Guidance for Reopening Buildings After Prolonged Shutdown or Reduced Operation

Coronavirus Disease 2019 (COVID-19)

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Summary of Changes

- Added guidance for lead and copper in building water systems with low or no use
- Added guidance for mold awareness, monitoring, and remediation during and after prolonged building shutdowns
- Updated *Legionella* guidance for people with weakened immune systems and the use of respiratory protection when flushing water systems
- Updated title to reflect content

The temporary shutdown or reduced operation of a building and reductions in normal water use can create hazards for returning occupants. Check for hazards before reopening after a prolonged period of building inactivity. Hazards include **mold**, ***Legionella*** (the cause of Legionnaires' disease), and lead and copper contamination from corroded plumbing. For mold, a "prolonged period" may be **days**, **weeks**, or **months** depending upon building-specific factors, season, and weather variables.[1] For *Legionella*, a "prolonged period" may be **weeks** or **months** depending on plumbing-specific factors, disinfectant residuals, water heater temperature set points, water usage patterns, and preexisting *Legionella* colonization.[2] For lead and copper, a "prolonged period" may be **hours**, **days**, **weeks**, or **months** depending on plumbing and water-specific factors, the amount of time the water remains stagnant inside the pipes, whether there are protective scales or coatings present inside pipes that prevent metals from leaching into water, and the materials used to build the plumbing system.[3] 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

Mold will grow on building materials where there is moisture, produced from leaks or condensation from roofs, windows, or pipes, or from a flood. Mold can grow on a variety of surfaces, such as ceiling tiles, wallpaper, insulation, drywall, carpet, and fabric. People with asthma and other respiratory conditions and those with mold allergy or weakened immune systems should avoid buildings suspected or confirmed to have mold contamination. Ensure that your building does not have mold after a prolonged shutdown to maintain a safe working environment for returning occupants.

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

1. Maintain indoor humidity as low as possible, not exceeding 50%, as measured with a humidity meter. Building managers may consider continuous monitoring of indoor humidity using a digital hygrometer, ideally more than once daily, to minimize the need to access the building.
2. After a prolonged shutdown and before occupants return, buildings should be assessed for mold and excess moisture.
    a. Building inspections by trained industrial hygienists can recognize dampness or mold by sight or odor, without the need for sampling and laboratory analysis. NIOSH offers tools and instructions to assess dampness and mold in

schools and general buildings. These tools can be used by building maintenance staff as well as industrial hygienists.

   b. If dampness or mold is detected, address the source of water entry first. Clean-up and remediation should then be conducted before the building is reoccupied. Plan the remediation before beginning work. Resources for remediation of buildings and homes with mold are provided by NIOSH, the New York City Department of Health and Mental Hygiene , the Environmental Protection Agency (EPA), and CDC .

3. After an assessment has confirmed that mold and moisture are not detected (Step 2a), OR after remediation has been completed (Step 2b), a building HVAC system that has not been active during a prolonged shutdown should be operated for at least 48 to 72 hours (known as a "flush out" period) before occupants return.
   a. During this period, open outdoor air dampers to the maximum setting that still allows desired indoor air temperatures.
   b. If an odor is detected that suggests mold growth (such as a musty smell) after the "flush out" period, look for mold that may not have been identified earlier. If mold is found, conduct remediation as described in Step 2b.
   c. Continue the "flush out" process until no odors are apparent.
   d. The condition of HVAC filters used during the "flush out" period should be carefully assessed prior to building occupancy and replaced with new or clean filters as necessary.
4. After a building is reopened and occupied, routine (e.g., weekly) checks of the HVAC system are recommended to ensure operating efficiency.
   a. During HVAC checks, inspect and replace filters as indicated or needed.
   b. The frequency of HVAC system checks can be gradually reduced (e.g., monthly, quarterly), depending on the operational and maintenance specifications for the HVAC system.
   c. Maintain indoor temperature and relative humidity within ranges recommended in ASHRAE Standard 55-2017, Thermal Environmental Conditions for Human Occupancy .
5. If no routine HVAC operation and maintenance program is in place for the building, one should be developed and implemented. At a minimum, consider including the following:
   a. Inspection and maintenance of HVAC components
   b. Calibration of HVAC system controls
   c. HVAC testing and balancing

Content adapted from the National Institute for Occupational Safety and Health [NIOSH] Heating, Ventilation, and Air Conditioning [HVAC] Cleaning and Remediation guidance.

Additional information and CDC guidance on controlling dampness issues that result in indoor mold growth, as well as on renovation and remediation if indoor mold has become an issue is available from NIOSH.

Legionella and Legionnaires' disease

Stagnant or standing water in a plumbing system can increase the risk for growth and spread of *Legionella* and other biofilm-associated bacteria. When water is stagnant, hot water temperatures can decrease to the *Legionella* growth range (77–108°F, 25–42°C). Stagnant water can also lead to low or undetectable levels of disinfectant, such as chlorine. Ensure that your water system is safe to use after a prolonged shutdown to minimize the risk of Legionnaires' disease and other diseases associated with water.

People at increased risk of developing Legionnaires' disease, such as those with weakened immune systems, should consult with a medical provider regarding participation in flushing, cooling tower cleaning, or other activities that may generate aerosols. Wearing a half-face air-purifying respirator equipped with an N95 filter, or an N95 filtering facepiece, may be appropriate in enclosed spaces where aerosol generation is likely. Respirators must be used in accordance with a comprehensive respiratory protection program, which includes fit testing, training, and medical clearance ahead of their use (see OSHA standard 29 CFR 1910.134 and OSHA Legionellosis website). For more information about N95 respirators, visit the NIOSH National Personal Protective Technology Laboratory (NPPTL) website.

8 steps to minimize *Legionella* risk before your business or building reopens

1. Develop a comprehensive water management program (WMP) for your water system and all devices that use water. Guidance to help with these processes are the following:
    a. Water Management Program Toolkit:
    This toolkit is designed to help people understand which buildings and devices need a *Legionella* water management program to reduce the risk of Legionnaires' disease, what makes a good program, and how to develop it.
    https://www.cdc.gov/legionella/wmp/toolkit/index.html
    b. Preventing Legionnaires' Disease: A Training on *Legionella* Water Management Programs (PreventLD Training):
    Take this training from CDC and partners on creating a water management program to reduce risk of Legionnaires' disease. PreventLD Training aligns with industry standards on managing risk of *Legionella* bacteria.
    https://www.cdc.gov/nceh/ehs/elearn/prevent-LD-training.html
    c. Hotel Guidance:
    Considerations for Hotel Owners and Managers: How to Prevent Legionnaires' Disease
    https://www.cdc.gov/legionella/wmp/hotel-owners-managers.html
    d. Operating Public Hot Tubs/Spas:
    https://www.cdc.gov/healthywater/swimming/aquatics-professionals/operating-public-hot-tubs.html
    e. Reduce Risk from Water: Plumbing to Patients:
    Water management programs in healthcare facilities are an important way to help protect vulnerable patient populations as well as staff and visitors.
    https://www.cdc.gov/hai/prevent/environment/water.html
    f. Preventing Occupational Exposure to *Legionella:*
    https://www.cdc.gov/niosh/docs/wp-solutions/2019-131/default.html
2. Ensure your water heater is properly maintained and the temperature is correctly set.
    a. Determine if your manufacturer recommends draining the water heater after a prolonged period of disuse. Ensure that all maintenance activities are carried out according to the manufacturer's instructions or by professionals.
    b. Make sure that your water heater is set to at least 140°F.
    c. Higher temperatures can further reduce the risk of *Legionella* growth, but ensure that you take measures to prevent scalding.
3. Flush your water system
    a. Flush hot and cold water through all points of use (e.g., showers, sink faucets)
        i. Flushing may need to occur in segments (e.g., floors, individual rooms) due to facility size and water pressure. The purpose of building flushing is to replace all water inside building piping with fresh water.
    b. Flush until the hot water reaches its maximum temperature. Where possible, hot water at the tap should reach at or above 120°F. Anti-scalding controls and devices may limit the maximum temperature at the point of use.
    c. Care should be taken to minimize splashing and aerosol generation during flushing.
    d. Other water-using devices, such as ice machines, may require additional cleaning steps in addition to flushing, such as discarding old ice. Follow water-using device manufacturers' instructions.
4. Clean all decorative water features, such as fountains
    a. Be sure to follow any recommended manufacturer guidelines for cleaning.
    b. Ensure that decorative water features are free of visible slime or biofilm.
    c. After the water feature has been re-filled, measure disinfectant levels to ensure that the water is safe for use.
5. Ensure hot tubs/spas are safe for use
    1. Check for existing guidelines from your local or state regulatory agency before use
    2. Ensure that hot tubs/spas are free of visible slime or biofilm before filling with water
    3. Perform a hot tub/spa disinfection procedure before use
        i. CDC Hot Tub Disinfection Guidance (follow Steps 4–9 and 12–13).
        https://www.cdc.gov/legionella/downloads/hot-tub-disinfection.pdf
        ii. Facilities may decide to test the hot tub/spa for *Legionella* before returning to service if previous device maintenance logs, bacterial testing results, or associated cases of Legionnaires' disease indicate an elevated level of risk to occupants. All *Legionella* testing decisions should be made in consultation with facility water management program staff along with relevant public health authorities.

6. Ensure cooling towers are clean and well-maintained

a. Ensure that cooling towers are maintained (including start-up and shut-down procedures) per manufacturer's guidelines and industry best practices.
    i. Guidance on start-up and shut-down procedures from the Cooling Technology Institute (CT 159): https://cti.org/pub/cticode.php
b. Ensure that the tower and basin are free of visible slime, debris, and biofilm before use.
    i. If the tower appears well-maintained, perform an online disinfection procedure.
        - Guidance on disinfection procedures from the Cooling Technology Institute: http://www.cti.org/downloads/WTP-148.pdf

7. Ensure safety equipment including fire sprinkler systems, eye wash stations, and safety showers are clean and well-maintained
    a. Regularly flush, clean, and disinfect these systems according to manufacturers' specifications.
8. Maintain your water system
    a. Consider contacting your local water utility to learn about any recent disruptions in the water supply. This could include working with the local water utility to ensure that standard checkpoints near the building or at the meter to the building have recently been checked or request that disinfectant residual entering the building meets expected standards.
    b. After your water system has returned to normal, ensure that the risk of *Legionella* growth is minimized by regularly checking water quality parameters such as temperature, pH, and disinfectant levels.
    c. Follow your water management program, document activities, and promptly intervene when unplanned program deviations arise.

Lead and Copper in Building Water Systems with Low or No Use

Metals, such as lead and copper, can enter drinking water in a building from corrosion of a building's plumbing (pipes, fixtures). Corrosion is a chemical reaction that dissolves or wears away metal from pipes and fixtures. Corrosion may occur during long periods of low or no water use, leading to potentially high levels of lead or other metals in the building's drinking water. Lead is harmful to health, especially for children, as there is no known safe level in children's blood. For more information on corrosion and how lead gets into water, visit CDC's Lead in Drinking Water webpage or EPA's Basic Information About Lead in Drinking Water website .

Additionally, water sitting stagnant (not flowing) in the pipes can make the water chemistry more corrosive over time and use up any corrosion control chemicals added by water utilities to limit the release of lead and copper. This may further disturb protective pipe scales or coatings inside plumbing materials. If pipe scales are disrupted, lead and copper could continue to be released at higher levels until the scales are restored after the building returns to normal operations.

To prevent high levels of lead and copper in the drinking water while there is low or no use of the building, follow **EPA's Maintaining or Restoring Water Quality in Buildings with Low or No Use** guidance. This guidance has strategies to maintain the water quality in the building and prevent water stagnation. Maintaining water quality will flush potentially corrosive water and disrupted pipe scale containing lead out of the pipes. It will ensure fresh water containing proper levels of corrosion control chemicals is brought into the building and help restore any disrupted pipe scales prior to building opening.

Take additional steps to reduce lead and copper in drinking water. Preventing stagnation does not completely prevent the release of lead into drinking water and may require additional steps, including:

1. **Learn about the water coming into your building.**
   Contact your water utility if you'd like to receive a copy of their latest annual drinking water quality consumer confidence report. More information and ways to locate these reports is available from EPA . If your water comes from a private well or water supply, check with your health department for information on water quality in your area.
2. **Test your water for lead.**
   If you are served by a water utility, they may test your water upon request. You may also contact laboratories certified to test for lead in water. For information on locating these laboratories, see EPA's List of laboratories included in the National Lead Laboratory Accreditation Program .
3. **Sample from faucets used for drinking water or cooking**, including drinking fountains, breakroom and/or kitchen sinks, and any kitchen kettle (large containers used for cooking) filler outlets. Do not sample from faucets not used for drinking water or cooking, such as sinks in janitor closets or outdoor hoses.
4. **Use cold water.**

Use only cold water for drinking and cooking. Water that comes out of the tap warm or hot can have higher levels of lead. Remember, boiling water does not remove lead from water.

5. **Clean your aerators.**
   Regularly clean faucet screens (also known as aerators). Sediment, debris, and lead particles can collect in your aerator. If lead particles are caught in the aerator, lead can get into your water.
6. **Use filters properly.**
   If you use filters, make sure they are certified to remove lead. Follow manufacturer instructions for installation and maintenance. Replace filter cartridges before they expire to maintain their effectiveness. Do not run hot water through filters. Find more information about choosing a filter certified to reduce lead on EPA's website .

[1] For example, a building that is damp and has poor ventilation in a humid region might develop mold growth in a few days that will proliferate unless these conditions change. In contrast, a building that is dry and well-ventilated in a arid climate might not develop significant mold growth for weeks, months, or at all.

[2] For example, a building potable water system with extensive dead-legs, low disinfectant residuals, tepid hot water temperatures, minimal water flow, and an established *Legionella* biofilm might promote substantial *Legionella* growth and dissemination in weeks or months. In contrast, a building with an efficiently designed potable water system that maintains high disinfectant residuals, elevated hot water temperatures, regular water flow, and has no preexisting *Legionella* population may not support *Legionella* colonization at all.

[3] For example, a building potable water system with a lead service line, lead-soldered plumbing fittings, elevated water temperature, and low mineral content would create conditions conducive for lead to leach into the water in a few hours. In contrast, a building water system constructed with lead-free plumbing materials and supplied with water that contains corrosion control chemicals would prevent metals from leaching into the water system and reduce or eliminate exposure.

Additional Resources

- NIOSH Workplace Solutions: Preventing Occupational Exposure to *Legionella*
- CDC Model Aquatic Health Code
- CDC Healthcare Water System Repair and Recovery Following a Boil Water Advisory or Disruption of Water Supply
- ASHRAE Standard 188: Legionellosis Risk Management For Building Water Systems
- ASHRAE Guideline 12: Minimizing the Risk of Legionellosis Associated with Building Water Systems
- Cooling Technology Institute Legionellosis Guideline 2008 (WTP148)
- Cooling Technology Institute Legionellosis Guideline 2020 (GLD159)
- EPA Maintaining or Restoring Water Quality in Buildings with Low or No Use

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