Returning Plumbing to Safe Use After Extended Shutdowns or Low Occupancy:

Large Buildings, Standards, Considerations, and Gaps

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Special Thanks to...

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September 1, 2020
1. Water safety issues for large buildings
2. Standards and guidance
3. Gaps and moving forward
4. Other information that’s new and coming soon

- Plumbing education videos
- Flushing plans
- Plumbing explainers
- List of projects
- Scientific opinions
- Resources ➔ presentations
- Scientific reports
- External plumbing docs
- YouTube Channel

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Corporation Stop

Water Main (metal or plastic)

Water meter

Utility Service Line (metal or plastic)

Property Service Line (metal or plastic)

[sometimes other water sources]

Commercial district

Street

Fire Hydrant

Single vs. Multiple tenants

Property Owner Responsibility

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PURDUE UNIVERSITY
Stagnation  noun

stag·na·tion | \stag-ˈnā-shən

a state or condition marked by lack of flow, movement

When water does not flow well; areas of stagnant water encourage biofilm growth and reduce temperature and level of disinfectant

Merriam-Webster

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Centers for Disease Control and Prevention
Prior to the pandemic, stagnation posed health risks

The time scale of concern can sometimes be just a few days

Copper can leach

- Nausea, vomiting, diarrhea, abdominal cramps

Lead can leach

- Nausea, vomiting, diarrhea, abdominal cramps, longer-term developmental issues with children

But other metals too! Scale can be suspended.

Harmful organisms (e.g., Legionella pneumophila and other opportunistic pathogens) can grow - better

- Many organisms cause respiratory illness, and other infections can occur

Exposure Routes of Concern: Ingestion, Dermal, Inhalation

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There’s Little Public Understanding and Awareness about Building Water Safety and Contamination

For example, all legionella detections (and investigations) are not being publicly reported

<table>
<thead>
<tr>
<th>Time</th>
<th>Location(s)</th>
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| August| The Netherlands, gym  
Pennsylvania, 4 schools  
Ohio, 8 schools  
Texas, healthcare building  
Canada, hospital  
Georgia, CDC office buildings  
UK, office building  
UK, hospital |
| July  | UK, Buckingham Palace  
California, hotel  
UK, 3 schools  
Ohio, 1 school, LD illness (yr ago LD fatality)  
UK, university campus |
| June  | Michigan, nursing home  
Illinois (LD misdiagnosed as COVID)  
UK, 1 school |

For example, all legionella detections (and investigations) are not being publicly reported.
Shutdowns and Consequences - Extreme Plumbing Stagnation and Recommissioning

1. Support to the plumbing and public health sectors on building water safety guidance and decisions, **ongoing**
2. Building water safety review due to prolonged stagnation with experts from 7 private and public sector organizations, **complete**
3. Field testing to determine how impacted building water safety is in actual large buildings, **ongoing**
4. Bench-/pilot-scale testing to determine how to fully recover contaminated building water system devices and equipment, **planned**
5. Help transform public awareness, **ongoing**

*EPA Small Systems Workshop*  
September 1, 2020
Initiating a Transformative Building Water System Research Collaborative in Rapid Response to the COVID-19 Pandemic

1. Host 3 formal collaborative workshops on building water safety, **planned**
2. Determine the practices applied across select institutions nationwide that address building water system safety, **ongoing**
3. Conduct a meta-analysis of studies at the end of the 1-year effort and identify new prioritized research and innovation needs influenced by the multiple independent studies and collaborative workshops, **planned**

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Since March 2020, there have been more than 63+ guidance documents telling building owners what they could do to prevent and deal with stagnation situations.

Many differ quite dramatically. Some lack key info (safety, devices, sensitive population, etc.).
Why are they so different?

Different perspectives - sides of the elephant
Different starting information about water safety or plumbing
Guidance targeted for different readers
Deliberate step-by-step documents vs. general advice
Some are derivatives of others, & others... & others!
Some have been revised (version 3 since March 2020)
Media, water utilities, & associations making even brief(er) messages

Document objectives: Awareness vs. Informational vs. Warnings vs. Actions
Non-enforceable standards and guidelines exist… but focus only on legionella


[NEW] ASHRAE Guideline 12-2020, Minimizing the Risk of Legionellosis Associated with Building Water Systems

NEW: State-of-the-knowledge review about water safety impacts of prolonged stagnation

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

Download FREE here:
https://doi.org/10.1002/aws2.1186
Coming Soon: Evidence informed guidance for reduced and no building water use

Collaborative effort
William Rhoads, Ph.D., Virginia Tech
Michele Prévost, Ph.D., Polytechnique Montreal
Kelsey J. Pieper, Ph.D., Northeastern University
Tim Keane, Legionella Risk Management, Inc.
Andrew J. Whelton, Ph.D., Purdue University
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Caitlin R. Proctor, Ph.D., Purdue University
Marianne Grimard-Conea, École Polytechnique de Montréal

Document Title TBD
Expected Fall 2020
Coming Soon: COVID-19 inspired building water safety testing results from many others

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**NEW: School Water Safety, Summer vs. Fall**

Discovered school wide copper contamination, and multiple claims by agencies proven incorrect:

- High alkalinity groundwater is a copper leaching problem
- Spot flushing does not guarantee water will have < 1.3 mg/L copper
- Only options: In-building whole or POU treatment
- Consultant recommended activated carbon filters (bad) not ion exchange
- Lack of prior testing at schools indicates larger problem likely exists

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**Finding Contaminated Water in a 7-Year Old Green School**

Download here: [https://doi.org/10.1039/D0EW00520G](https://doi.org/10.1039/D0EW00520G)

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**Graph:**

- Total Copper Concentration (ppb) vs. Distance from water meter (ft)
- Utility Cold, North Cold, South Cold, Additional North Cold, Additional South Cold
Some Ongoing Initiatives

11 buildings across 4 studies
All free chlorine disinfectant
3-5 months of low/no water use
Some served by the same utility
Some have recirculation loops, in-building storage, showers
All had indoor copper pipe
Up to 400 water outlets/building
Not all had as-built drawings

1. Elementary school, Indiana (Ra et al.)
2. Large residential building, Indiana (Angert et al., led by Proctor, Ph.D.)
3. Institutional buildings, Indiana (Ra et al.)
4. Elem/mid/high school, Ohio (Ley et al.)
Water management programs basically nonexistent at daycares, schools, colleges, and universities.

Metal (Cu, Pb, Ni, Zn) exceedances. Don’t just look at water fountains.

Legionella pneumophila detected in 3 of 4 studies:
- 2 buildings where flushing applied, no legionella detected after flushing, 2 weeks later low levels (<10 MPN/100 mL)
- Highest levels found in cold water, not hot water. Water fountain hot spots.

Hypochlorite disinfection levels varied (est. 160-340 mg/L+ for 3 hours). Likely due to ineffective mixing, reactions, and/or decay.
Preliminary Field Observations: A Few Gaps

Lack of clear Go/No-Go levels for *Legionella pneumophila* and other pathogens
- Some consultants invoke the zero MCLG, others invoke different numbers
- One health department invoked a conversation with CDC that zero is only acceptable
- CDC doesn’t have explicit Go/No-Go levels for buildings
- Risk-based levels can range from 1 to 1000s CFU/100mL depending on exposure route

Most of the time other pathogens are not being examined

Some health departments discourage school water testing (lead, copper, legionella, etc.) because they claim CDC discourages water testing unless there’s a suspected outbreak

Many health officials and primacy agency staff lack familiarity of building water systems

Local, state, and federal government agencies issue sometimes vague statements. Some consultants then implement what they want (i.e., qPCR testing for legionella only \(\Rightarrow\) followed by thermal disinfection \(\Rightarrow\) then a 36 hr qPCR test only, not other follow-up)
NEW: Fires cause water infrastructure contamination, wider implications may be significant

Wildfire caused widespread drinking water distribution network contamination

Download FREE here: https://doi.org/10.1002/aws2.1183

VOCs and SVOCs present, levels can exceed hazardous waste limits (40 ppm benzene, etc.)

Do Not Use water order should be issued

Protect homeowners and their plumbing
More Results of this USEPA Grant Coming Soon: Right Sizing Tomorrow’s Water Systems for Efficiency, Sustainability, and Public Health, 2016-Present

Andrew Whelton, Jade Mitchell, Joan Rose, Juneseok Lee, Pouyan Nejadhashemi, Erin Dreelin, Tiong Gim Aw, Amisha Shah, Matt Syal, Maryam Salehi
Building Water Essentials
Online Short-Course for Public Health Professionals

COMING SOON!

Fall 2020, If interested e-mail
awhelton@purdue.edu
Thank you... www.PlumbingSafety.org

COVID-19 Response
Camp Fire Response

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✓ Plumbing education videos
✓ Flushing plans
✓ Plumbing explainers
✓ List of projects
✓ Scientific opinions
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