refrigerators with icemakers;
 - Showers;
 - Kitchen sink sprayer hoses;
 - Water features that generate aerosols (ornamental fountains, spas); and
 - Parts of the system used by children, older adults, and other vulnerable people.
- Before flushing, remove faucet aerators (screens) from all water taps and clean any sediment that has built up on the aerator. For deposits that are difficult to remove, soak the aerator in white vinegar for a few minutes and then scrub it with a brush. Replace the aerator if it is in poor condition.
- Remove point-of-use filters to limit the amount of sediment that gets trapped in the filter during flushing. Afterward, replace the old filter with a new filter. Some types of water treatment devices may need to be disinfected or replaced before being used; follow the manufacturer instructions.

2. Initial flushing and cleaning

The initial flush clears out any contaminants that accumulated during stagnation and draws in fresh water to the building plumbing. ***Always follow manufacturer guidance when cleaning/flushing individual components connected to building plumbing. This helps ensure proper flushing and limits the chance of damaging components.***

- Clean fixtures, including any showerheads, to remove any contaminants from the complex internal structures of the faucet.
- Clean water treatment systems like point-of-use filters and water softeners according to manufacturer specifications.
- Clean all decorative water features according to manufacturer specifications. Be sure to

¹² <https://www.cdc.gov/control-legionella/php/wmp/index.html>

- clean any visible slime or biofilm from water features.
- Perform flushing in segments (e.g., floors, wings, or individual rooms) according to facility size and water pressure.
 - Flushing should proceed unidirectionally, from the service entrance to the periphery, or far end, of the plumbing system (distal points).
 - Flush water lines through all points of use (showers, sink faucets). Flush cold water lines first and repeat the flushing process for hot water lines.
 - 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.
 - Let the water run for at least 15 minutes **or** until the tap that is farthest away from where the water comes into the building consistently produces cold water at a stable temperature, whichever takes longer.
 - Turn off all the faucets in the order that you opened them (beginning in the basement and moving up to the top floor).
 - Building plumbing systems have a variety of places where water is stored. At a minimum, these should be drained and flushed with clean, cold water after the building's 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; and
 - Ultrapure water storage (membrane filtration).
 - Clean any visible slime or biofilm from hot tubs/spas before refilling them with water. Perform a [hot tub/spa disinfection procedure](#)¹³ before use.
 - Clean any visible slime or biofilm from all cooling towers and basins before use and maintain them per manufacturer's guidelines and industry best practices. If the tower appears well-maintained, perform an online disinfection procedure. [Guidance on cooling towers disinfection procedures](#)¹⁴ is available online from the CDC.
 - Refill the water in any decorative water fountain, and measure disinfectant levels to ensure that the water is safe to use.
 - Complete any necessary maintenance of water heaters according to the manufacturer instructions or hire a professional to perform the maintenance.
 - Complete any necessary maintenance of onsite water treatment systems according to the manufacturer instructions.
 - Replace any aerators and/or filters that were removed before flushing and cleaning.

¹³ <https://www.cdc.gov/control-legionella/php/toolkit/hot-tub-module.html>

¹⁴ <https://www.cdc.gov/control-legionella/php/toolkit/cooling-towers-module.html>

Additional Resources

Water Research Foundation

- [Flushing Guidance for Premise Plumbing and Service Lines to Avoid or Address a Drinking Water Advisory](https://www.waterrf.org/research/projects/flushing-guidance-premise-plumbing-and-service-lines-avoid-or-address-drinking)¹⁵

Journal of Water & Health

- [Analysis of building plumbing system flushing practices and communication](https://iwaponline.com/jwh/article/17/2/196/65542/Analysis-of-building-plumbing-system-flushing-practices-and-communication)¹⁶

CDC

- [Federal Requirements to Reduce Legionella Risk](https://www.cdc.gov/control-legionella/php/healthcare/federal-requirement.html)¹⁷
- [Considerations for Reducing Risk: Water in Healthcare Facilities](https://www.cdc.gov/healthcare-associated-infections/php/toolkit/water-management.html)¹⁸
- [Healthcare Water System Repair and Recovery Following a Boil Water Alert or Disruption of Water Supply](https://www.cdc.gov/infection-control/hcp/reopen-health-facilities/water-system-repair.html)¹⁹
- [Emergency Water Supply Planning Guide for Hospital and Healthcare Facilities](https://www.cdc.gov/water-emergency/hcp/toolkit/index.html)²⁰

American Water Works Association (AWWA)

- [AWWA Replacement and Flushing of Lead Service Lines](https://store.awwa.org/AWWA-C810-17-Replacement-and-Flushing-of-Lead-Service-Lines-PDF)²¹

Environmental Protection Agency

- [Restoring Water Quality in Buildings for Reopening](https://www.epa.gov/sites/default/files/2020-05/documents/final_checklist_for_maintaining_building_water_quality_5-6-2020.pdf)²²

Rhode Island Water Works Association

- <https://www.riwwa.net/>

¹⁵ <https://www.waterrf.org/research/projects/flushing-guidance-premise-plumbing-and-service-lines-avoid-or-address-drinking>

¹⁶ <https://iwaponline.com/jwh/article/17/2/196/65542/Analysis-of-building-plumbing-system-flushing>

¹⁷ <https://www.cdc.gov/control-legionella/php/healthcare/federal-requirement.html>

¹⁸ <https://www.cdc.gov/healthcare-associated-infections/php/toolkit/water-management.html>

¹⁹ <https://www.cdc.gov/infection-control/hcp/reopen-health-facilities/water-system-repair.html>

²⁰ <https://www.cdc.gov/water-emergency/hcp/toolkit/index.html>

²¹ <https://store.awwa.org/AWWA-C810-17-Replacement-and-Flushing-of-Lead-Service-Lines-PDF>

²² https://www.epa.gov/sites/default/files/2020-05/documents/final_checklist_for_maintaining_building_water_quality_5-6-2020.pdf