Water Bugs: Building Water Stagnation – Water Quality and Addressing Concerns

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Florida Section AWWA Seminar
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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

Many thanks to Brad Caffery at Purdue University

Access to world-class expertise, capabilities, and education in and outside Purdue
Nearby Innovation Partner with Full-Scale Testing Facility

Onsite Education & YouTube Channel

Plumbing Testing Facility at Purdue

Onsite Testing and Technical Support
COVID Specific
Building Water Safety Support Resources

✓ Advice for building owners, health officials and utilities
✓ Building water safety education videos
✓ Guidance on how to create flushing plan
✓ Access to the Building Water Safety Study
✓ Guidance on building water safety from multiple nations and U.S. states

Restoring Water to Medical, Residential, and Commercial Buildings, Shutdowns, Unsafe Water

The COVID-19 pandemic has caused widespread building shutdowns, but also emergency restoration of water to previously closed medical facilities and homes. Several serious building drinking water safety risks exist. As people begin using the water again, they will encounter extremely stagnated water with excessive lead, copper, and bacterial concentrations, that may include harmful organisms like legionella that can cause disease outbreaks.

There are no national or industry guidelines for building reopening after extended shutdowns.

The U.S. National Science Foundation funded Purdue University researchers to rapidly address this serious public health concern. This rapid response effort involves partnerships with the American Society of Plumbing Engineers and International Association of Plumbing and Mechanical Officials and collaborations with other building water and public health experts from across North America.

[ NSF.gov: government website description of this rapid response grant ]

Questions

- A list of your rapid response efforts in response to the COVID-19 outbreak
- Advice on what I should do as a public health official, building owner, or water utility
- Download a copy of the Experts Building Water Safety Study released April 7, 2020
- Guidance on how to create a building flushing plan
- Brief educational videos on building water safety topics
Sometimes there are other water sources like onsite wells....
Stagnation noun

stag·na·tion | \ stag-ˈnā-ʃən

a state or condition marked by lack of flow, movement
Normal water use or preventative flushing

Extended stagnation or inadequate recommissioning

Fresh water

- disinfectant residual
- corrosion control
- stable biofilms
- dissolved oxygen
- microbial activity
- stable scales

No Water Use

- disinfectant residual
- corrosion control
- dissolved oxygen
- iron corrosion
- microbial activity
- scale stability
- biofilm

Little or no change in:
- microbial communities
- pathogen incidence
- Pb & Cu levels
- disinfection byproducts

Chloramine system

\[ \text{NH}_2\text{Cl} \]

Chlorine system

\[ \text{Cl}_2 \]

- nitrifying bacteria
- pH
- metals
- residuals
- microbial communities
- pathogens
- scale stability

Potential Water Quality Impacts Associated with Water Use Patterns

https://doi.org/10.1002/aws2.1186
Stagnated water can poses health risks

**Metals (Cu, Pb, others)**

*Copper* (can exceed safe limits in just 48 hours sometimes): Nausea, vomiting, gastrointestinal distress

*Lead*: Developmental issues with children and acute effects

**Harmful organisms** e.g., *Legionella pneumophila* and other opportunistic pathogens: Many organisms cause respiratory illness, other infections can occur
Our Response to COVID-19 Building Water Safety Issues: March 2020 to Present

U.S. National Science Foundation RAPID Award 2027049

 Shutdowns and Consequences - Extreme Plumbing Stagnation and Recommissioning

1. State of science review of water stagnation with experts from 7 private and public sector organizations, [done]
2. Support to the plumbing and public health sectors on guidance and decisions, ongoing
3. Field testing to examine building water safety, ongoing
4. Lab testing to examine contaminated systems and devices, planned
5. Help transform public awareness, ongoing
1. Rapidly organize and lead a nation-wide Building Water Systems Research Collaborative with multiple institutions focused on generating and sharing new knowledge within the research community and with the public.

2. The collaborative will share cutting-edge knowledge, protocols, best analytical practices, big data, and field practices through a series of formal interactions amongst an interdisciplinary team with a common focus.
Considerations for Large Building Water Quality after Extended Stagnation

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Illnesses are here

In the US, healthcare providers are being warned

Indiana Health Alert Network Notification – July 10, 2020
Legionellosis Testing: Reminder for Seasonality and Building Reopenings

ISDH is alerting healthcare providers to an anticipated seasonal increase in *Legionella* infections combined with a potential increase in cases resulting from building re-openings. ISDH reminds all healthcare providers to test for *Legionella* when evaluating adults with symptoms of pneumonia, even during the COVID-19 pandemic.

Testing should include both urine antigen testing (UAT) and *Legionella* sputum/respiratory culture following these guidelines:

We have already had confirmed illness during the pandemic

- Staff member died (2019), Legionnaires Disease
- Staff member sick (June 2020), Legionnaires Disease
- Found LP in aerators at select locations including janitor sink
When the pandemic struck, no guidance documents about building plumbing stagnation and recommissioning existed.

These **NEW** documents have been informed by our paper, the document writer’s firsthand experience, extrapolated from short-term evidence, and/or documents issued by others.

*But, some lack key info.*
Safety: Exposure to Contaminated Water during Flushing and Heat Exhaustion

Personal Protective Equipment

OSHA and other worker safety agencies recommend respirators (N95) if Legionella is suspected or possible.

For respirators, medical clearance and a respiratory protection program is needed.

Reduce exposure by applying controls

My personal warnings...

- Some people are sending workers to flush stagnant water that may have pathogens without any respiratory protection. Bad idea.
- Some people think “masks” are respirators. They are not.
- Persons with preexisting conditions should avoid this activity.
- Getting a building flushed is a lot of work. Don’t do too much at once.
COVID-19 Lessons from a School, Indiana USA

3 buildings on campus, built in the 1960s
3 months of low to no water use, little irrigation use

**Characteristics**

- Public water supplier service area chlorine residual range <0.2 to 1.3 mg/L
- Each building has 1 service line, 1 water heater, no recirc loops
- Copper pipe, kitchen, classroom, bathroom sinks, toilets, water fountains; outdoor spigots; refrigerators, dishwashers, coffeemaker connected to the building water system; *no showers, no cooling towers*
COVID-19 Lessons from a Large Residential Building, Indiana USA

Proctor and Angert et al. – In Progress

Built in the 1940s
Zero water use during summer 2020
10,000 sqft,
Typically 20+ people living in the building

Characteristics
- Public water supplier service area chlorine residual
- The building has 1 service line, 1 water heater + extra tank, no recirc loops
- Water softener, Galvanized iron pipe + copper pipe,
- Kitchen, bathroom sinks, toilets, outdoor spigots; refrigerators, dishwashers, **YES showers**
COVID-19 Lessons from an Institutional Campus, Indiana USA

Kyungyeon Ra et al. – In Progress

4 buildings, various uses: classroom, administrative, laboratories, food preparation, breakrooms, bathrooms

Periodic flushing by owner during the pandemic

**Characteristics**

Public water supplier, free chlorine
Each building has 1 service line, some have multiple water heaters, and recirc loops, various ages
Building Water Stagnation Guide

In Development, To be released 2020

Lead By:  

Supported By:  

With Support From:
Tips: What does a building owner need?

Digital Disinfectant Residual Analyzer

HACH DR300
~$500/each

Digital Thermometer

Thermapen
~$90/each

Here are just 2 examples. NOTE: Do not use pool disinfectant test kits. Test strips can be misleading.
Tips: The Big Flush Out

Clean aerators

Address all outlets

Clean them well
Don’t Forget!

Deal with water treatment

Tackle high risk components

Flush appliances
Learn how to create a building flushing plan

Visit our Plumbing Safety YouTube Channel for Short Education Videos
Questions? Andrew J. Whelton, Ph.D. awhelton@purdue.edu


Other Reports Coming Soon from Us in 2020:
Lessons learned: Camp Fire disaster water contamination:
https://doi.org/10.1002/aws2.1183
School water copper and legionella contamination investigation
Testing results of our ongoing rapid response water stagnation study
Define water testing considerations

**Risk factors** = Population, stagnation duration, building specific issues, exposure potential

**Locations** = At the POE, outlet type, distance from the POE, cold and/or hot systems

**Level 1:** Disinfectant residual and water temperature. *If not doing this now, please start.*

**Level 2:** Copper, lead for ingestion exposure locations – fountains, breakroom faucets, cafeteria faucets, etc.

**Level 3:** *Legionella* and other microorganisms. Applicable for inhalation (and dermal) exposure locations – showers, decorative fountains, cooling towers, etc.