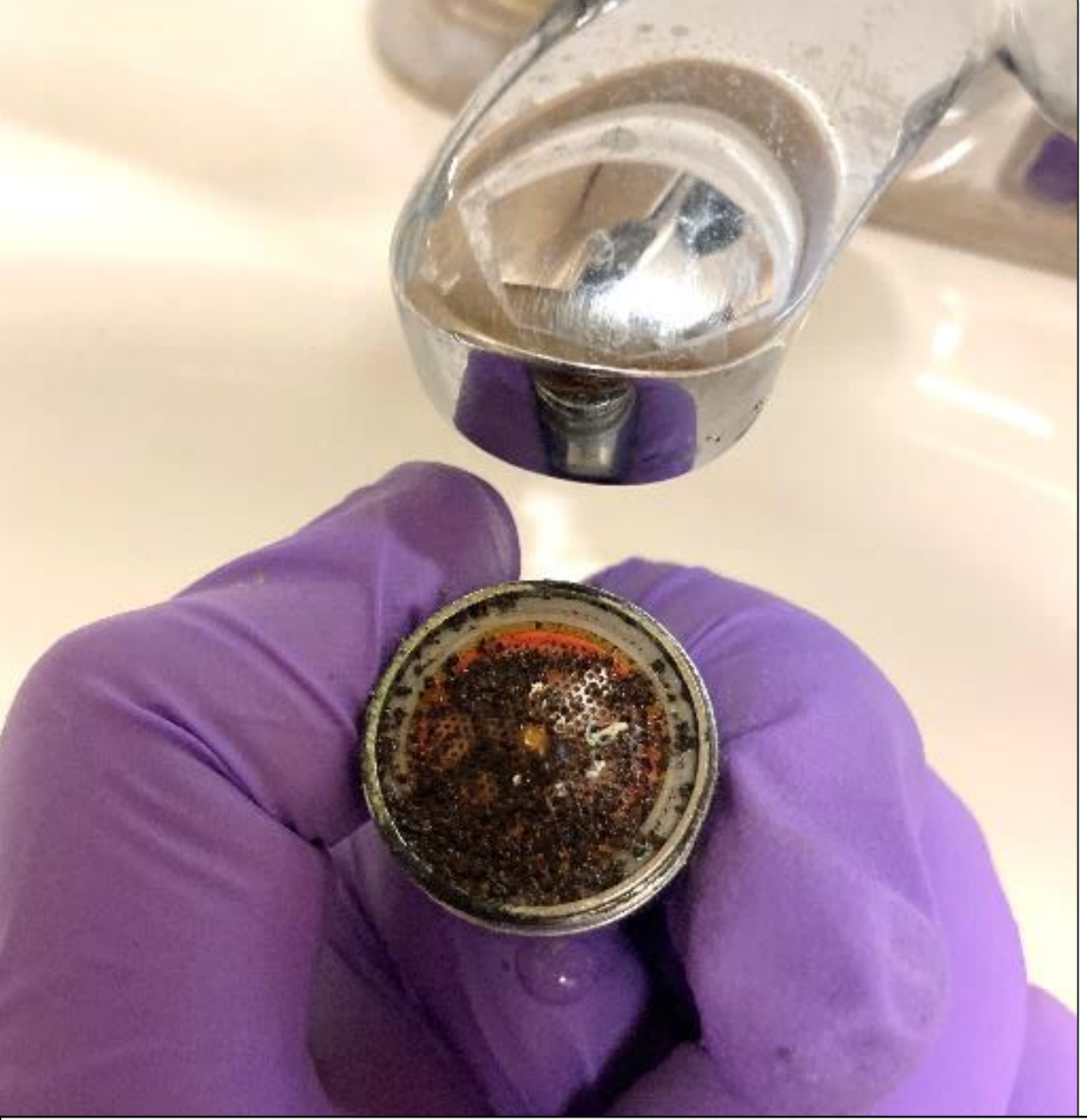

Water Safety in Buildings: Issues at Hand

Andrew J. Whelton, Ph.D.
Civil, Environmental, and Ecological Engineering

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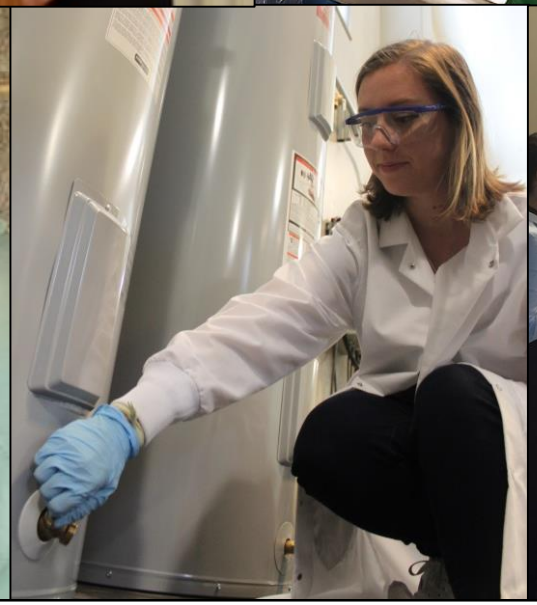
Agricultural, Biological, Environmental, and Ecological Engineering


THE SEAL OF THE GOVERNOR OF WEST VIRGINIA


ZONE 5



Commercial district

Street

Fire Hydrant

PROPERTY OWNER RESPONSIBILITY

Single vs. Multiple tenants

BUILDING PLUMBING

Water meter

Corporation Stop

Water Main (metal or plastic)

WATER UTILITY RESPONSIBILITY

Utility Service Line (metal or plastic)

Property Service Line (metal or plastic)

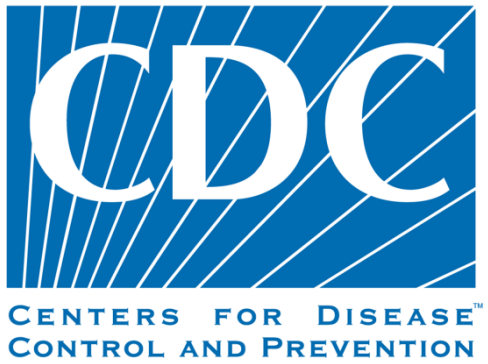
[sometimes other water sources]

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



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

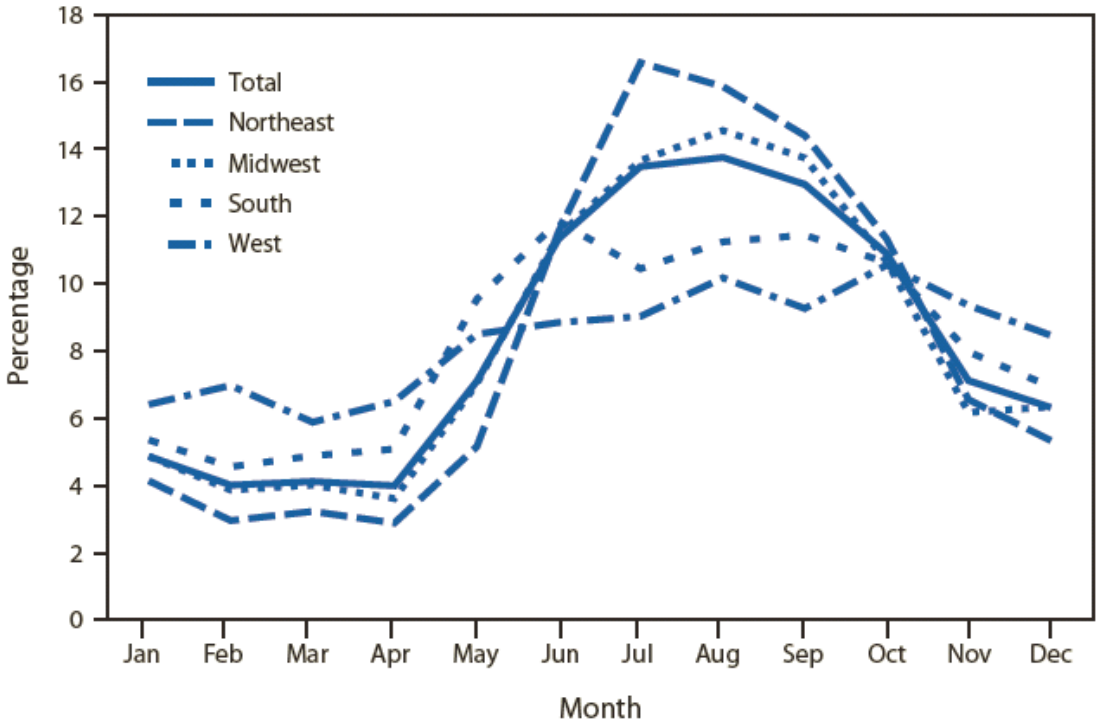
Lead can leach

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

U.S. National Science Foundation RAPID Award 2027049

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***

Helping

IAPMO

American Water Works Association

astho™

SLOAN

Whirlpool Corporation

NRDC

Washington State Department of Health

ASDWA

Ohio Environmental Protection Agency

ASPE American Society of Plumbing Engineers

NEHA Training

SAFE WATER ENGINEERING

2020: 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

AWWA WATER SCIENCE

Considerations for Large Building Water Quality after Extended Stagnation

Download FREE here:

https://doi.org/10.1002/aws2.1186

PURDUE UNIVERSITY VIRGINIA TECH

LEGIONELLA RISK MANAGEMENT

THE UNIVERSITY OF MEMPHIS

Arizona State University

Northeastern University

THE UNIVERSITY OF IOWA

POLYTECHNIQUE MONTRÉAL

Some Ongoing Initiatives

11 buildings across 4 studies

All free chlorine disinfectant

3-5 months of low/no water use

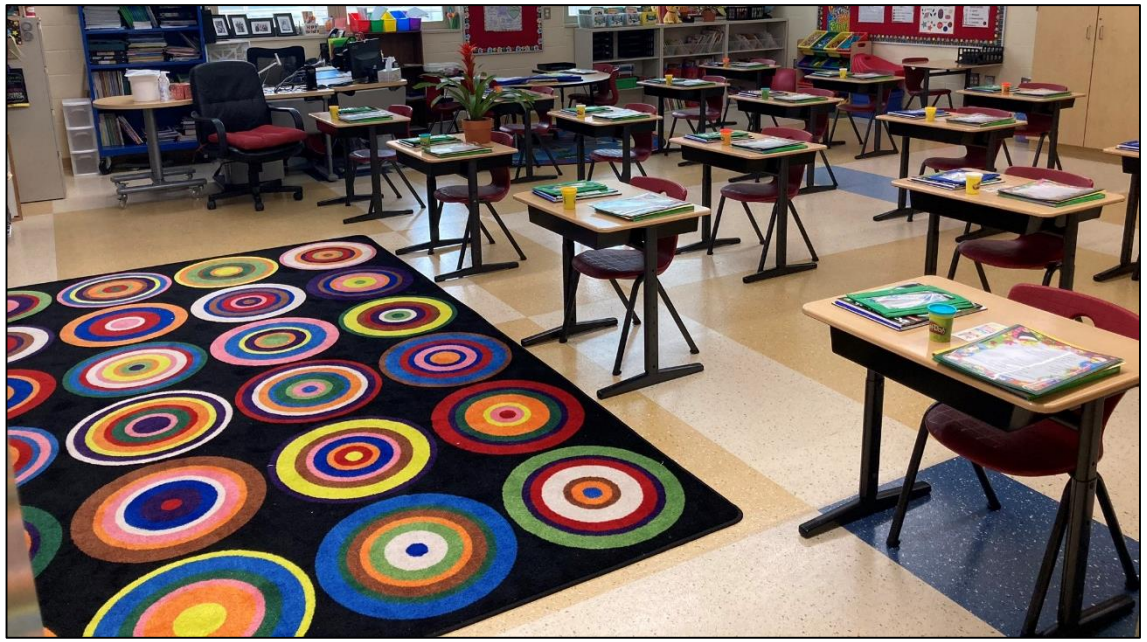
Some served by the same utility

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

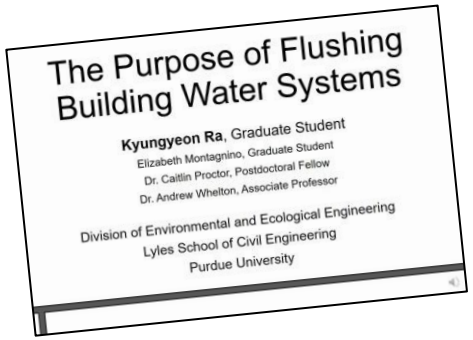


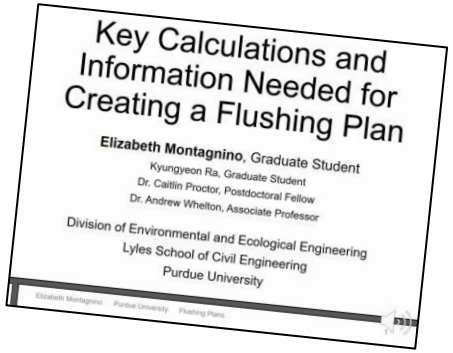
1. Elementary school, Indiana (Ra et al.)
2. Large residential building, Indiana (Angert et al., led by Proctor, Ph.D.)
3. Institutional buildings, Indiana (Ra et al.)
4. Elem/mid/high school, Ohio (Ley et al.)

Preliminary Findings

YouTube

Plumbing Safety Channel





Water management programs basically nonexistent at daycares, schools, colleges, and universities

Metal (**Cu, Pb, Ni, Zn**) health-based limit 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.

Super chlorination levels throughout building differed (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, legionella only

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

Some consultants implement what they want (i.e., qPCR testing for legionella only ➔ followed by thermal disinfection ➔ then a 36 hr qPCR test only, not other follow-up)

Coming Soon: COVID-19 inspired building water safety testing results from many others

Resources

www.PlumbingSafety.org

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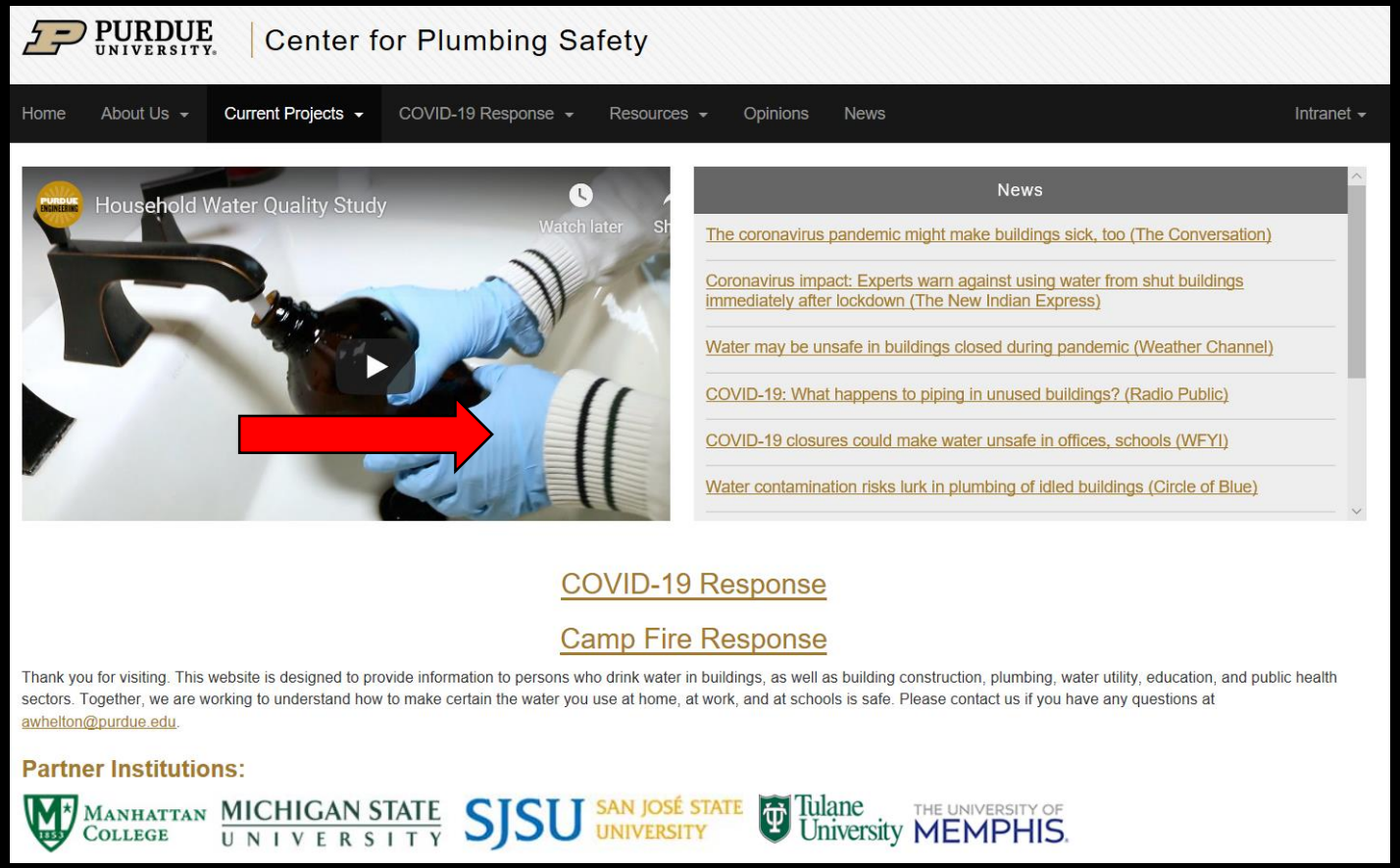
@TheWheltonGroup



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