Rehabilitation of Building Water Systems

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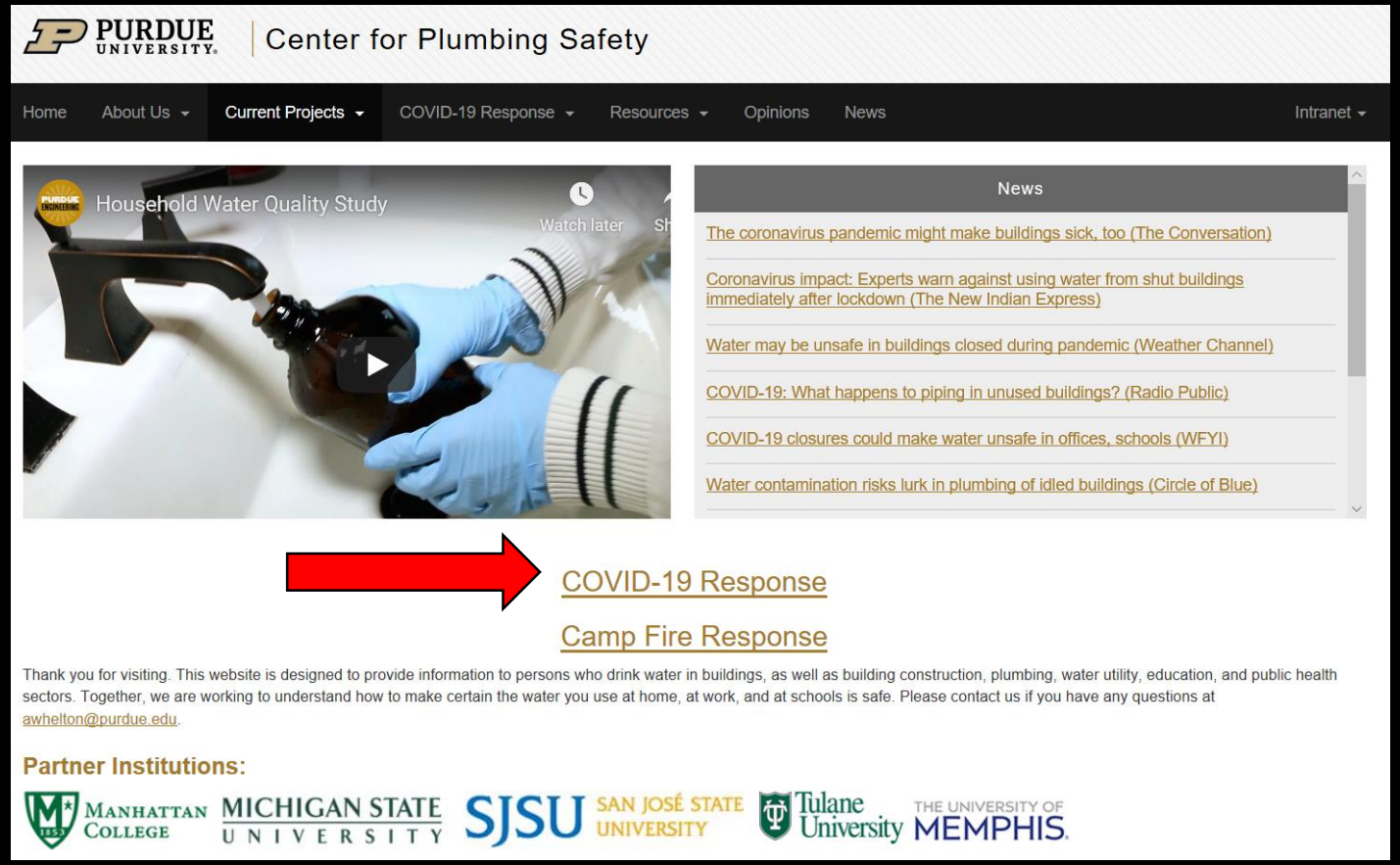
More information here… www.PlumbingSafety.org



Access to world-class expertise, capabilities, and education in and outside Purdue

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

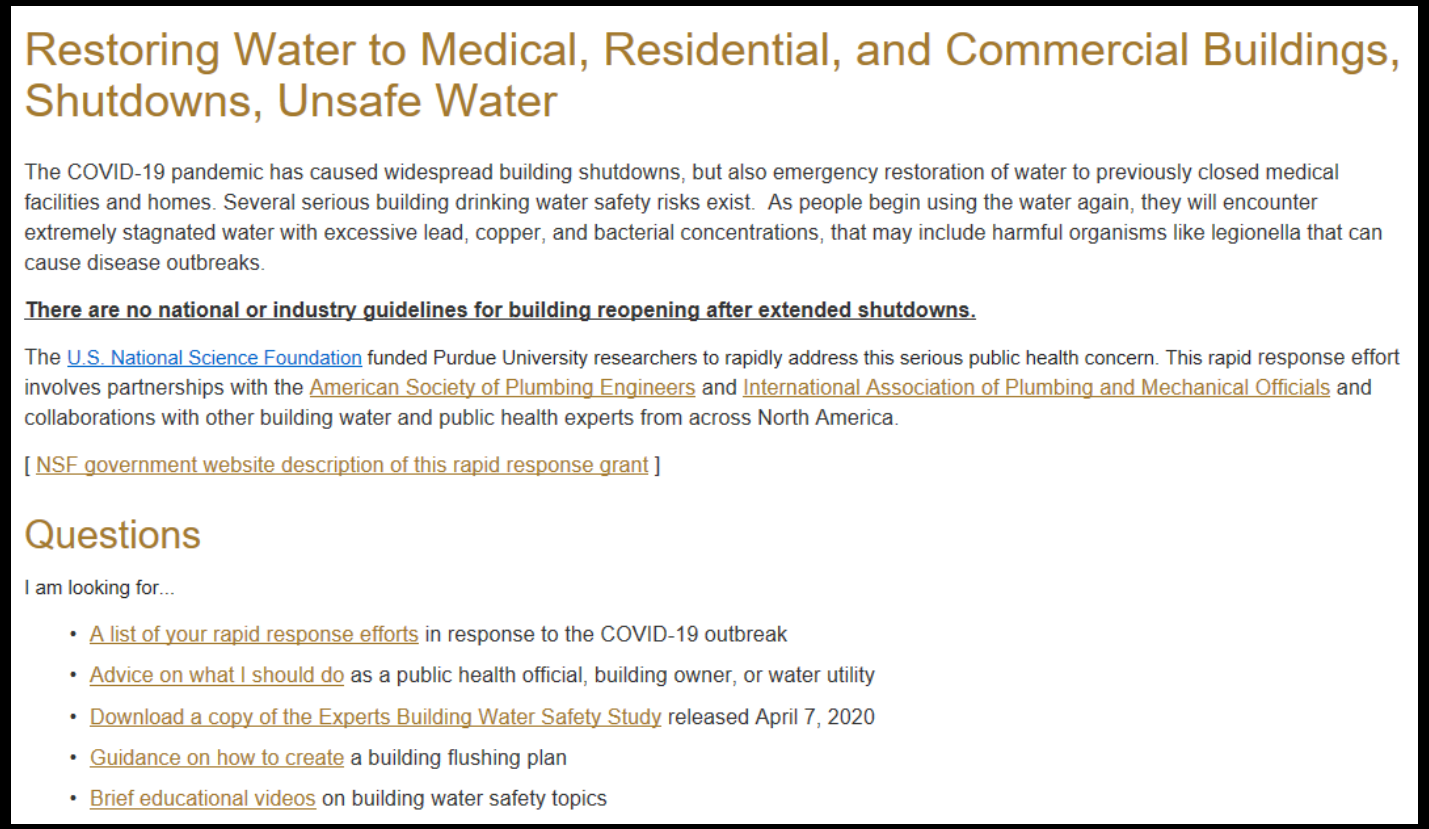
Onsite Education & YouTube Channel

Nearby Innovation Partner with Full-Scale Testing Facility

Plumbing Testing Facility at Purdue

Onsite Testing and Technical Support

COVID Specific Building Water Safety Support Resources



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.

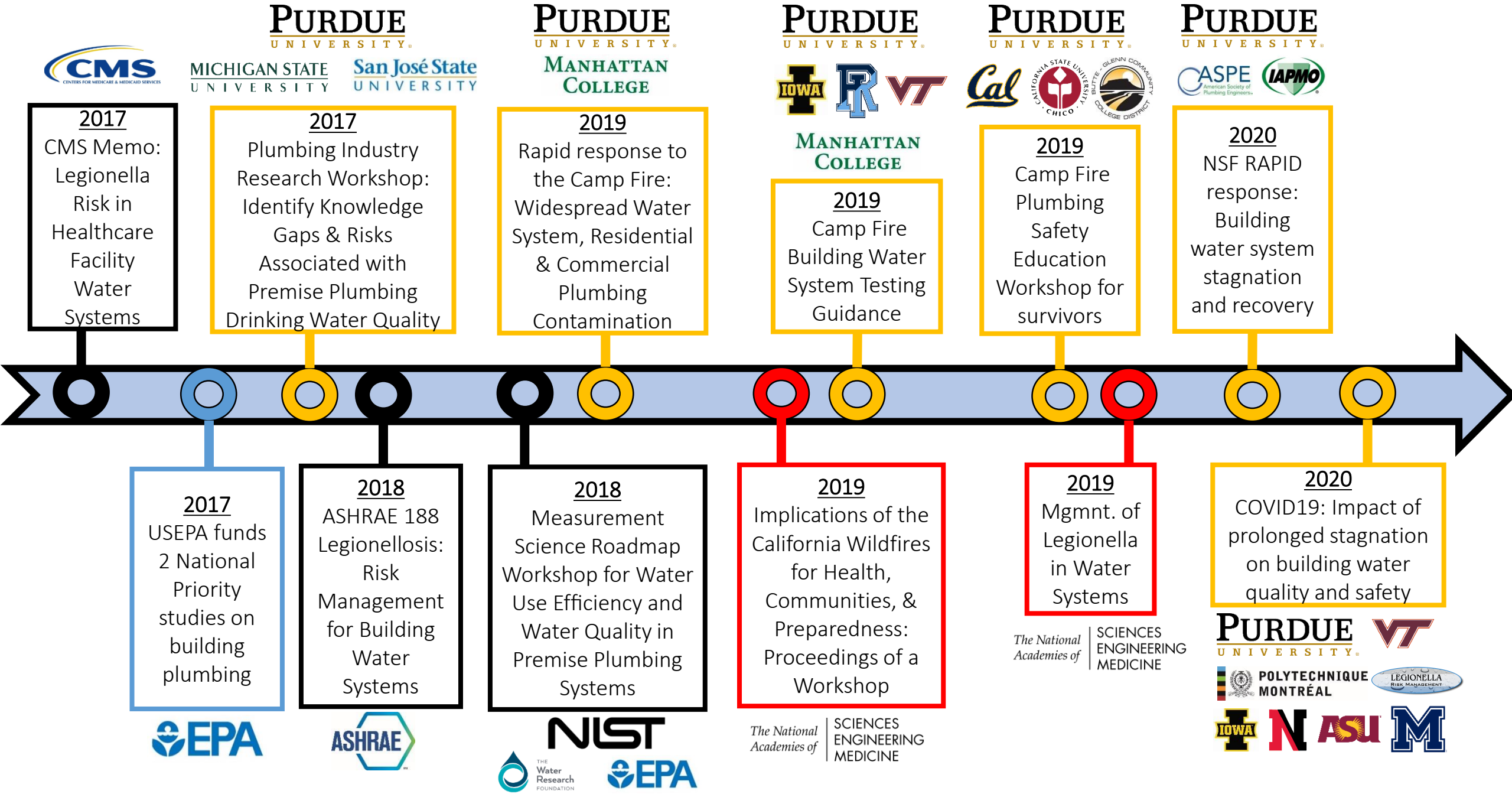
[NSF government website description of this rapid response grant]

Questions

I am looking for...

- 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

- ✓ 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


2017
CMS Memo: Legionella Risk in Healthcare Facility Water Systems
2017
Plumbing Industry Research Workshop: Identify Knowledge Gaps & Risks Associated with Premise Plumbing Drinking Water Quality
2019
Rapid response to the Camp Fire: Widespread Water System, Residential & Commercial Plumbing Contamination
2019
Camp Fire Building Water System Testing Guidance
2019
Camp Fire Plumbing Safety Education Workshop for survivors
2020
NSF RAPID response: Building water system stagnation and recovery
2017
USEPA funds 2 National Priority studies on building plumbing
2018
ASHRAE 188 Legionellosis: Risk Management for Building Water Systems
2018
Measurement Science Roadmap Workshop for Water Use Efficiency and Water Quality in Premise Plumbing Systems
2019
Implications of the California Wildfires for Health, Communities, & Preparedness: Proceedings of a Workshop
2019
Mgmnt. of Legionella in Water Systems
2020
COVID19: Impact of prolonged stagnation on building water quality and safety

The coronavirus pandemic has prompted low to no water use in >5.6 millions buildings – in the U.S. alone

Bathrooms

Water fountains

Food preparation areas

Point-of-entry devices

Point-of-use devices

Breakrooms

Point-of-use devices

Stagnation *noun*

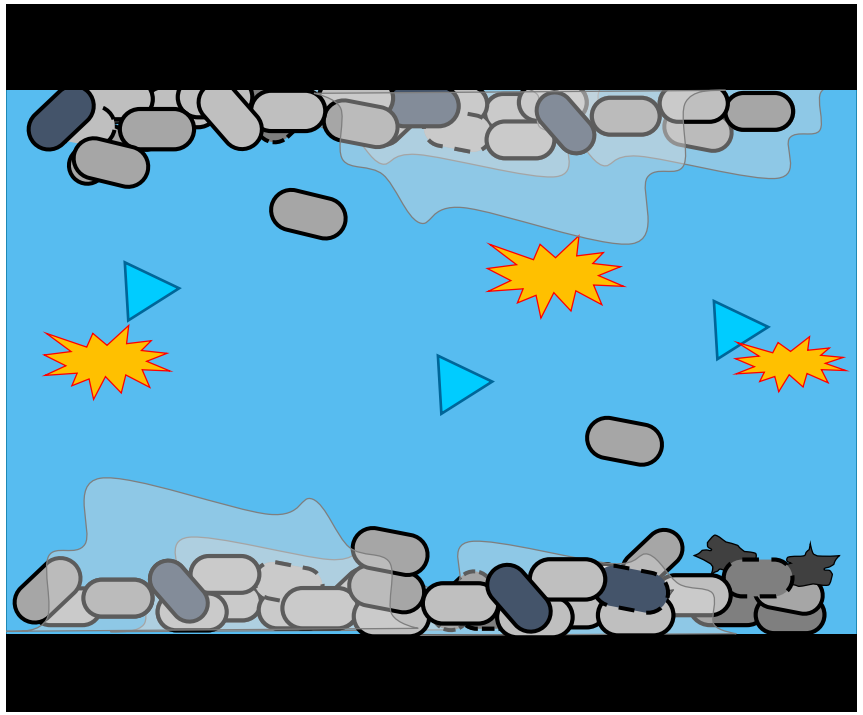
stag·na·tion | \ stag-ˈnā-shən

a state or condition marked by
lack of flow, movement

Stagnation causes water to get older

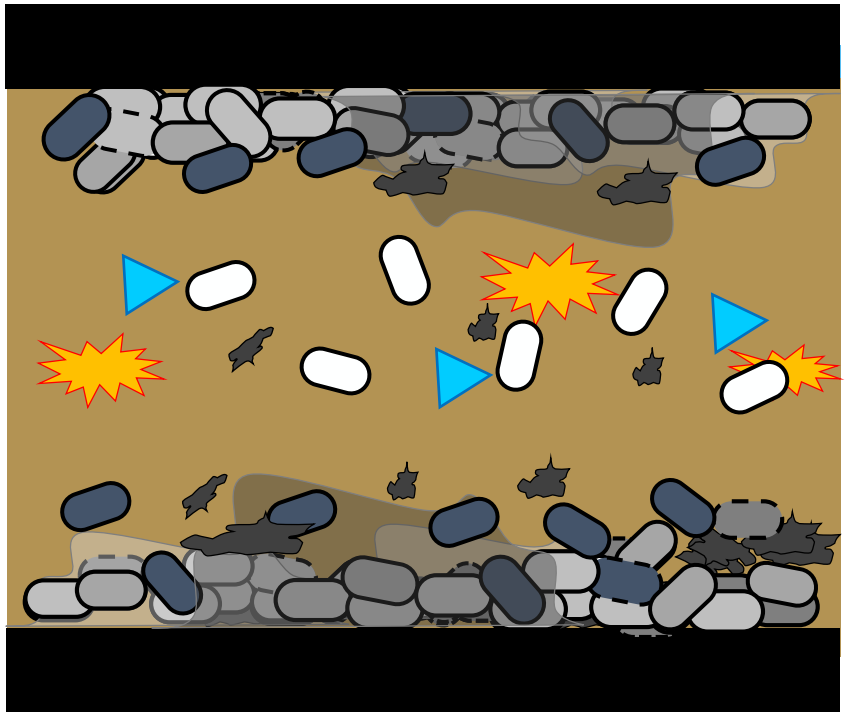
Normal water use refreshes:

- 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

Slide from Dr. Caitlin Proctor

Prior to the pandemic, stagnation posed health risks

During <u>short-term</u> 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)
  - Many of these organisms cause respiratory illness
  - Other infections can occur

Exposure Routes
- Ingestion
- Dermal
- Inhalation

Phenomena have not been studied in the long-term. So, how does one create guidance?

Exact Slide from Andrew Whelton's
November 8, 2019 PMI annual meeting presentation

Disasters Expose a Critical Lack of Plumbing Knowledge:
Federal, State, County agencies, and in Households

There are direct mental and physical health consequences on the population – More than 60% population reported anxiety, stress, or depression related to drinking water contamination (Camp Fire Community Survey, June 2019)

What's Needed

Basic understanding of plumbing design, use, materials, and aging

What products are in plumbing

How to use damaged plumbing post-disaster

How to test plumbing post-disaster

How to clean plumbing post-disaster

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 8 private and public sector organizations, ***ongoing***
3. Field testing to determine how impacted building water safety is in actual large buildings, ***ongoing***
4. Lab 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

NRDC

Washington State Department of Health

ASDWA

Ohio Environmental Protection Agency

ASPE American Society of Plumbing Engineers

NEHA TRAINING

Whirlpool CORPORATION

SAFE WATER ENGINEERING

#2. Building water safety review due to prolonged stagnation with experts from 8 private and public sector organizations

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

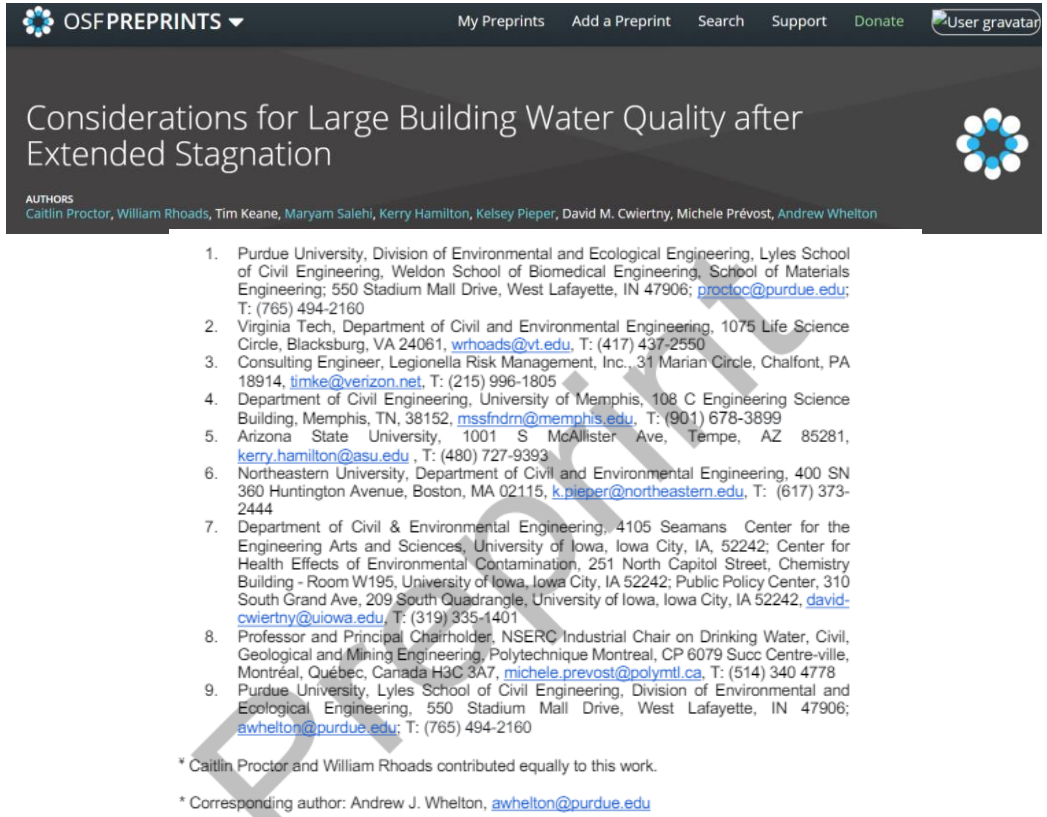
Kerry Hamilton, Ph.D., Arizona State University

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



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Considerations for Large Building Water Quality after Extended Stagnation

AUTHORS

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

osf.io/qvj3b/

When the pandemic struck, *no* guidance documents about building plumbing stagnation and recommissioning existed.

ZERO.

Today, more than 30 building water system stagnation and recommissioning "guidance" docs have been created by

National governments

State governments

City governments

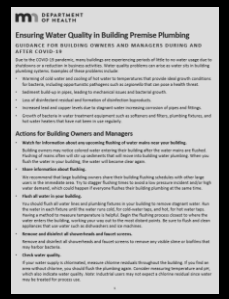
Public and private utilities

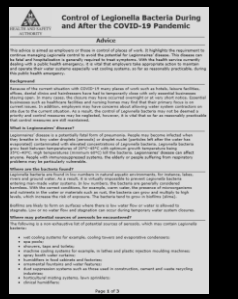
Private contractors

Trade industry associations

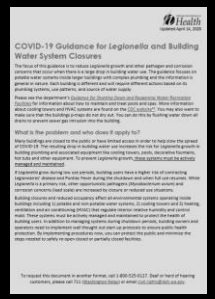
Nonprofit organizations

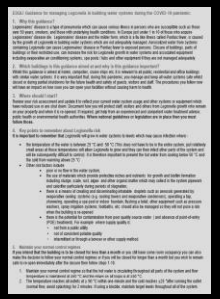
Device manufacturers


Ensuring Water Quality in Building Premise Plumbing


Control of Legionella Bacteria During and After the COVID-19 Pandemic

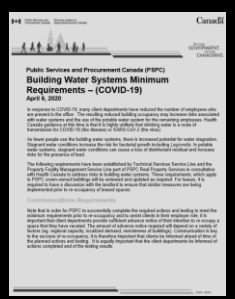
Advice


COVID-19 Guidance for Legionella and Building Water System Closures



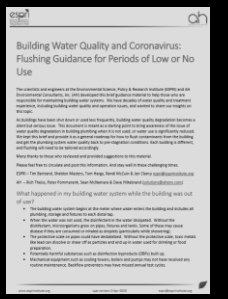

Public Health England

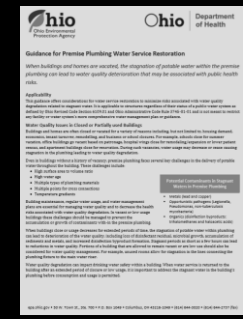
30th March 2020


Public Services and Procurement Canada (PSPC)

Building Water Systems Minimum Requirements – (COVID-19)

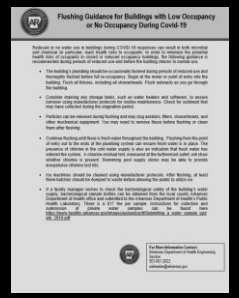
April 6 2020

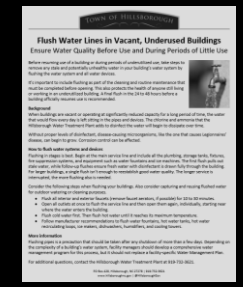

Building Water Quality and Coronavirus: Flushing Guidance for Periods of Low or No Use


Ohio Department of Health

Safe Management of Water Systems in Buildings During the COVID-19 Outbreak

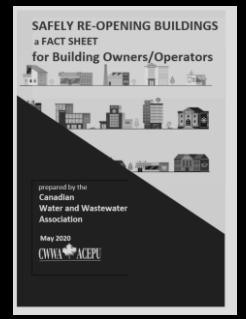
25th March 2020


Flushing Guidance for Buildings with Low Occupancy or No Occupancy During Covid-19


TOWN OF HILLSBOROUGH

Flush Water Lines in Vacant, Underused Buildings

Ensure Water Quality Before Use and During Periods of Little Use


SAFELY RE-OPENING BUILDINGS

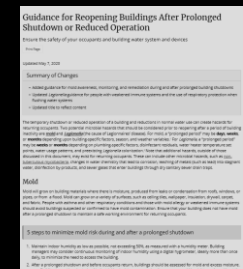
a FACT SHEET

for Building Owners/Operators

prepared by the Canadian Water and Wastewater Association

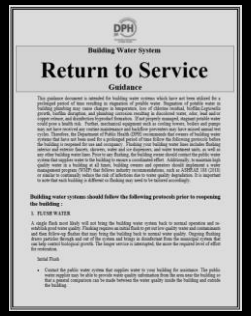
May 2020

CWWA ACEPU


Guidance for Reopening Buildings After Prolonged Shutdown or Reduced Operation

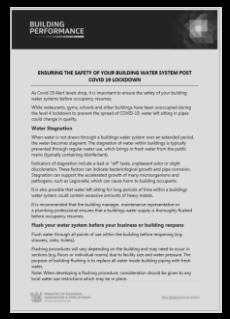
Summary of Changes

5 steps to minimize mold risk during and after a prolonged shutdown


Building Water System

Return to Service

Guidance


BUILDING PERFORMANCE

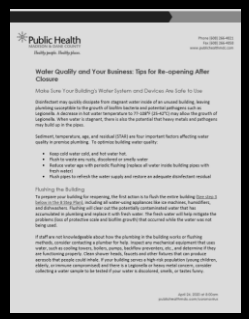
ENSURING THE SAFETY OF YOUR BUILDING WATER SYSTEM POST COVID 19 LOCKDOWN


AMERICAN WATER

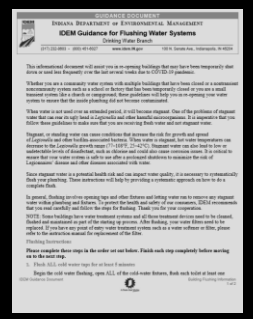
WE KEEP LIFE FLOWING®

A REMINDER FOR SCHOOLS AND BUSINESSES THAT CLOSED AS A RESULT OF THE CORONAVIRUS (COVID-19) OUTBREAK

HAS YOUR FACILITY BEEN CLOSED FOR WEEKS? FLUSH THE PIPES.

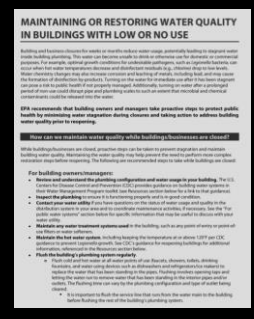

Public Health

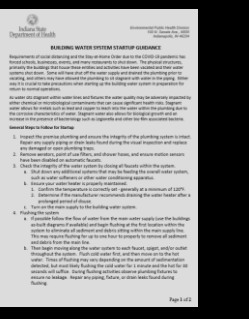
Water Quality and Your Business: Tips for Re-opening After Closure


INDIANA DEPARTMENT OF ENVIRONMENTAL MANAGEMENT

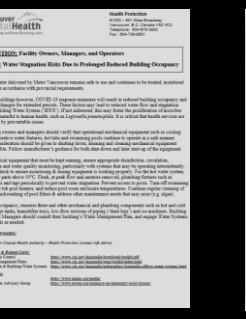
IDEM Guidance for Flushing Water Systems

Drinking Water Branch


MAINTAINING OR RESTORING WATER QUALITY IN BUILDINGS WITH LOW OR NO USE


Indiana State Department of Health

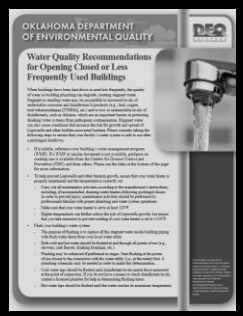
BUILDING WATER SYSTEM STARTUP GUIDANCE


Vancouver Coastal Health

Health Protection

ATTENTION: Facility Owners, Managers, and Operators

ISSUE: Water Stagnation Risks Due to Prolonged Reduced Building Occupancy


OKLAHOMA DEPARTMENT OF ENVIRONMENTAL QUALITY

Water Quality Recommendations for Opening Closed or Less Frequently Used Buildings

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.

HOT TOPIC: How do we avoid “recommissioning” our building water system due to low or no use?

Minimize water quality issues

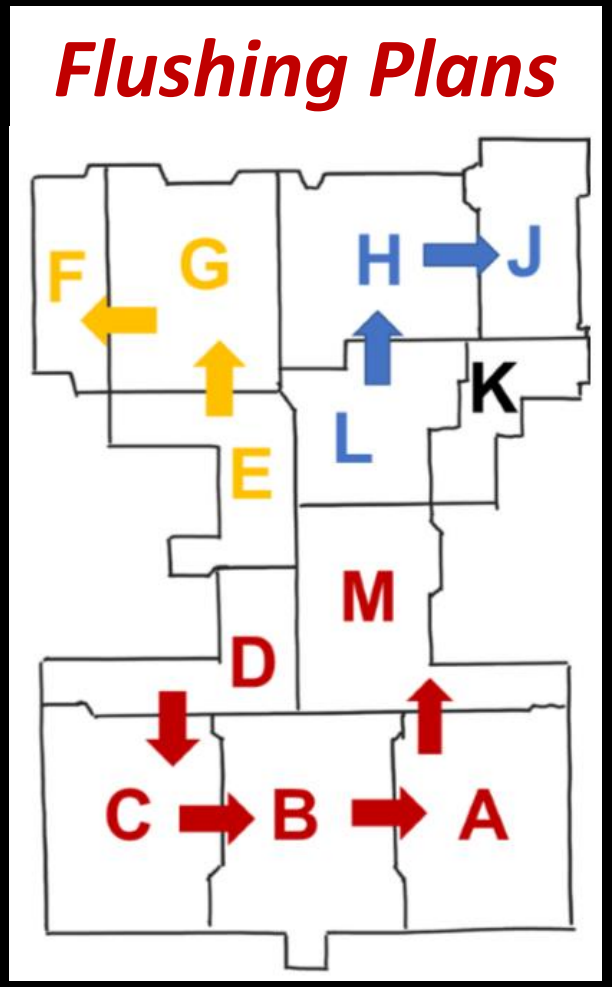
Source water must be fresh (utility, onsite well, Source may need to flush)

Clean devices and equipment

Flushing – Keep water fresh

Water heater and recirculation loops – Keep hot water hot, Keep cold water cold

Draining plumbing



HOT TOPIC: What plumbing recommissioning actions are needed after low to no water use?

When is it necessary? What do you need to do? – Evidence is lacking.

Possibly related? ASHRAE 188 for NEW CONSTRUCTION

Shock disinfection should occur within 3 weeks of planned occupancy.

If occupancy is delayed >4 weeks, another shock disinfection is required prior to occupancy.

Key Considerations

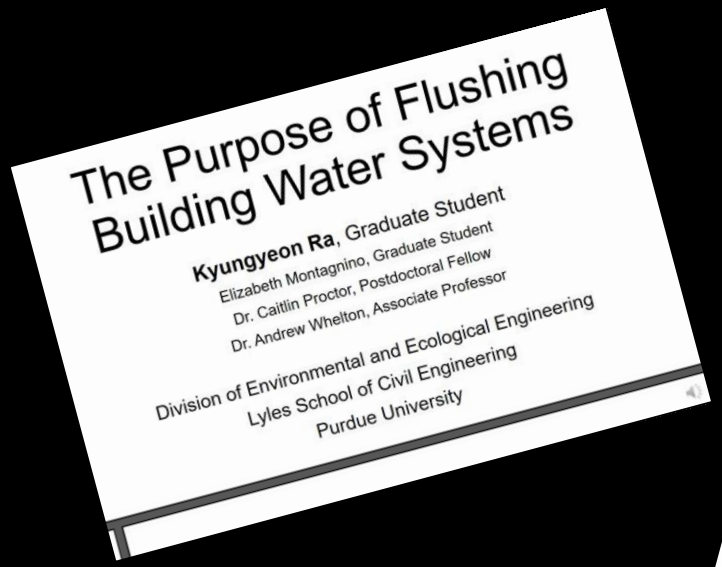
1. System integrity, clean devices and equipment
2. Flushing
3. Shock disinfection (chemical, thermal)
4. Testing with a purpose and plan
5. Communicate with a purpose

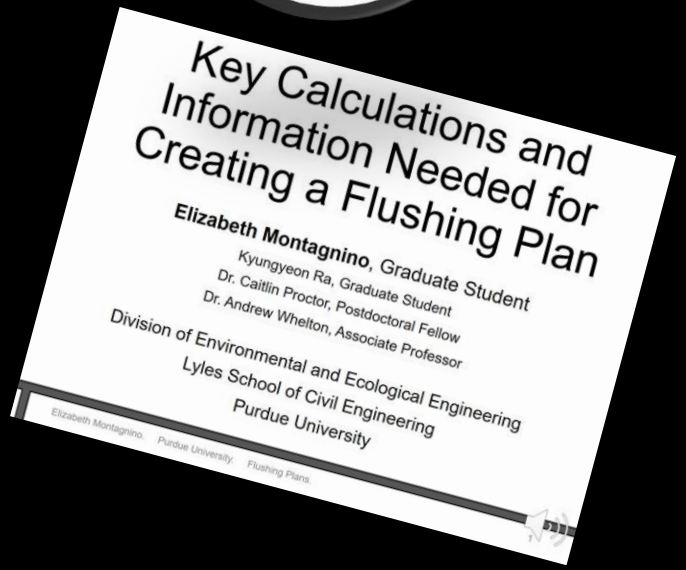
The pandemic is a defining moment in history

The plumbing sector can collectively advance public awareness and public health.

Education is Our Foundation

Workforce development too





Visit our Plumbing Safety YouTube Channel for Short Education Videos

Summer 2020 Course

EEE 495: Building Water Systems

3 Credits

Instructors:
Professor Andrew Whelton, Civil, Environmental, & Ecological Engineering, awhelton@purdue.edu
Dr. Caitlin Proctor, Biomedical, Materials, Civil, Environmental & Ecological Engineering, proctoc@purdue.edu

Prerequisites: Chemistry or biology, mass balance

Building water systems are sitting at low to no occupancy across the globe due to the COVID-19 pandemic. Stagnant water in them can pose significant human health risks due to chemical and microorganism accumulation and exposure. Students will be introduced to engineering and science principles underlying building water systems, current issues associated with the pandemic, and how prior disasters affected water systems.

The learning objectives are to:

1. Describe the chemical and microbiological contaminants common to building water systems,
2. Explain the factors that control contaminant accumulation in building water systems,
3. Apply mass balance principles to predict contaminant levels and exposure concentrations,
4. Identify remediation practices for reducing contaminated water from the systems, and
5. Use as-built construction drawings to determine how to avoid and remediate water quality problems.

Students will:

1. Complete out of class learning assignments,
2. Participate in mediated discussions with the Instructors, and
3. Create a final project. This will include creating a flushing plan for a specific building and evaluating officially issued guidance. Students will read and interpret construction drawings, calculate volumes and flowrates, and use Microsoft® Excel.

Let's Make an Impact Together

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"Unless someone like you cares a whole awful lot, nothing is going to get better. It's not."

— Dr. Seuss, The Lorax