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Getting Back to Business: Reopening and Reoccupying Buildings in a Post-Pandemic Environment

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Right People. **Right** Perspective. **Right** Now.

Webinar Outline



Current Situation:
Building Reopening...finally



Pre-Occupancy:
Reopening Buildings & Utility Systems



Post-Occupancy:
COVID-19 Safe Work Practices



Industry Guidance & Resources



So...What now?



Current Situation

- Total shutdown in March 2020 for all “non-essential” businesses.
 - Partial closures, limited occupancies & fluctuating census
- Cases & deaths **trending down** nationally, numerous states removing occupancy restrictions (e.g. Tier Status)
- Delta variant still cause for concern in some areas



COVID Data Tracker

United States
At a Glance

Cases Total **33,545,316**
Last 30 Days

Deaths Total **603,181**
Last 30 Days

67.1% of Adults with At Least
One Vaccination

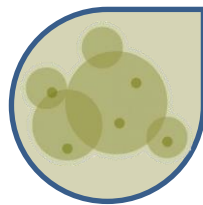
Community
Transmission **Moderate**

Reopening Buildings & Utility Systems

PRE-OCCUPANCY

Reopening Buildings & Utilities

- Prolonged reduced occupancy or full shut-down can impact building systems
 - Water intrusion (mold growth)
 - Stagnant water (*Legionella*, lead)
 - Unused HVAC systems (IAQ/IEQ)



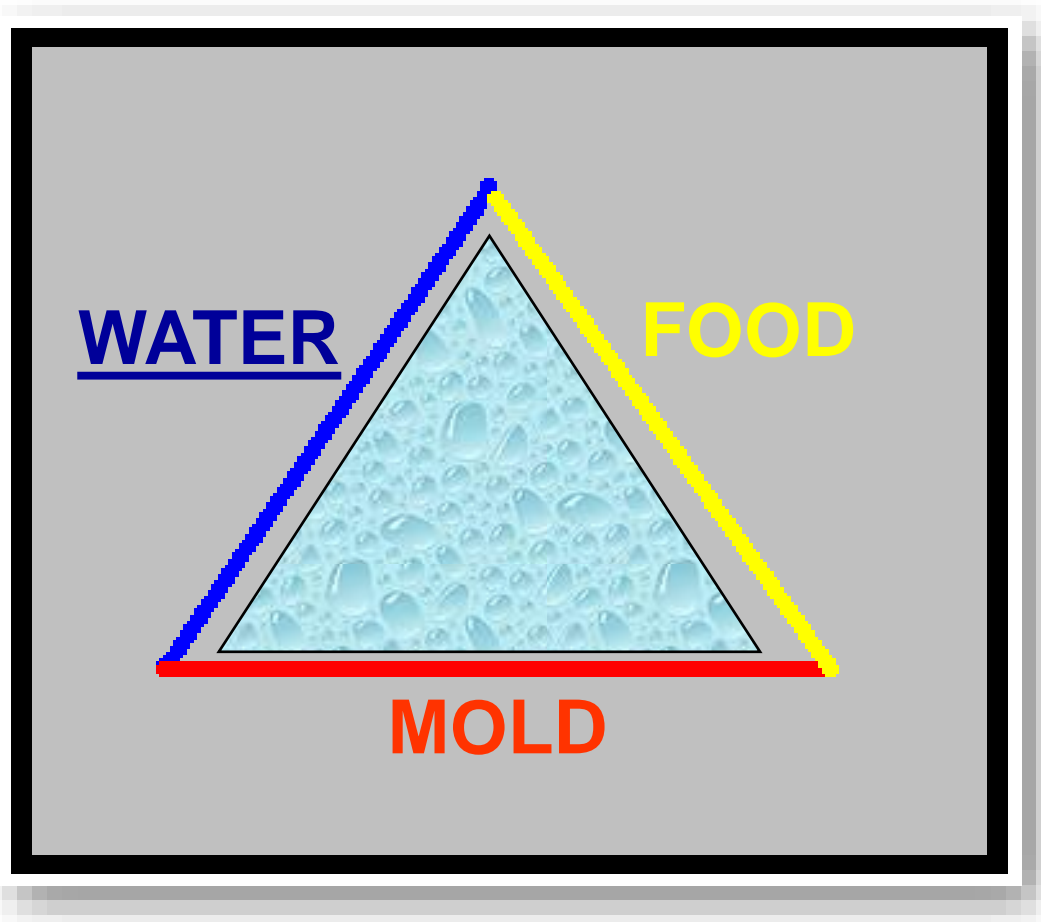
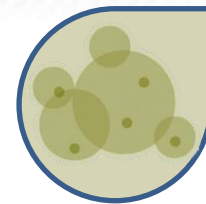
CDC Guidance for Reopening

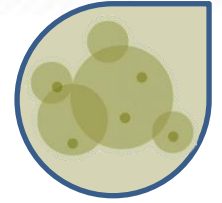


[CDC: Guidance for Reopening Buildings After Prolonged Shutdown or Reduced Operation](#)

- Temporary shutdown, reduced operation and reductions in normal water use can create hazards for returning occupants.
- Check for hazards before reopening after a “*prolonged period*” of building inactivity:
 - “For mold, a ‘prolonged’ period may be **days, weeks, or months** depending on buildings-specific factors, season, and weather variables”
 - “For Legionella, a ‘prolonged period’ may be **weeks or months**”
 - “For lead and copper, a ‘prolonged period’ may be **hours, days, weeks, or months**”
 - “Note that additional hazards not discussed on this page may exist for returning occupants. These can include other hazards, such as non-tuberculous mycobacteria, disinfection by-products, and sewer gases that enter buildings through dry sanitary sewer drain traps.”

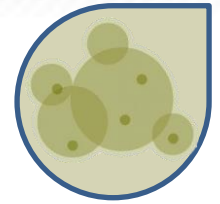
Mold – Growth Dynamics





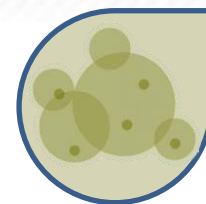
Mold - Growth Dynamics

- Limiting factors in the built environment:
 - Moisture
 - Organic building material
- Mold spores are ubiquitous
 - found in almost all indoor and outdoor environments at background levels
- Mold can grow within 24-48 hours
- Key is to control limiting factors



Mold – Water Sources

- Water intrusion can occur from multiple sources:
 - Building envelope failures (runoff, rain)
 - Condensation/humidity/steam
 - Flooding
 - Plumbing leaks/failures
- May have occurred at any time in low occupancy buildings

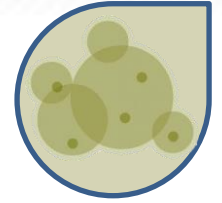


Mold - Food Sources

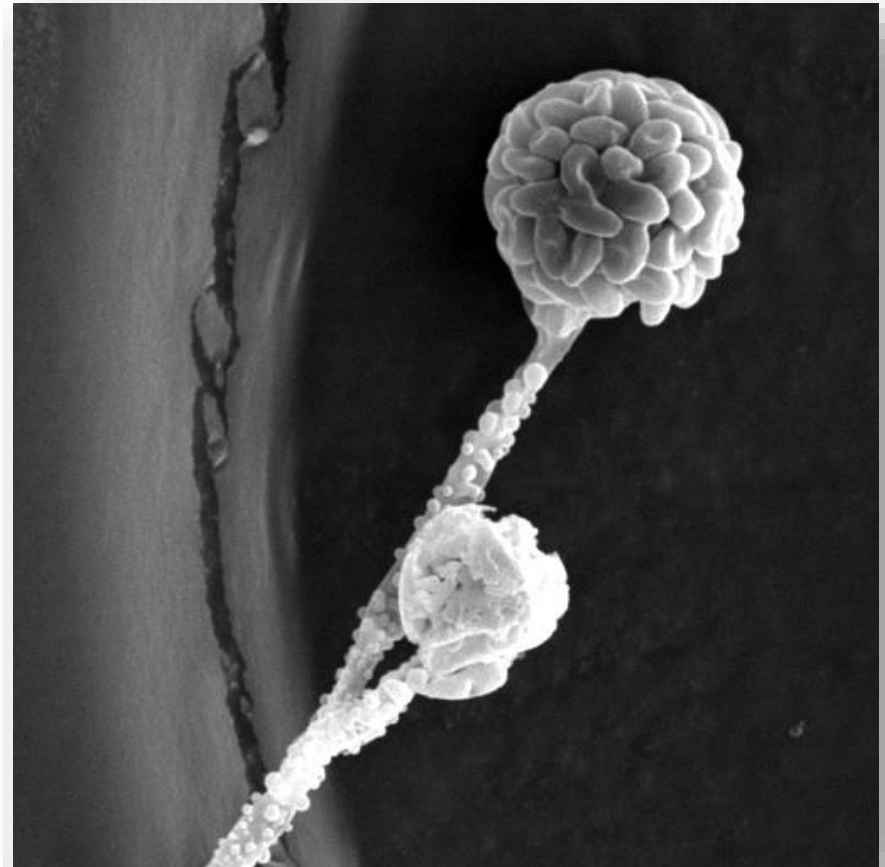
- Paper
- Gypsum
- Wood
- Fabric
- Leather
- Soil/Plant Matter
- Adhesives
- Food
- Organic Debris/Particulate



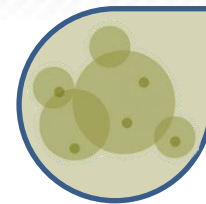
Mold - Spores



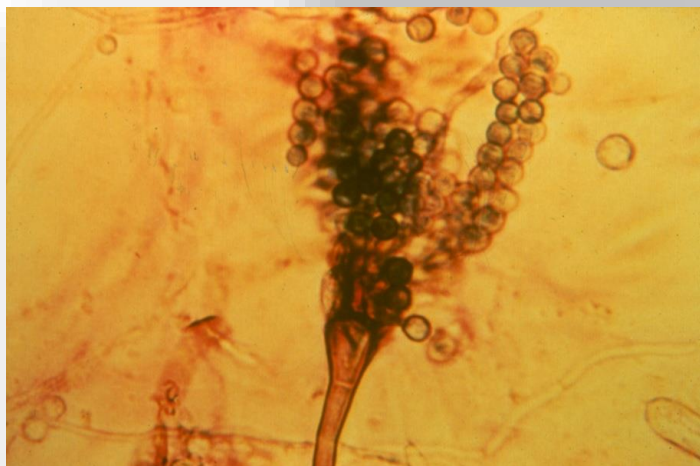
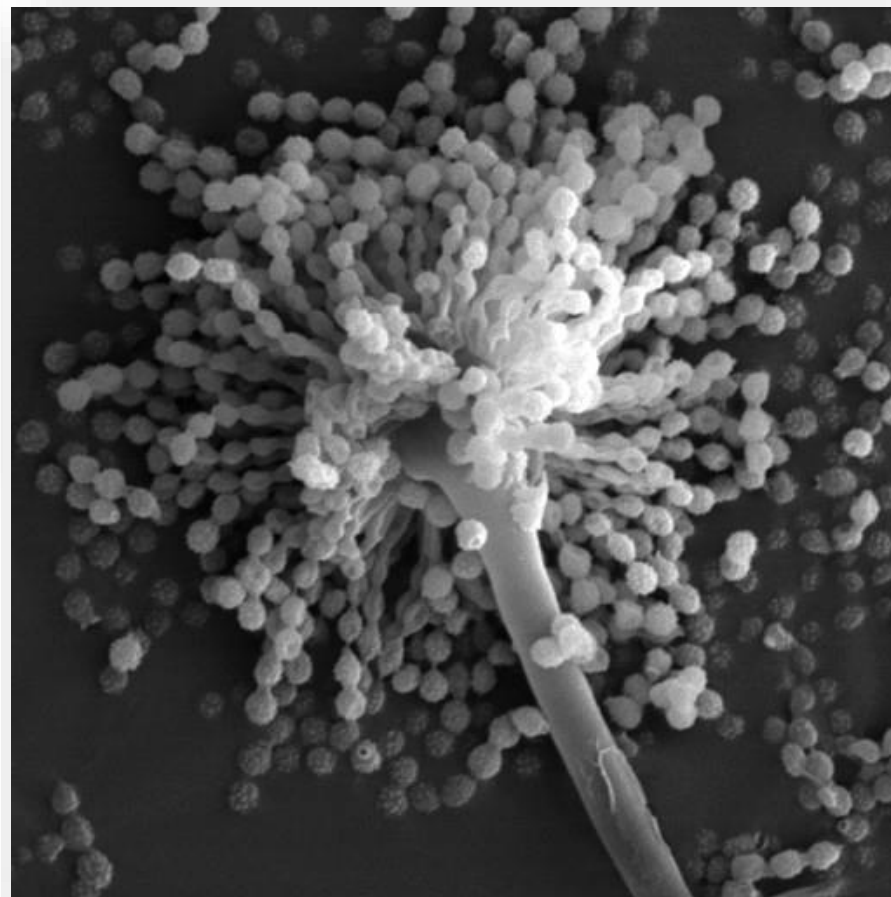
Stachybotrys

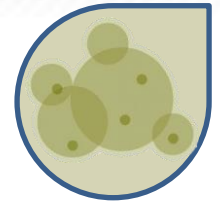


Mold - Spores

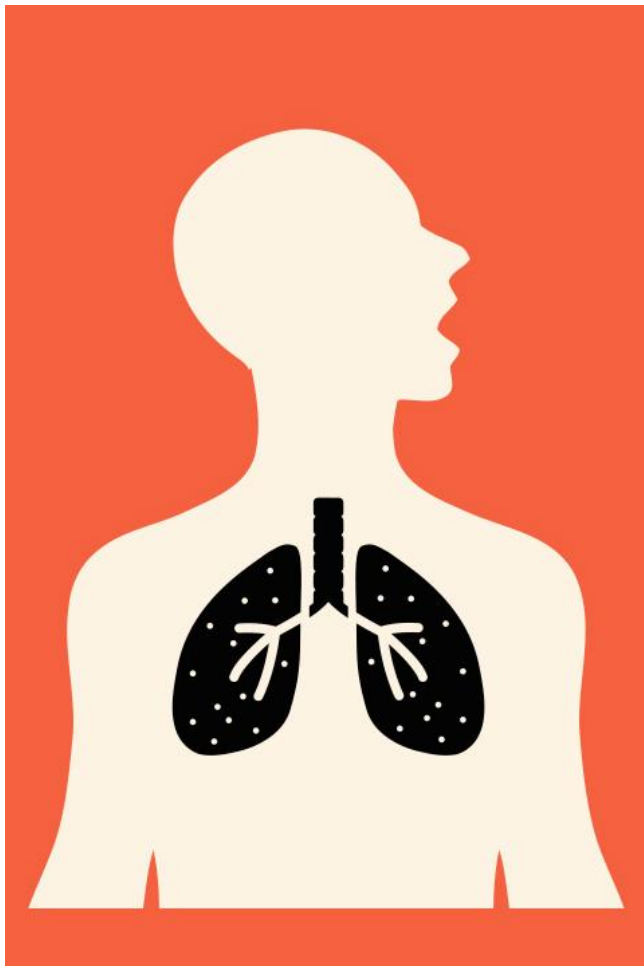


Aspergillus



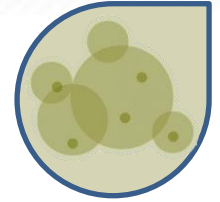


Is Mold Harmful to People?

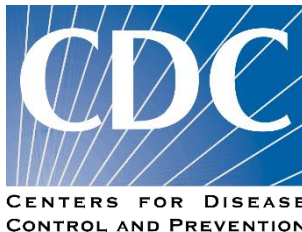


- People regularly exposed to background levels
- Problems can occur when:
 - People are exposed to atypical levels of mold
 - People become more sensitive to mold
- Health effects:
 - Allergic (hay fever, rashes, asthma, HP)
 - Infectious (immune compromised, healthcare)
 - Toxic (ingestion, not inhalation, argued)
- Conclusion
 - Mold in buildings should be addressed

CDC 5 Steps – Mold



“5 Steps to Minimize Mold Risk”



- 1 Maintain indoor humidity to <50%
- 2 Assess indoor spaces for water intrusion and mold growth; remediate
- 3 Following inspection with no mold or remediation, perform HVAC “flush out”
- 4 Perform routine (e.g., weekly) HVAC checks once building is reoccupied
- 5 Develop and implement a routine HVAC O&M Program

Lead in Water



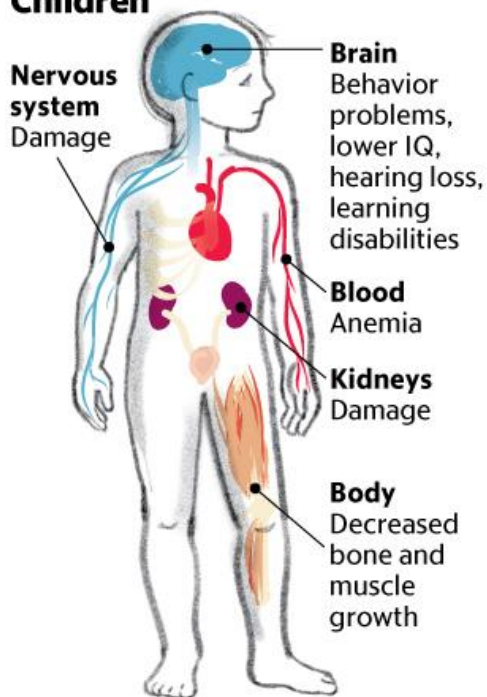
- Lead is harmful to health, especially for children.
- Lead enters drinking water from **corrosion of plumbing** (pipes, fixtures).
- **Corrosion can occur during long periods of low or no water use**, leading to potentially high levels of lead or other metals in drinking water.
- **Corrosion** is a chemical reaction that dissolves or wears away protective scales & coatings inside plumbing materials.
- Stagnant water in pipes can also make the water chemistry more corrosive over time.



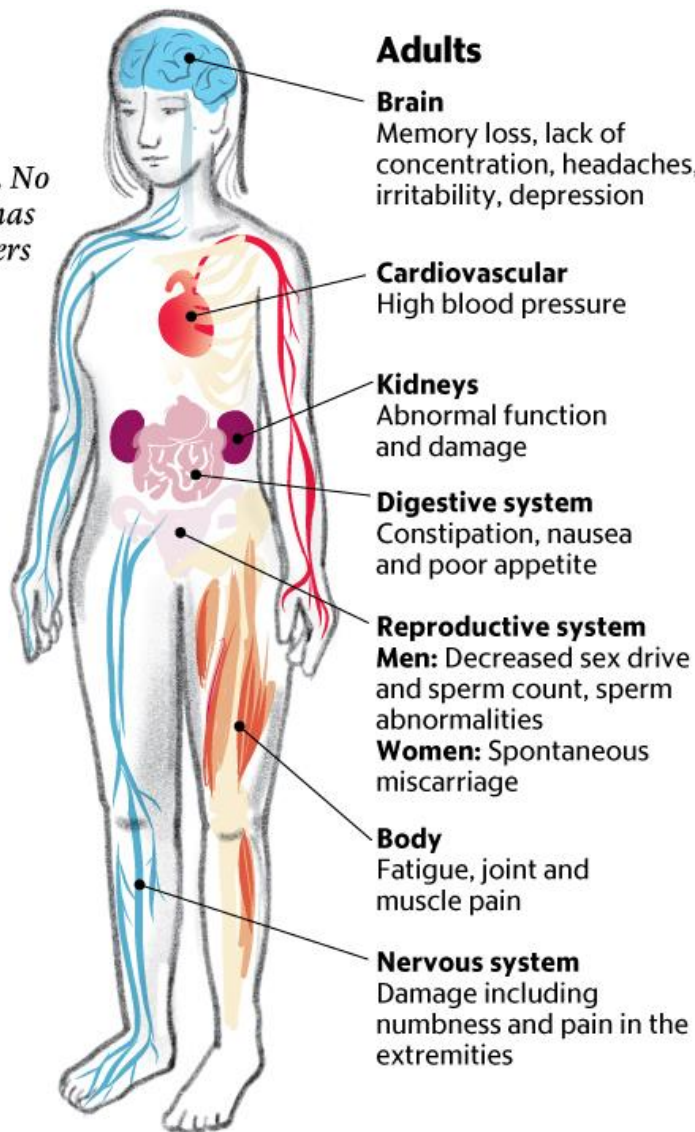
Lead exposure

Although often without obvious symptoms, lead exposure can affect nearly every part of the human body. No safe level of lead in the bloodstream has been determined by the federal Centers for Disease Control and Prevention.

Children



Sources: Centers for Disease Control and Prevention; National Institutes of Health



Lead – Current Status



EPA estimates that up to 20% of a person's lead burden comes from drinking water

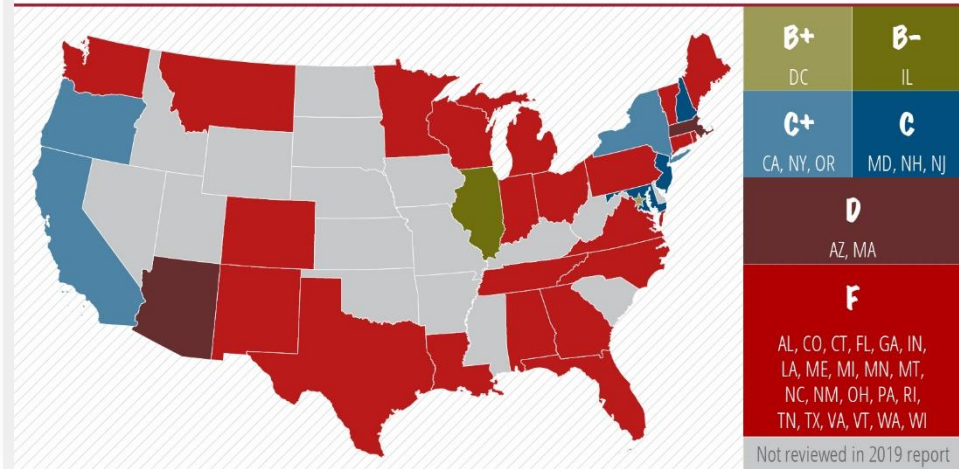


An estimated 9.2 million lead service lines are in place at U.S. residences. Lead pipes and fittings are expected to be prevalent in U.S. buildings



According to the EPA, there is no safe level of lead, especially for children

Twenty-two states failing to get the lead out



Courtesy of: USPIRG

Lead – Standards & Guidelines



EPA			OEHHA California Office of Environmental Health Hazard Assessment	Prop 65	American Academy of Pediatrics DEDICATED TO THE HEALTH OF ALL CHILDREN™	FDA
MCL	AL ¹	MCLG ²	PHG ³	Warning Level ⁴	Action Threshold ⁵	Quality Limit
“Not feasible”	15 ppb	0 ppb	0.2 ppb	0.2 ppb	1 ppb	5 ppb

¹Not health-based; level determined to be feasible for public water system to attain by adjusting water chemistry

²Based on occurrence of “low level effects” and status as a Class B2 carcinogen

³Based on neurobehavioral effects of exposure in children and hypertensive effects of exposure in adults; LOAEL of 10 ug/dL blood lead for both children and adults; assuming child water consumption of 1 L/day

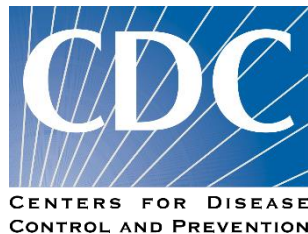
⁴Calculated based on the Prop 65 regulatory limit of 0.5 µg/day from any one source due to potential for reproductive and developmental effects; assuming child water consumption of 1 L/day

⁵Action threshold; “there is no safe level of lead”

CDC 6 Steps – Lead



**“Additional
Steps to
Reduce Lead
in Drinking
Water”**



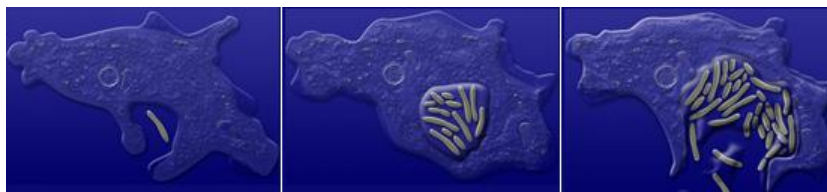
- 1 Learn about the water coming into your building
- 2 Test your water for lead at an EPA certified laboratory
- 3 Sample ONLY from potable water faucets used for drinking/cooking/eating
- 4 Use only cold water for drinking and cooking
- 5 Clean your aerators regularly
- 6 Use and maintain filters properly

“Flushing does not prevent the release of lead into drinking water and may require additional steps.”

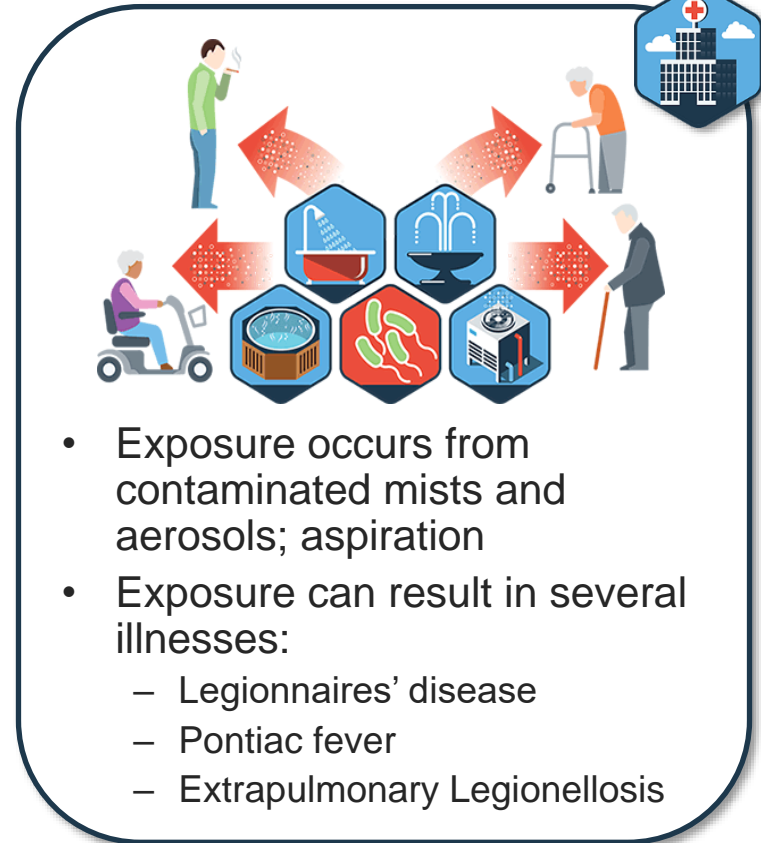
Legionella In Water



- Pathogenic bacteria
- Naturally occurring in water systems/soil
- Risk is attributed to amplification/growth in uncontrolled conditions



Courtesy of: Pall Medical




- Exposure occurs from contaminated mists and aerosols; aspiration
- Exposure can result in several illnesses:
 - Legionnaires' disease
 - Pontiac fever
 - Extrapulmonary Legionellosis

Graphics courtesy of CDC




Legionella Growth Conditions




Temperature:

- Ideal Growth Range ~ 77°F – 113°F
- Heating/Storage ≥140°F
- Target Delivery Temp (cold) ≤77°F
- Target Delivery Temp (hot) ≥120°F




Low/No Flow:

- Building Closure/Reduced Occupancy
- Dead Legs



Low/No Disinfectant:

- Stagnant Conditions
- High Temps



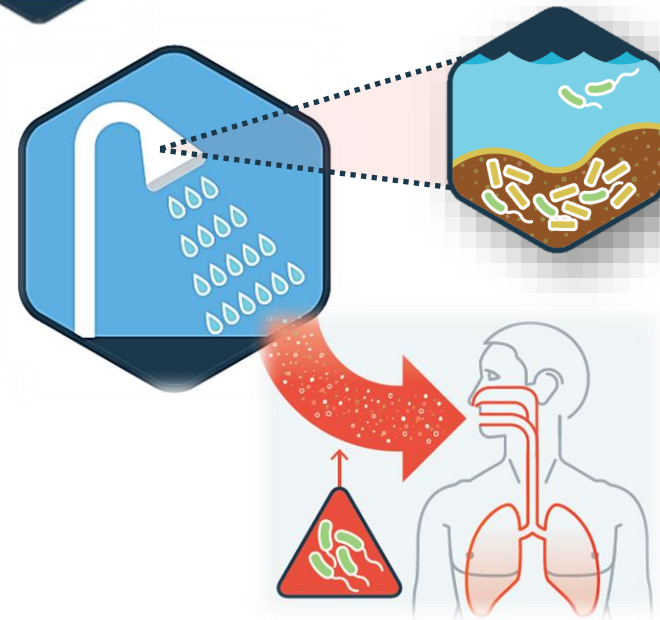
Corrosion/Scale:

- Stagnant Conditions
- Biofilm Formation



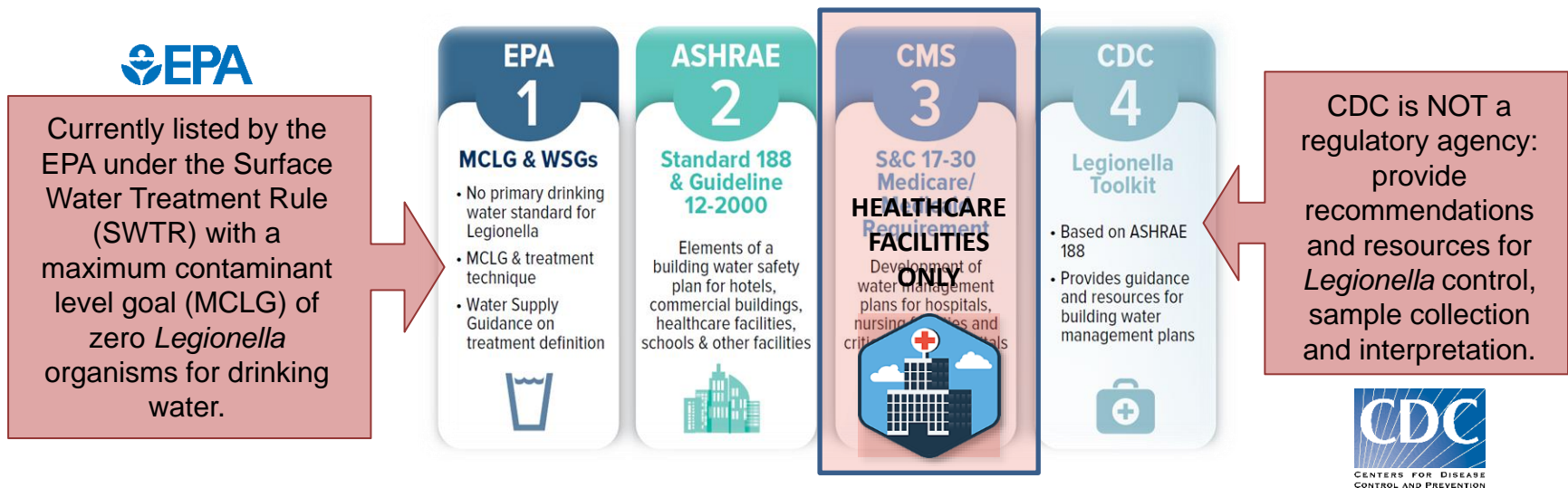
Graphics courtesy of CDC

Legionella Exposure Pathway



Graphics courtesy of CDC

Legionella Standards & Guidelines



Graphic courtesy of ASDWA, 2019



“8 Steps to Minimize *Legionella* Risk Before Your Business or Building Reopens”



Make a plan, heat, flush, clean & maintain.

- 1 Develop a comprehensive Water Management Program (WMP)
- 2 Maintain water heater and set temperature (140°F)
- 3 Flush your water system
- 4 Clean all decorative water features, such as fountains
- 5 Ensure hot tubs/spas are safe for use
- 6 Ensure cooling towers are clean and well-maintained
- 7 Clean and maintain safety equipment (fire systems, eyewash/showers)
- 8 Maintain your water system (WMP, temp, disinfectant, pH)

HVAC Systems & IEQ



- HVAC Systems are critical to maintaining adequate indoor air quality
- Many HVAC systems shut off or set to reduced operation during building shut-downs to conserve energy/cost
- Reduced HVAC operation can result in build up of indoor air pollutants
- HVAC systems can be optimized to supplement COVID-19 safe work practices

Common Sources of Indoor Pollutants



- Appliances (e.g., stoves)
- Office equipment (e.g., copiers)
- Building materials (e.g., paints, carpets)
- Furniture
- Office products and supplies
- Cleaning products
- Tobacco use
- Outdoor environment/air
- Pets, rodents, insects
- People
-and many more



Radon



Carbon Monoxide



Lead



Volatile Organic Compounds



Biological Pollutants

Graphic courtesy of University of Nebraska



Graphic courtesy of Catalyst Magazine

“Steps to Improve Ventilation”



- 1 Increase the introduction of fresh outdoor air (open HVAC dampers, open windows/doors)
- 2 Ensure ventilation systems operate properly for the anticipated space occupancy
- 3 Rebalance or adjust HVAC systems to increase total airflow to occupied spaces
- 4 Generate clean to less clean airflow by repositioning supply/return grilles/dampers
- 5 Improve central air filtration (increase air flow, increase filter rating, ensure fit)
- 6 Run the HVAC at maximum outdoor airflow for 2 hours before and after occupancy
- 7 Maintain restroom and kitchen exhaust fans and ensure they are fully operational
- 8 Use portable air filtration devices to enhance air cleaning
- 9 Use UV germicidal irradiation (UVGI) to supplement disinfection, if needed



CENTERS FOR DISEASE
CONTROL AND PREVENTION

COVID-19 Safe Work Practices

POST-OCCUPANCY

COVID-19 Health & Safety



Health

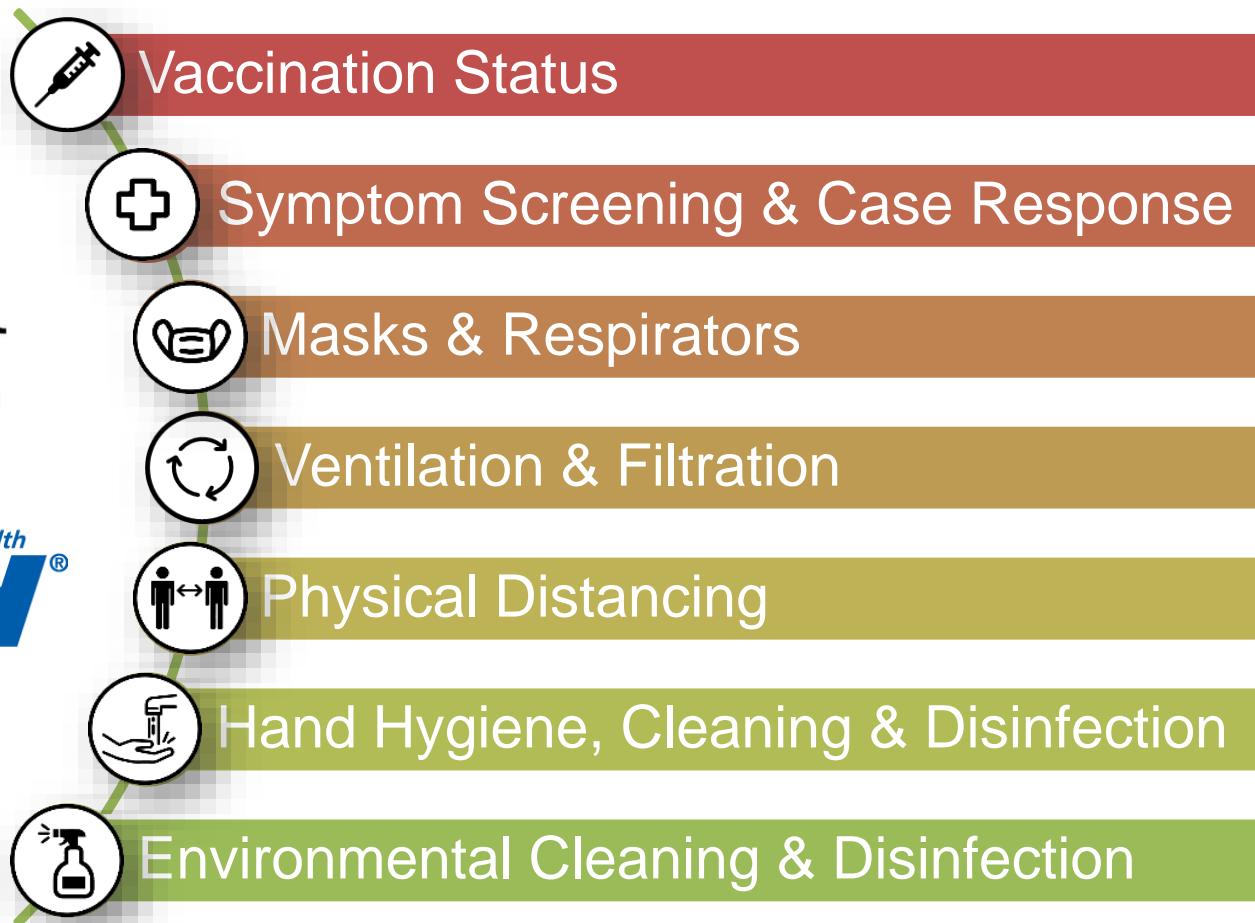
- Medical Screening
- Vaccination
- Transmission Routes



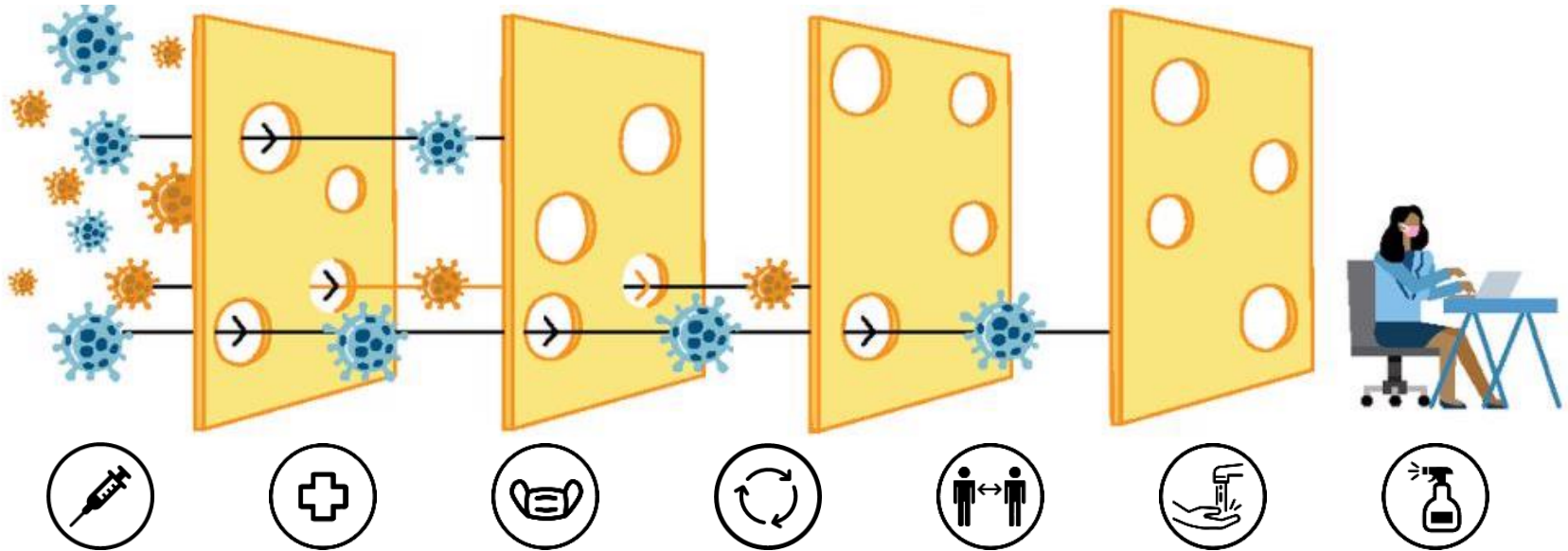
Safety

- Protective Equipment
- Engineering Controls
- Administrative Controls

Safe Work Practices



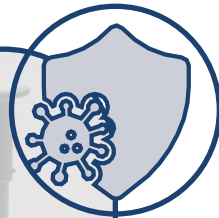
Layering Controls: The Swiss Cheese Model



James Reason, Ph.D.'s "Swiss Cheese Model"
from the Cleveland Clinic's Return to Work Amid COVID-19 Paper

Safe Work Practice Design Overview

COVID-19 is respiratory disease that is transmitted from person to person through viral particles in the air.



Address viral contagion through vaccination & symptom screening



Address airborne hazards with face coverings or respirators



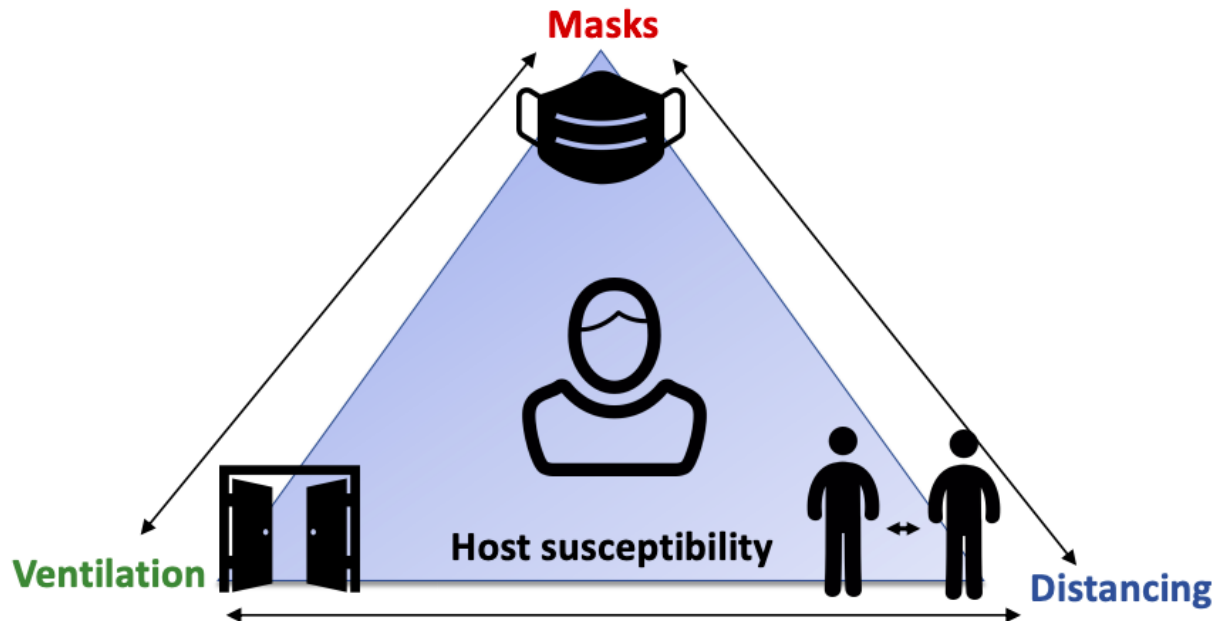
Optimize indoor air quality by increasing ventilation and filtration



Limit close contacts through distance and time

Risk Mitigation Triangle

- When one intervention is maximized, others can be relaxed



Legend: Three points of the non-pharmaceutical interventions to combat COVID-19 are complementary. As one decreases, the other can compensate. So with more ventilation (e.g. outdoors), the mask can be less fitted; with higher fit and filtration masks, less distancing and ventilation are required. Host susceptibility is also a factor in the strength of NPIs required.

[https://www.thelancet.com/journals/laninf/article/PIIS1473-3099\(20\)30982-8/fulltext](https://www.thelancet.com/journals/laninf/article/PIIS1473-3099(20)30982-8/fulltext)



INDUSTRY GUIDANCE & RESOURCES

Additional Resources

- [EPA “Information on Maintaining or Restoring Water Quality in Buildings with Low or No Use” \(updated 2021\)](#)
- [CDC “COVID-19: Ventilation in Buildings” \(updated 2021\)](#)
- [CDC “Guidance for Reopening Buildings after Prolonged Shutdown or Reduced Operation” \(updated 2020\)](#)
- [AWWA “Responding to Water Stagnation in Buildings with Reduced or No Water Use” \(2020\)](#)
- [AIHA: “Recovering from COVID-19 Building Closures” \(2020\)](#)
- [ESPRI “Water Quality and Coronavirus: Flushing Guidance for Periods of Low or No Use” \(revised 2020\)](#)
- [HSPH “Risk Reduction Strategies for Reopening Schools” \(2020\)](#)
- [Cal/OSHA “COVID-19 Guidance Resources” \(2021\)](#)





SO WHAT NOW?

Pre-Occupancy Recommendations

- Develop & implement a mold & moisture O&M Program
 - Perform a mold & moisture inspection, remediate as needed using a qualified professional or contractor
- Develop & implement a water management program (lead, *Legionella*)
 - Include temperature and flow management, O&M, and water chemistry monitoring
- Develop an HVAC O&M program and make necessary adjustments to airflow, filtration
 - Add supplemental filtration, UVGI as feasible

Post-Occupancy Recommendations

- Establish a COVID-19 Safe Work Practices program that addresses:
 - Vaccination status
 - Symptom screening & case response
 - Personal protective equipment (masks, respirators)
 - Ventilation and filtration
 - Physical distancing
 - Hand hygiene, cleaning & disinfection
 - Environmental cleaning & disinfection
- Ensure program compliance with state, local requirements

Thank You!

For any follow-up questions, please feel free to reach out to our presenters:

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- Megan Canright – mcanright@forensicanalytical.com, 858-247-1050

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