Water stagnation:

Risks and strategies to address them

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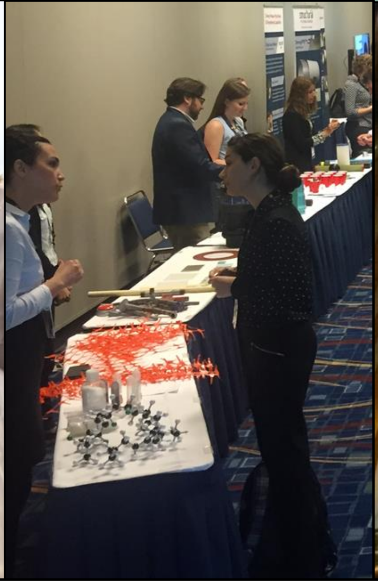
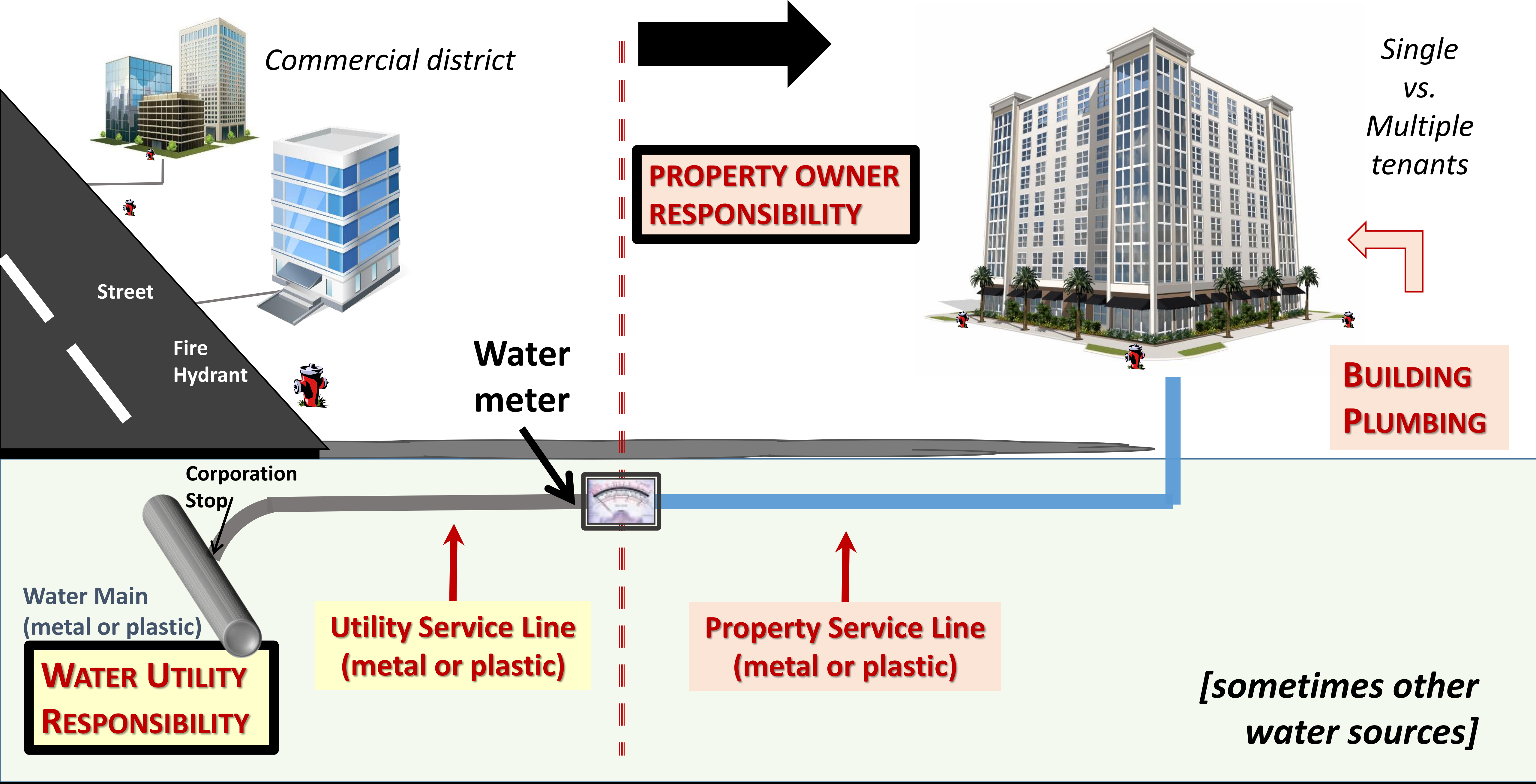
1. Overview of what happens to water quality upon stagnation in the distribution system and within building plumbing
2. What are risks associated with these changes?
3. What can we do about this to reduce the risks?
4. What guidance is available?
5. How can we determine that these approaches work?


ZONE 5




Commercial district
Street
Fire Hydrant
Water meter
PROPERTY OWNER RESPONSIBILITY
Single vs. Multiple tenants
BUILDING PLUMBING
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

Merriam-Webster

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

CDC
CENTERS FOR DISEASE CONTROL AND PREVENTION

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, ***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 · NRDC · Washington State Department of Health · ASDWA · Ohio Environmental Protection Agency · ASPE American Society of Plumbing Engineers · NEHA Training · SLOAN · Whirlpool Corporation · SAFE WATER ENGINEERING

Building water safety review due to prolonged stagnation with experts from 7 private and public sector organizations

Collaborative effort

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Considerations for Large Building Water Quality after Extended Stagnation

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

PURDUE UNIVERSITY · VIRGINIA TECH · LEGIONELLA RISK MANAGEMENT · THE UNIVERSITY OF MEMPHIS · ASU Arizona State University · Northeastern University · THE UNIVERSITY OF IOWA · POLYTECHNIQUE MONTRÉAL

Commercial plumbing can be very complex

Water source

Service line

Safety devices including valves

Water treatment devices

Water service and distribution piping and faucet connectors

Hot water heating, recirculation system

Fixture and fixture fittings

Pumps, tanks

Point-of-use devices

Table 1. Types of building plumbing components

Components	Description
Water source	Municipal water, onsite well, treated surface water, rainwater.
Service line	Pipe system that carries water from the source to the building water system. Service line materials are variable and may or may not be the same as indoor pipes.
Safety devices including valves	Pressure relief valve, pressure reduction value, isolation valve, mixing valve, thermostatic mixing valves, backflow prevention device, water hammer arrestors. Materials can include aluminum, brass, copper, lead, plastic, and stainless steel.
Water treatment devices	Filter, strainer, water softener, chemical addition equipment for disinfection and corrosion control.
Water service and distribution piping and faucet connectors	Various material types have been used to include acrylonitrile butadiene styrene (ABS), brass, cast iron (CI), chlorinated polyvinyl chloride (CPVC), copper, crosslinked polyethylene (PEX), ductile iron (DI), high density polyethylene (HDPE), lead, lead lined steel, multilayer pipes, polyethylene raised temperature (PERT), polypropylene (PP), unplasticized polyvinyl chloride (uPVC), polyvinylidene fluoride (PVDF), black steel, stainless steel.
Hot water recirculation system	Hot water is pumped through primary and secondary water heater loops, which serve different building zones to reduce delivery time of hot water. These have to be hydraulically balanced. Equipment includes master mixing valves, local mixing valves, flow balancing valves, pressure reducing valves,hot water return pumps and water heaters. Multiple temperature loops may exist. Operation of pumps may be intermittent in some systems.
Fixtures and fixture fittings	Aerator, air washers, atomizers, bathtub, bidet, decorative fountains, dishwasher, drinking fountain, eyewash stations, manual faucet, electronic faucet, faucet flow restrictors, hoses, point of use mixing valves, hot tubs, humidifiers, ice machines, misters, shower head, shower wand, sink, tub spout, toilet, urinal, washbasin
Pumps	Pumps are often used for pressure boosting within the building (i.e., for multi-story buildings) where water pressure entering the building is not adequate for water use at distal locations. Pumps are also used for hot water recirculation systems.
Tanks	Standard water heater, pressure tanks, on-demand water heater, hydropneumatic tanks, cold water supply storage tank. Water heaters can contain Mg or Al sacrificial anodes and plastic dip tubes.
Point-of-use devices	On-faucet treatment system, under sink treatment system.

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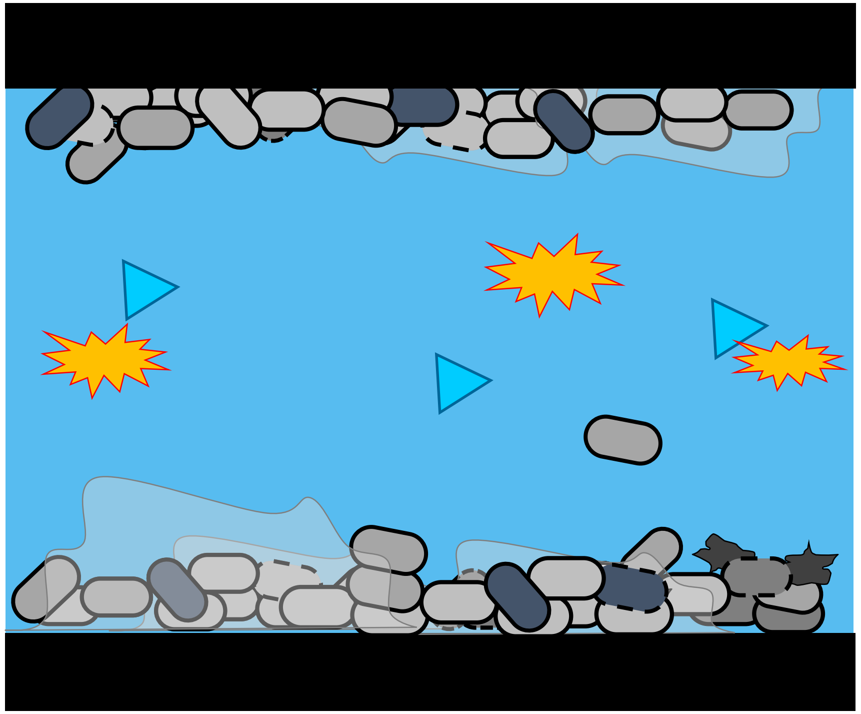
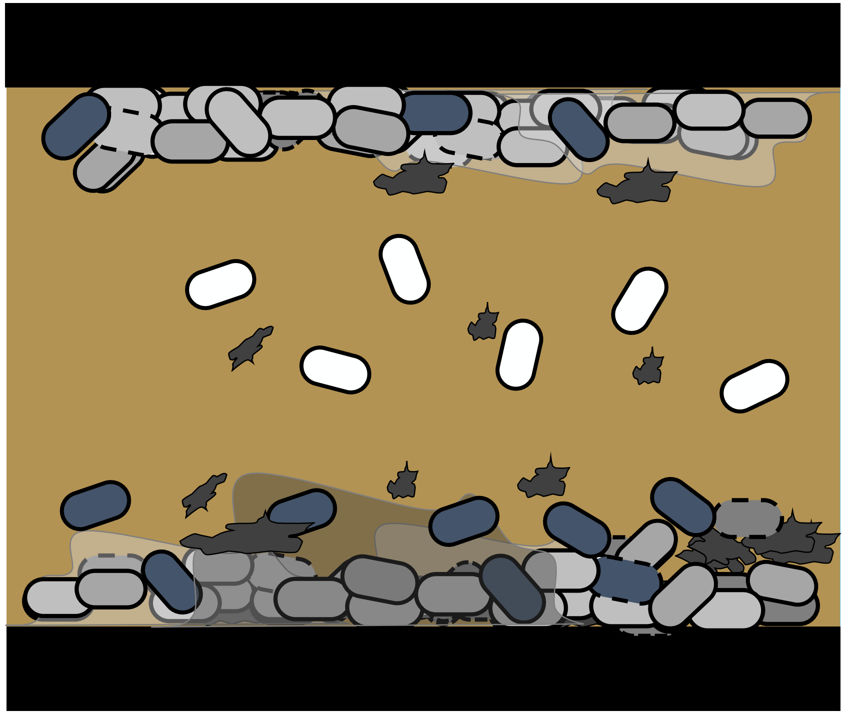
Stagnation causes water to get older

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



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



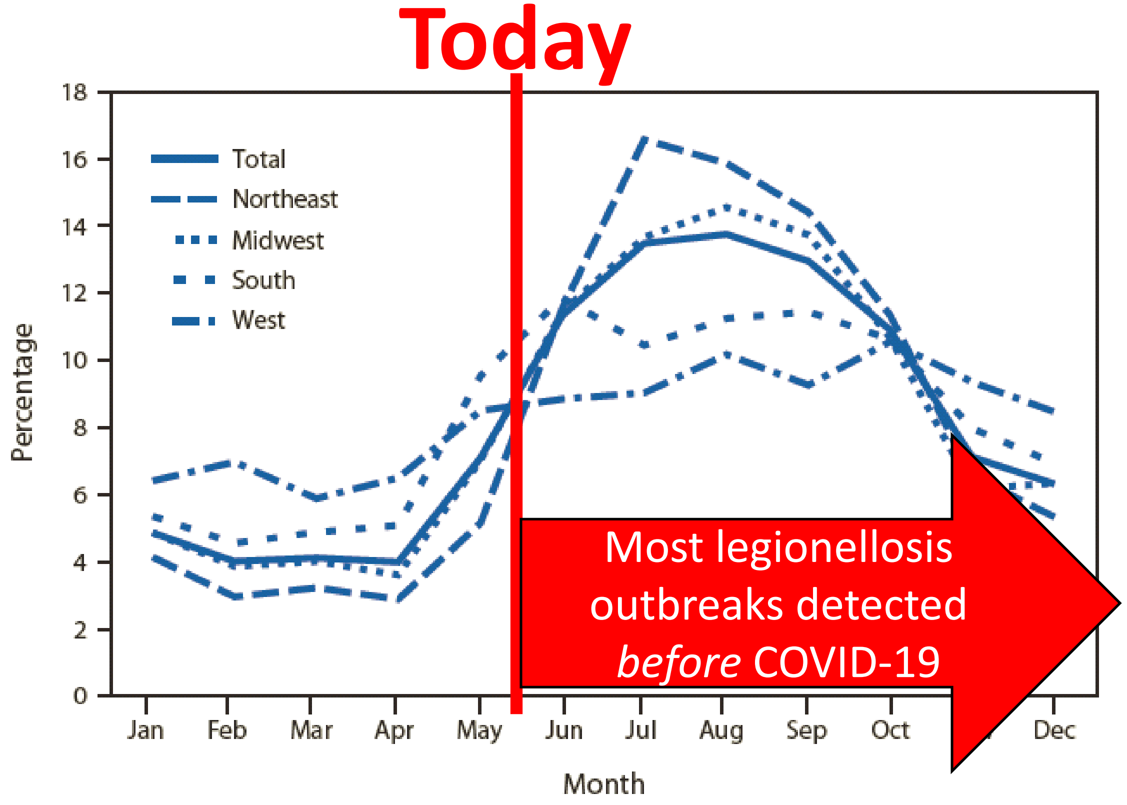
Disinfectant in water – used to reduce microbial growth in water, typically chlorine
Corrosion control – used to reduce metals leaching, stabilizes pH and may add chemicals

Slide from our YouTube Videos

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
- **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

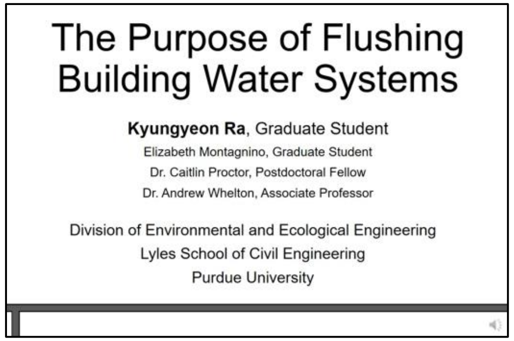


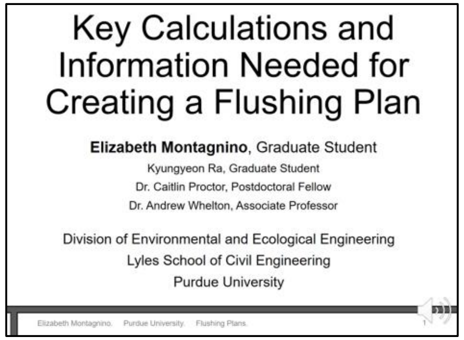
Exposure Routes of Concern: Ingestion, Dermal, Inhalation

How could we *prevent* water quality problems?

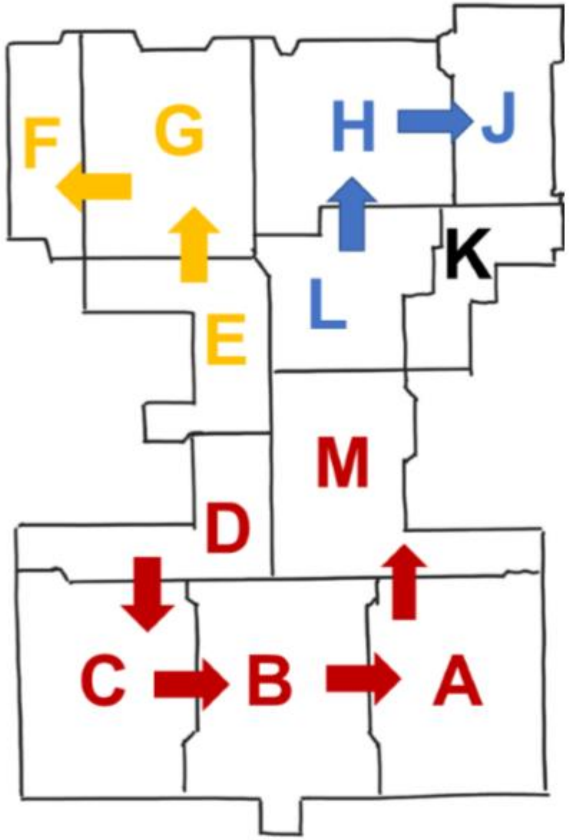
Keep the water moving! ≠ stagnation

- 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





Flushing Plans



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

Flushing and More Intensive System Cleaning Could Make People Sick

Engineering Controls

- Fill sink and floor drains traps with water
- Maintain pressure when flushing
- During flushing (especially initial), many methods to reduce exposure: Cover toilets, showerheads, faucets, reduce splashing, use hoses
- Flooding, cross-connections, dealing with waste

Administrative and Work Practice Controls

- Temporarily forbidding use of high-risk exposure items (showers, hot tubs, decorative fountains)
- Temporarily closing facilities to concentrate use

Personal Protective Equipment (PPE)

- Protect against scalding
- Protect against chemical exposure
- OSHA and other agencies recommend respirators *if* Legionella is *suspected or possible*

OSHA

N95 respirators, but recommends voluntary use of N100 "if *Legionella* contamination is possible"

AIHA
Protecting Worker Health

P100 HEPA filter respirators when sampling building water and *Legionella* may be present

Since March 2020, there have been more than ***45+*** 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?

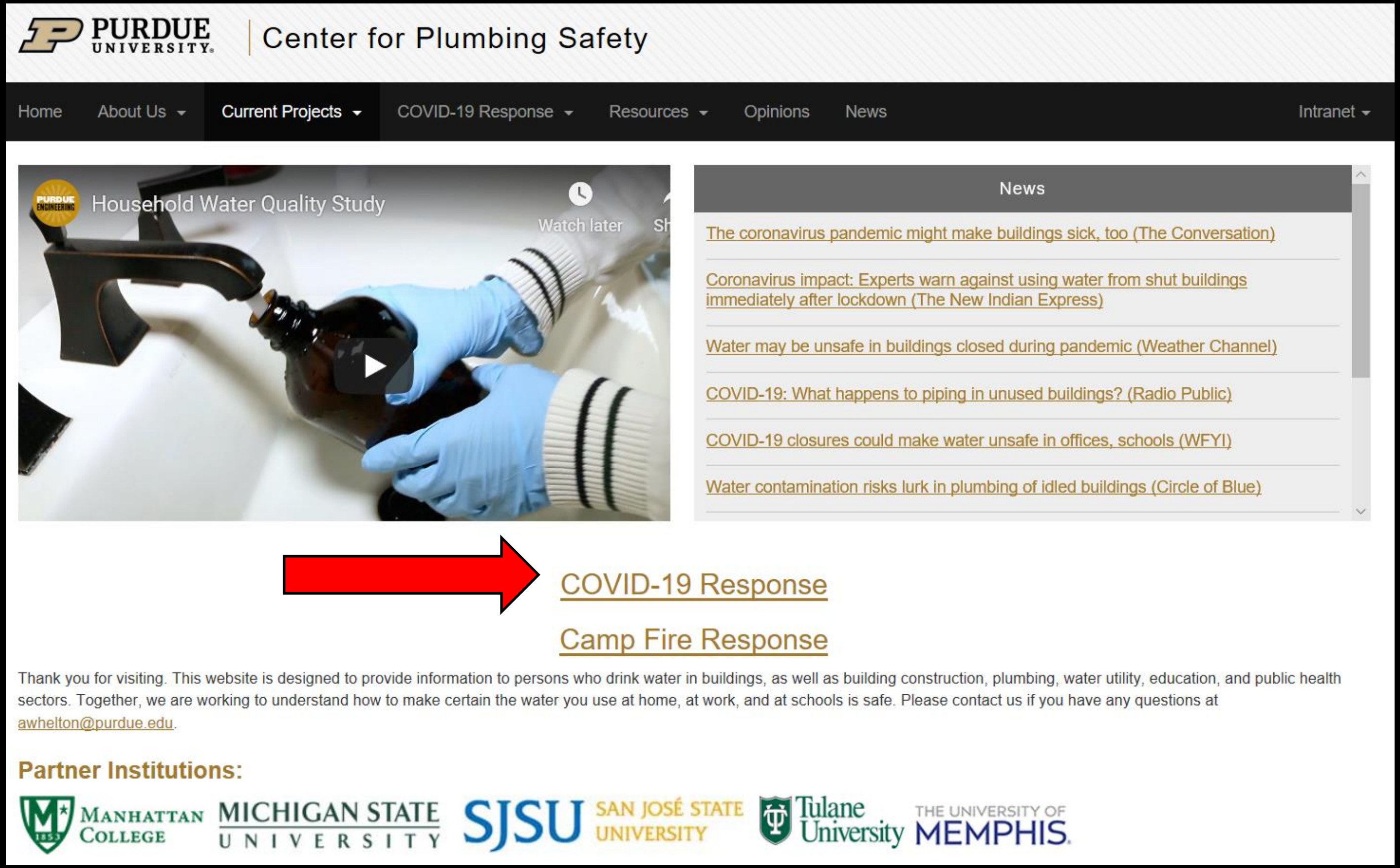
- Different perspectives - *sides of the elephant*
- Different starting information about water safety or plumbing
- Guidance targeted for different readers
- Deliberate step-by-step documents vs. general advice
- Some are derivatives of others, & others… & others!
- Some have been revised (version 3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

Awareness vs. Informational vs. Warnings vs. Actions

Q: How will we know if guidance document recommendations work or cause problems?

Q: How will we know how many cases of chemical and microbiological caused waterborne illnesses occur?

Thank you… www.PlumbingSafety.org



- ✓ 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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Just some of the questions we're being asked

Is legionella the only health risk?

Will the hospital / doctors detect legionella outbreaks?

Where do I find building water system reopening guidance?

What are the health risks of flushing?

What does a building water system flushing plan look like?

How long does each faucet need to flush?

How should the water be tested?

What legionella test method should I use?

If legionella is found, what should be done?

What is the right water heater temperature?

Can the water be treated in the plumbing without flushing it?

What needs to be done to the filters and other devices?

When is shock disinfection recommended?

How do I clean [*insert name*] device?