Responding to Low Building Water Use: Concerns and Best Practices for Facility Managers

Information for Building Owners, Building Managers, Health Officials, and Building Occupants
More information here... www.PlumbingSafety.org

A Resource for All
✓ Plumbing news
✓ Plumbing education videos
✓ Plumbing explainers
✓ List of projects
✓ Scientific opinions
✓ Resources ➔ presentations
✓ Scientific reports
✓ External plumbing docs

COVID Specific Building Water Safety Support Resources

AWWA, Friday May 15, 2020, Webinar
Stagnation causes water to get older

**Normal water use** refreshes:
- disinfectant residual &
- corrosion control

**Old water** (not refreshed):
- bacterial growth &
- corrosion not controlled

**Disinfectant** in water – used to reduce microbial growth in water, typically chlorine
**Corrosion control** – used to reduce metals leaching, stabilizes pH and may add chemicals
Prior to the pandemic, stagnation posed health risks

During short-term stagnation, high concentrations of metals and harmful organisms have been found in building water systems. A few issues include…

- **Copper** can leach from pipes (an exceed safe limits in just 48 hours sometimes)
  - This can increase to toxic levels causing gastrointestinal distress

- **Lead** can also leach from water system components
  - Lead causes developmental issues with children

- **Harmful organisms** (e.g., *Legionella pneumophila* and other opportunistic pathogens) grow
  - Many of these organisms cause respiratory illness
  - Other infections can occur

*These reactions have not been studied in the long-term*

Watch on YouTube: [Why Does Water Quality Change Inside Buildings?](https://www.youtube.com/watch?v=...)
1. Support to the plumbing and public health sectors on building water safety guidance and decisions
2. Building water safety review due to prolonged stagnation with experts from 8 private and public sector organizations
3. Field testing to determine how impacted building water safety is in actual large buildings
4. Lab testing to determine how to fully recover contaminated building water system devices and equipment
5. Help transform public awareness
#2. Review paper

Collaborative effort

Caitlin R. Proctor, Ph.D., Purdue University
William Rhoads, Ph.D., Virginia Tech
Tim Keane, Legionella Risk Management, Inc.
Maryam Salehi, Ph.D., University of Memphis
Kerry Hamilton, Ph.D., Arizona State University
Kelsey J. Pieper, Ph.D., Northeastern University
David R. Cwiertny, Ph.D., University of Iowa
Michele Prévost, Ph.D., Polytechnique Montreal
Andrew J. Whelton, Ph.D., Purdue University

Considerations for Large Building Water Quality after Extended Stagnation

Authors
Caitlin Proctor, William Rhoads, Tim Keane, Maryam Salehi, Kerry Hamilton, Kelsey Pieper, David M. Cwiertny, Michele Prévost, Andrew Whelton

DOI: https://doi.org/10.31219/osf.io/qvj3b

osf.io/qvj3b/
What actions can be taken to prevent water quality deterioration?

Normal use:
• Building water management plans

Extended stagnation/low-use
• Periodic flushing
• Change water heater operation
• Drain plumbing?

COVID-19 considerations:
• Utility mains also have stagnation
• Slow ramp-up of economic activity
What actions can be taken to deal with water quality deterioration?

- Recommissioning plumbing
  - System integrity checks
  - Flushing (and cleaning)
  - Shock disinfection
  - Testing
- Professional help might be needed
  - Address complex mechanical and treatment equipment
  - Develop effective flushing plans
  - Perform shock disinfection safely (thermal or chemical)
  - Perform accurate testing
How do organisms cause disease?

**Multiple exposure routes**
- Drinking
- Inhalation
- Dermal (skin, eyes, wounds)

**Multiple exposure activities**
- Showering
- Anything with splashing/aerosols

Typically affect only vulnerable populations, but anyone can be affected
- Immunocompromised
- Certain pre-existing conditions
- Elderly
Precautions

• Personal protective equipment (PPE)
  • OSHA and other agencies recommend respirators if Legionella is suspected

• Reducing exposure
  • During flushing (especially initial), many “tricks” to reduce exposure
  • Cover toilets, showerheads, faucets, reduce splashing

• Temporary closures of facilities
  • Temporarily forbidding high-risk exposure activities (showering)
  • Temporarily closing facilities to concentrate use

• Technical considerations
  • Flooding, cross-connections, dealing with waste
  • Pressure issues with high flowrate flushing

https://static.grainger.com/rp/is/image/Grainger/1AGD3_AS01?$zmmain$
Who should be involved?

• Developing guidance
  • Many government (and non-government) agencies doing this

• Communication about risks
  • Public health officials
  • Building owners?
  • Utilities

• Taking action (flushing, disinfecting)
  • Building owners can task maintenance/facilities managers
  • Plumbers, contractors, engineers may need to be involved
  • Utilities
Flushing achieves 3 goals

**Goal 1:** Remove materials that accumulate in water during *stagnation*

**Goal 2:** Remove some biofilms and sediments,
   (if done at sufficiently high enough speeds)

**Goal 3:** Bring *fresh water* into pipes

Flow
Understanding plumbing configuration

**What you can see**

**Floor 2**

**Floor 1**

**Basement**

Legend:

- **Pipes**
  - Hot
  - Cold
- **Sinks**
- **Kitchen**
- **Bathroom**
- **Janitorial**
- **Toilet**
- **Shower**
- **Irrigation**

- **Appliances**
  - F - fridge
  - D - dishwasher
  - C - water cooler

**Point of Entry**

**Water Softener**

**Water heater**
Understanding plumbing configuration

Option 1
Softened water for irrigation
One central riser

Legend
- F - fridge
- D - dishwasher
- C - water cooler
Understanding plumbing configuration

Option 2

Hot water recirculation line
Irrigation linked to first floor

Legend

- F - fridge
- D - dishwasher
- C - water cooler

- Pipes
- Hot
- Cold
- Sinks
- Kitchen
- Bathroom
- Janitorial
- Toilet
- Fountain
- Shower
- Irrigation
- Appliances
Understanding plumbing configuration

Option 3
Multiple risers
Non-softened water for irrigation

Legend
- Pipes
- Hot
- Cold
- Sinks
- Kitchen
- Bathroom
- Janitorial
- Toilet
- Fountain
- Shower
- Appliances
- F - fridge
- D - dishwasher
- C - water cooler
Incomplete flushing

Incomplete flushing fails to get fresh water all the way to all water outlets.
10 actions building owners should consider

1. **Contact** government public health department, they may have specific requirements.
2. **Communicate** info provided by the health department to occupants.
3. Don’t have a building water management plan? **Document** everything.
4. **Flush** at least weekly. *More frequent is better.* Document! Create a flushing plan.
5. **Conduct** maintenance: Aerators, POU/POE treatment devices, water heaters, shower-wand tubing, etc.
6. **Start** an inventory of building water system components
7. **Use** an inexpensive digital handheld disinfectant analyzer to monitor in-building levels. Document!
8. **Contact** a plumber or engineer for assistance
9. **Do not** shock disinfect, drain plumbing, shut off water heaters and recirculation loops without expert help. Major issues can develop.
10. **Reach out** to us if you have questions.
Learn how to create a building flushing plan

The Purpose Of Flushing Building Water Systems

Kyungyoon R., Graduate Student
Glebushko Shagachkine, Graduate Student
Dr. Cathi Perode, Professor
Dr. Joanna Whelan, Assistant Professor
Division of Environmental and Ecological Engineering
Lyons School of Civil Engineering
Purdue University

Visit our Plumbing Safety YouTube Channel for Short Education Videos

Example Procedure for Flushing an Actual School Building
April 6, 2020, Version 1

I. Background

Sometimes buildings are shut down or experience long-periods of low occupancy and the water inside the property plumbing stagnates. Water can stagnate inside the building pipes and tanks, but also in the buried water service line that transports drinking water from its source to the building. Stagnation allows for contaminant levels of metals such as lead and copper to increase in the water. Microbes are also likely to grow. Under normal building water use, the amount of contamination in water is not typically a problem, but long stagnation periods can cause water quality to deteriorate to unacceptable levels. To remove this water from the property plumbing, a procedure was developed based on as-built construction drawings and experience inside the building. The procedure below is provided to help demonstrate the steps needed to flush the stagnant water from a specific building and replace it with fresh water from the water utility main buried out in front of the property.

This guidance was developed using as-built drawings for an actual building where the characteristics were known. Factors of safety were not applied. Due to non-ideal flows commonly encountered in plumbing, several flushing times may need to be increased. In a prior study for flushing home interior faucets the factory of safety applied was 10. So, all flushing times may need to be 10% longer. No safety factors were applied.

Year Built 2011
Size:
- 2 floors (1st floor: classrooms, auditorium, two gyms, and cafeteria; 2nd floor: mechanical attic)
- All water only located on first floor
- The building area is 209,030 square feet, while the total area for the property (including sporting fields) is 3,373,152 square feet
- There are 12 different building sections (A, B, C, D, E, F, G, H, J, K) and each has various uses.

Water Transport and Use on Property:
- A public water system (PWS) delivers chlorinated drinking water to the property through a buried service line.
- PWS water used for drinking, appliances, hot water, and irrigation.
- After passing through the water meter, an 8-inch PVC pipe service loop circles entire school campus (3,181 feet, volume 8,689 gallons). Some branches exist that convey water to a field house, concession stand, and yard hydrants (a 2 inch existing fire hydrant branches off from the fire line around the building to the near the concession stand, and few others are located outside the building).
- 4 inch irrigation pipe line also branches off from the fire line around the building. In this document, flushing of the irrigation line is not included. The building service line and building itself is only the focus.
- Water enters the school building by traveling through this loop, and then into a 4 inch ductile iron pipe (160 ft, volume 164 gallons)

Devices:
- Two point-of-entry water softeners (52.36 gallons each, one used at a time)
- Four water heaters (139 gallons each)
- Total four hot water recirculation loops, one heater for each loop (a 150°C loop for the kitchen and three 120°C loops for domestic water)
Professionals like you have a key role to play in keeping building water safe

1. Millions of buildings across the U.S. have now been affected by low to no water use.
2. Care must be taken to minimize building water system stagnation and water quality impacts.
3. Building owners should consult their health departments.
4. Our website contains education materials and guidance documents.
5. If you have a question reach out. You’re not alone.