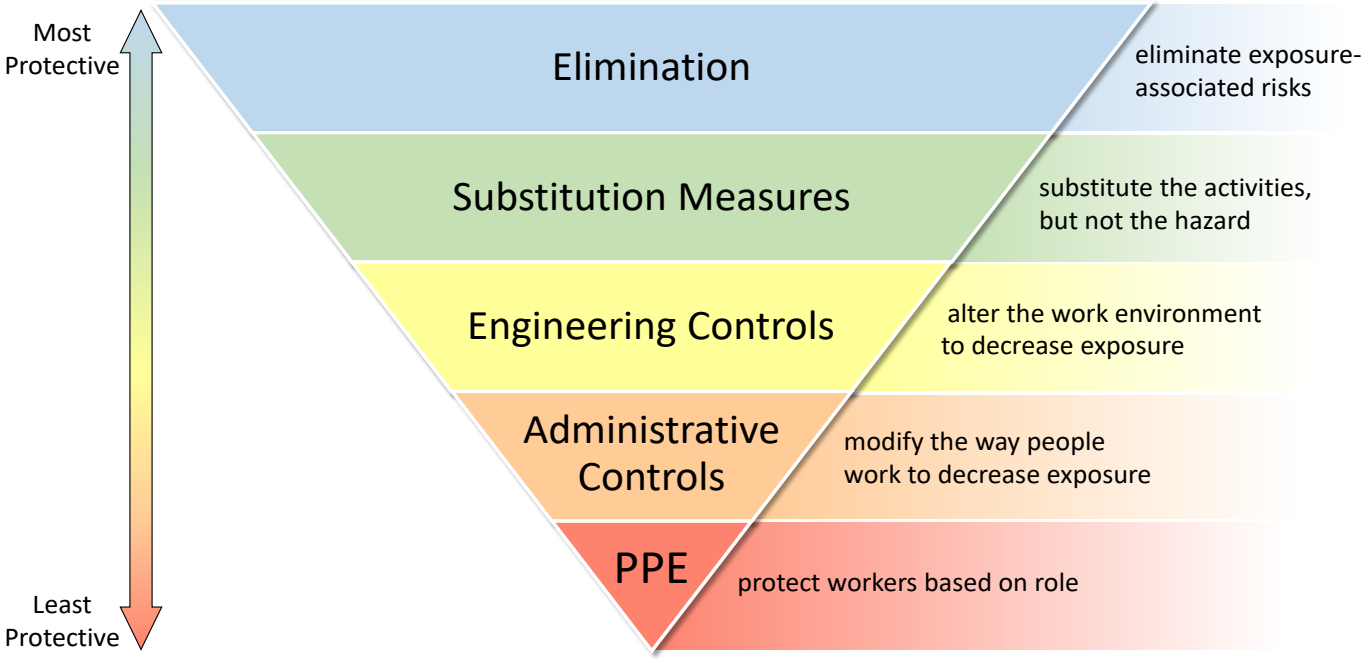
Sustaining Workplace Operations

Building Readiness Annex

This document customizes the COVID-19 hierarchy of controls for ensuring Building Readiness as there is a return to normal workplace operations. See Figure 1 for a graphical summary of the hierarchy of controls. The Sustaining Workplace Operations document provides detailed information of the COVID-19 hierarchy of controls. The controls presented in this annex may need to be customized to suit the specific location where they are employed. If the facility contains more than one type of work environment, see the appropriate annex(es).

Figure 1. **COVID-19 Hierarchy of Controls for Workplace Operations**



Adapted from NIOSH Hierarchy of Controls

Minimizing the risks to the mission and ensuring the health, safety, and protection of the Army workforce and partners are priorities as the Army returns to full operations. The reopening of workplaces should be conducted in a thorough, deliberate manner and should account for several factors before employees are allowed to return. Additionally, consideration for the comfort of returning employees is essential, as many employees may have increased concerns.

Building Readiness

Prior to the resumption of workplace operations, processes must be put into place to address hazards resulting from the prolonged shutdown and limited occupancy of buildings and to address employee concerns regarding the application of social distancing within the workplace. This document addresses building system readiness. For general readiness guidance, refer to the Workplace Operations document.

A draft building readiness checklist is provided in Appendix 1 at the end of this Annex.

COVID-19 CORONAVIRUS DISEASE 19

For current COVID-19 information:
https://phc.amedd.army.mil/covid19
https://www.coronavirus.gov/

The Military Health System Nurse Advice Line is available 24/7:
Call 1-800-874-2273 option #1
or visit https://www.health.mil/I-Am-A/Media/Media-Center/NAL-Day-at-a-glance

For more information, contact your installation's Department of Public Health

U.S. ARMY Public Health Prevent. Promote. Protect. Army Public Health

The Army COVID-19 Information Hotline:
1-800-984-8523
Overseas DSN 312-421-370
Stateside DSN 421-3700

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Applicability

This information is intended for buildings located on military installations that have been abandoned, vacated, or shut down for a prolonged period of time. However, the guidance is appropriate for any heating, ventilation, and air-conditioning (HVAC) or building water system, independent of location, which has been out-of-service for an extended time.

Elimination:

Elimination of disease transmission risk will require the development and broad distribution of an effective vaccine. For the COVID-19 pandemic, elimination of workplace exposure can be achieved by requiring all workers to telework, canceling all travel, and implementing other workplace restrictions.

Substitution:

Substitution traditionally replaces the hazard with a less-hazardous item, substance, or practice. For the COVID-19 pandemic, an example of substitution is only having essential personnel on-site to perform required missions, while keeping the remainder of the workforce in telework status.

Engineering Controls:

Engineering Controls and Healthy Building Strategies Engineering Controls involve reducing or removing hazards from the workplace. In workplaces where they are appropriate, these types of controls reduce exposure to hazards without relying on worker behavior and can be the most cost-effective solutions to implement.

Engineering Controls: Ventilation

HVAC Controls after Prolonged Shutdown or Reduced Operations

For HVAC control measures during pandemic operations and additional guidance, see APHC TIP No. 98-113-0420, *Measures to Modify Building HVAC for Health and Comfort during the COVID-19 Pandemic*.

Building Preparation:

Pre-occupation HVAC Maintenance

Inspect HVAC equipment, systems, and controls in coordination with the building operation and maintenance plan (see Building Operation and Maintenance Plan section below) and design documentation to ensure they are in good working order (no issues such as leaks, fungal growth, damage, accumulation of debris or other obstructions to component operation). Ensure any necessary repairs are completed prior to occupancy. The American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE) recommends that all building owners and service professionals follow the requirements of the ASHRAE Standard 180-2018, *Standard Practice for the Inspection and Maintenance of Commercial HVAC Systems*. The Army Technical Manual (TM) 5-610, *Preventive Maintenance Facilities Engineering, Buildings and Structures,* also contains a checklist for maintenance activities. Review contract agreements to ensure continuity with requirements.

Ensure facilities maintenance personnel are properly protected to perform necessary functions (see Occupational Safety and Health Administration (OSHA) Standards and ASHRAE guidance (https://www.ashrae.org/technical-resources/healthcare#maintenance)). The ASHRAE recommends following the joint guidance from U.S. Environmental Protection Agency (EPA) and the Centers for Disease Control and Prevention (CDC) on proper cleaning procedures for high-touch areas of HVAC and other building services, such as switches and thermostats, as well as the interior of refrigerators and refrigerating devices.

Review modes of operation of building systems to include occupied, unoccupied (temporary and long-term), and restart conditions. These modes, settings, and set points should be documented, so that they may be restored at another time if necessary. If so equipped, building dedicated outdoor air systems (DOAS), economizer, or demand control ventilation systems that are modified during the pandemic should be re-evaluated based on current conditions. Specific occupancies, such as health care, may have different operational requirements.

HVAC Building Flush

Flushing involves running a building's HVAC system with the highest possible outdoor air damper setting and airflow volume while maintaining desired temperature and humidity levels within the building. This includes operating the exhaust fans, as well as opening the outside air dampers to the maximum extent possible, and may require reprogramming of the control system. The extent to which outdoor air dampers can be opened will vary depending upon temperature and humidity conditions and the system's design. If the building is not provided with a mechanical ventilation system, coordinate with facilities maintenance personnel on the feasibility of opening windows for 2 hours prior to re-occupation when the outdoor air temperature and humidity are acceptable. Upon completion of the flush, the damper positions should be corrected to desired settings, providing at least the minimum outdoor air according to ASHRAE 62.1.

After a prolonged shut down of the building HVAC system, the National Institute of Occupational Safety and Health (NIOSH) guidance recommends flushing buildings after inspecting for the presence of mold or mildew (see Mold section). If no mold or mildew is found, or after remediation for mold or mildew occurs, open the outdoor air dampers to the maximum setting that will accommodate design indoor air temperatures. Continue until there are no odors.

Prior to building occupation, the ASHRAE guidance recommends flushing buildings for 4 hours. It is recommended that temperature control and ventilation parameters either be trended through the building automation system (BAS), or measured to verify proper temperature and ventilation control after flushing.

Operate the HVAC systems in occupied mode for at least 24 hours after ***any HVAC flushing*** and before occupation to ensure the systems can maintain the designed and desired environment.

When occupancy takes place, ASHRAE recommends flushing of the building for at least 2 hours before and after occupancy. Confirm the occupancy schedules and review the programmed HVAC operation schedule in the BAS including HVAC components (i.e., unitary controls). Modify as needed to fit the current occupancy schedules and ventilation requirements. When pandemic conditions subside, return the building HVAC programming and damper settings to normal design operation. Rebalancing of the HVAC system, if necessary, should be done by a qualified testing and balancing firm.

Resuming Routine HVAC Maintenance

After a building is reopened and occupied, regular (e.g., weekly) checks of the HVAC system are recommended to ensure operating efficiency. The frequency of HVAC system checks can be gradually returned to routine frequency (e.g., monthly, quarterly), depending on the operational and maintenance specifications for the HVAC system and current conditions. Specific occupancies, such as health care, may have different operational requirements. At a minimum:

- Inspect and replace filters as necessary.
- Provide outdoor air sufficient to meet design and ASHRAE 62.1 guidance.
- Ensure cooling and heating systems maintain indoor temperature and relative humidity within desired ranges or as recommended in ASHRAE Standard 55-2017, *Thermal Environment Conditions for Human Occupancy*.
- Ensure exhaust fans are operational to remove odors and contaminants.

Filtration efficiencies, if increased during the pandemic or pre-occupation period, should be re-evaluated periodically based on current conditions with the capability of restoring high-efficiency filtration, as needed. Changes to the HVAC system to accommodate additional pressure drop should be revisited if filter efficiency is reduced. ASHRAE recommends continuing increased filtration efficiency for one to two replacement cycles after the building is occupied.

Building HVAC system operational settings, if changed during the pandemic or pre-occupation period, should be periodically reviewed based on current conditions.

Building Operation and Maintenance Plan

Guidelines for a preventive maintenance program, as well as assessment and maintenance tasks, can be found in Army TM 5-610, Preventive Maintenance Facilities Engineering, Buildings and Structures, ASHRAE Standard 180, and EPA/NIOSH Building Air Quality guidance. If no routine HVAC operation and maintenance program is in place for the building, one should be developed and implemented. At a minimum, CDC recommendations include the following:

- Respond promptly to any occupant building concerns.
- Clean or replace HVAC filters regularly.
- Check function of outdoor air intakes and provide outdoor air per ASHRAE 62.1.
- Inspect exhaust fans to ensure they are in working order.
- Consider earlier start times for HVAC systems.

Indoor Environmental Quality (IEQ) Considerations:

Building operators may find that there are IEQ issues due to workplaces being unoccupied or maintained less frequently due to stay-at-home orders.

- Common IEQ issues include:
  - » Temperature and humidity at uncomfortable settings
  - » Odors
  - » Water intrusion and damage
  - » Waste and pest issues

Usually the best way to address IEQ concerns is to adjust the ventilation for the building. Some IEQ issues require changes to the building structure or infrastructure, such as water intrusion or leaks. These changes are not directly part of the engineering controls, rather they indirectly impact building conditions as included in this guidance.

Temperature and Humidity

Ensure that temperature and humidity are set at ranges that are comfortable for most people. Ways in which to accomplish this include:

Maintain temperatures at design or per ASHRAE Standard 55. Assuming slow air movement (less than 40 feet per minute) and 50% indoor relative humidity, the operative temperature (assumed as average air temperature only for buildings without radiant temperature panels, with low heat transfer windows/wall, and low solar heat gain through windows) recommended by ASHRAE ranges from 68.5°F to 75°F in the winter, and from 75°F to 80.5°F in the summer. The difference in temperature ranges between the seasons is largely due to clothing selection and also varies with relative humidity.

The ASHRAE recommends a dew point kept below 62.2°F (16.8°C), and the EPA recommends maintaining indoor relative humidity between 30% and 60% to reduce mold growth (EPA 2012). ASHRAE guidance1 states that maintaining the space relative humidity between 40% and 60% decreases the bio-burden of infectious particles in the space and decreases the infectivity of many viruses in the air. Maintain relative humidity at 40—60%, where possible.

Odors

If the building operator notices any odors prior to reoccupying, they should investigate and address potential sources of odors. If the source of the odors cannot be found, contact facility management for assistance.

- Common sources of odors can be due to:
  - » P-traps and floor drains in plumbing system drying out
  - » Carpets and furnishings off-gassing
  - » Garbage/trash
  - » Rodents and pests
  - » Water intrusion
  - » Refrigerator malfunction and drip pans
  - » Unattended plants
  - » Spoiled foods
  - » Water damage

Keep P- and U-traps on plumbing drains wet (see plumbing system section below for additional information on plumbing related issues). Ensure the building's ventilation system is functioning as designed and has been inspected per the above section. Ensure that exhaust fans are functioning. See NIOSH Indoor Environment Quality guidance and the Mold section below for additional information.

Water Intrusion and Damage

During workplace assessments, building operators should ensure that standing water or water damage is not present. If standing water or water damage is discovered, contact facilities management. Water damage can lead to mold growth that can contribute to adverse health effects if employees are exposed (see Mold section below).

- Areas where water intrusion may occur:
  - Roof
  - Behind sinks
  - Refrigerators
  - Ice machines
  - Vending machines
  - Centralized plumbing rooms
  - Toilets
  - Water fountains
  - Windows and doors
  - Crawlspaces
- Signs of water damage include:
  - Stained ceiling tiles
  - Bubbling paint
  - Carpet damage
  - Buckled floors

Waste and Pest Issues

Outdoor and indoor waste areas should be inspected to ensure that waste was removed prior to building shut down.

If waste remained in or around the workplace during shutdown, then rodents, pests, and opportunistic microbes may be present. Facilities management should be notified to coordinate waste cleanup. Ensure workers wear the appropriate personal protective equipment (PPE).

If odors produced from waste are present, then it is recommended to either adjust ventilation accordingly or open windows and doors.

Building operators should be aware that waste pickup schedules may be altered, delayed, or rescheduled during the pandemic response.

Building operators are discouraged from attempting to "cover up" odors using products that produce a fragrance, as employees may have an adverse reaction upon exposure.

Mold

Molds are forms of fungi that are found naturally both indoors and outdoors. Excessive moisture can make mold growth a problem in some buildings. Molds produce spores, which are released into the air and can cause allergy symptoms in some people. Molds thrive in moist environments and when there is moisture that is not dried promptly (e.g., a burst pipe, leaking windows and roofs), molds can reproduce quickly. Molds tend to grow well on cloth, wood, and wallboard, but can grow on virtually any surface. Building operators should take steps to minimize the risk for mold after a prolonged shutdown by following the steps below:

- After a prolonged shutdown and before occupants return, buildings should be assessed for mold and excess moisture.
  - » Visual building assessments for water intrusion and mold growth can be conducted by trained building assessors (this will vary by state; contact Garrison for specific information), without the need for sampling and laboratory analysis. NIOSH offers instructions to identify and assess dampness and mold in schools and general buildings in their Dampness and Mold Assessment Tool.
  - » If dampness or mold is detected, address the source of dampness or water entry first. Conduct clean-up or remediation before the building is occupied. Resources for clean-up or remediation of buildings and homes with mold are provided by APHC (https://phc.amedd.army.mil/topics/workplacehealth/ih/Pages/Indoor-Air-Quality-Mold.aspx), NIOSH, Environmental Protection Agency (EPA, https://www.epa.gov/mold), and CDC (https://www.cdc.gov/niosh/topics/indoorenv/moldtesting.html).
- After an assessment has confirmed that mold and moisture are not detected, proceed to the building pre-occupation guidance above. If mold and/or moisture remediation is required and has been completed, 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.
  - » During this period, open outdoor air dampers to the maximum setting that still allows desired indoor air temperatures.
  - » If an odor is detected that suggests mold growth (e.g., 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 in this guidance.
  - » Continue the "flush out" process until no odors are apparent.
  - » HVAC filters used during the "flush out" period should be replaced with new or clean filters prior to occupancy.

Engineering Controls - Returning Building Water Systems to Service:

The temporary shutdown or reduced operation of a building and reductions in normal water use can create hazards for returning occupants. One of the potential microbial hazards that should be considered prior to reopening after a period of building inactivity is Legionella (the cause of Legionnaires' disease). 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.

When a water system is not in use, the water quality degrades. Water becomes stagnant, disinfectant concentrations plummet, harmful disinfection byproduct concentrations increase, and pathogen and biofilm populations proliferate. Prior to reoccupying a building, it is necessary to take steps to ensure that the water is safe for the building's occupants.

The following is guidance on returning water systems to service in buildings that have been abandoned, vacated, or shut down for a prolonged period of time. Most of this guidance uses engineering control measures to control water system hazards, but components of these controls are also administrative practices used to ensure the building water system is properly maintained.

Potential Issues with Building Water Systems

Successful restoration of a building's water system will ensure the safety of the water within the building. Stagnant water remaining in the pipes of unoccupied buildings will likely be non-potable and unpalatable (cloudy and discolored). The water may contain waterborne pathogens, such as non-fecal coliforms, nontuberculous mycobacteria, and other gram-negative bacteria that can cause infection and illness to humans. As noted above, a bacterium of significant concern is *Legionella*, which can cause Legionnaires' disease. Legionnaires' disease can result in severe pneumonia requiring hospitalization with a case-fatality rate of 10% for community-acquired cases.

Legionella is commonly present in natural bodies of water. Certain environmental conditions within a building's water system, such as water temperatures within a specific range (25—42°C [77—108°F]), sediment in water tanks or pipes, and scale or biofilm present in pipes, allow for the amplification of *Legionella* populations. *Legionella* is transmitted to humans via aerosolized water or when contaminated water is aspirated (water is breathed into the lungs). In general, any water fixture or piece of medical equipment that aerosolizes water or produces a spray has

the potential to transmit *Legionella* to humans. Outbreaks of Legionnaires' disease have been attributed to cooling towers, potable hot water systems (showers and faucets), decorative fountains, whirlpool hot tubs, humidifiers, and ice machines.

Water System Maintenance Planning

Returning a building water system to service requires a team effort by different entities on the installation. It is important to designate personnel to manage and coordinate the effort, which includes flushing water mains, disinfecting and flushing the building water system, and testing water quality. Regardless of who manages the effort, the installation's public health personnel need to coordinate with Directorate of Public Works (DPW) personnel. If there is an operational medical treatment facility on the installation, then public health assets also need to coordinate with infection control personnel.

Flushing External Water Mains

Flushing external water mains is necessary prior to initiating disinfection procedures within the building, as this practice ensures water of optimal quality will be used when the building water system is restarted. Flush fire hydrants within an appropriate radius (sequentially from those closest to the water supply source to those hydrants located further down the line) to ensure fresh water is present in the water mains servicing the building. The installation's DPW is typically responsible for conducting routine flushing operations and should conduct emergency or special flushing operations as well.

Assessment of Water System Components

Prior to placing the building's water system back in use, it is necessary to inspect certain components of the system to ensure they are working properly. Many components of the system will also require cleaning and disinfection. For disinfection procedures, use of an EPA-registered disinfectant is preferred. Otherwise, use a bleach solution with 1/3 cup of bleach per gallon of water. Components of the water system that require inspecting, cleaning, and/or disinfection are listed below:

Backflow Prevention Devices

DPW or facilities maintenance personnel should inspect backflow prevention devices and regular flow valves to ensure they are working properly and are not leaking.

Water Treatment Systems

If water treatment occurs within the building, ensure that treatment systems are cleaned and/or maintained properly. Examples of maintenance procedures may include replacing pretreatment filters and water softener chemicals, backwashing carbon tanks, or cleaning and disinfecting reverse osmosis membranes.

Water Storage Tanks

Thoroughly drain, clean, and disinfect all water storage tanks. Once hot water tanks are cleaned and disinfected, maintain domestic hot water at a minimum of 60°C (140°F) to ensure delivery of hot water at a minimum of 50°C (122°F) to all outlets. If there is a hot water recirculation loop, ensure that pipes are insulated. Water returned to the water tank via recirculation should also be 50°C. Cold water should be stored below 20°C (68°F).

Fixtures

Clean and disinfect all faucets and shower heads. If aerators are present in the fixtures, remove and disinfect all faucets and shower heads.

Ice Machines and Drinking Fountains

Clean, disinfect, and replace filters in ice machines and drinking fountains.

Point-of-Use Filters

Replace point-of-use filters.

Decorative Fountains

Drain and clean decorative fountains.

Cooling Towers, Evaporative Condensers, and Indirect Evaporative Coolers

Cooling towers and related devices have been implicated in many outbreaks of Legionnaires' disease, and studies have shown that detectable levels of *Legionella* are present in most devices. Follow the recommendations in the APHC Technical Information Paper No. 55-066-0617, *Legionella Control in Cooling Towers, Evaporative Condensers, and Indirect Evaporative Coolers*.

Special Considerations for Medical Facilities

If the building is a medical facility, or is going to be temporarily used as a medical facility, consider additional precautions to protect patient populations.

- Fixtures. Consider permanently removing aerators in high-risk patient areas. Otherwise, clean and disinfect the aerators monthly. If needed, install preset thermostatic mixing valves to avoid scalding at point-of-use. Ensure the warm water section of pipe between the control valve and showerhead is self-draining.
- Decorative Fountains, Hot Tubs, and Therapy Pools. Do not place decorative fountains back in use, as health risks to patients may outweigh the aesthetic benefits associated with these fixtures. Only place hot tubs and/or therapy pools back in use if they are essential to patient care.

Interior Pipe Disinfection Process

The DPW or facilities maintenance personnel must flush stagnant water from the building and then disinfect the potable water system. The two commonly used emergency decontamination methods are thermal disinfection (superheating) and shock chlorination. Based on recent guidance documents, shock chlorination is the preferred approach. However, characteristics of the building and the capability of personnel also need to be considered. Regardless of the disinfection method used, it is important to flush every outlet (even rarely used fixtures such as emergency showers and eye washes) in a sequential manner until water of adequate temperature or chlorine concentration is flowing. The time required to flush a building's water system will vary from building to building. Following disinfection, -whether via superheating or shock chlorination, implement a flushing program whereby all fixtures not regularly used are flushed for 5 minutes twice a week. Note that flushing needs to occur if there is a lag between disinfection and building occupancy.

Thermal Disinfection

This disinfection method entails increasing the building hot water temperature to 65oC (149oF), distributing it to all fixtures, and then flushing the system for an appropriate period of time (between 10 and 30 minutes). While this method does not require special equipment or supplies, it is labor-intensive and time consuming. It is important to note that this method is only effective when the most distant outlets receive water that is hot enough throughout the entire flushing process, which necessitates sufficient hot water heating capacity. In addition, thermal disinfection will not disinfect downstream of thermostatic mixer valves. Procedures for conducting thermal disinfection effectively and safely are summarized below:

- Maintain water heater temperatures between 71 and 77ºC (160—170ºF) while progressively flushing each outlet in the system for up to 30 minutes at 65ºC (149ºF), ensuring that the most distant outlets are flushed last.
- If flushing multiple outlets simultaneously, ensure that the temperature and flow capacity of the water heater is not exceeded.
- Following thermal disinfection, maintain hot water system temperatures >60ºC (140ºF) in all hot water lines and maintain an adequate concentration of disinfectant residual (0.2—0.5 milligrams per liter (mg/L)).
- After the water temperature has returned to normal, collect water samples from multiple locations, including the most distant outlets, and test water quality. Repeat the sampling procedure approximately 2 weeks later to determine if short-term control has been achieved.

Shock Chlorination

Shock chlorination entails injecting elevated concentrations of chlorine into the building's water system to achieve 2-3 mg/L of free chlorine throughout the system with a contact time between 2 and 24 hours. This method may be the only option for buildings where the most distant outlets cannot reach the temperature required for thermal disinfection. Shock chlorination can lead to increased corrosion of metal pipes or fixtures if applied incorrectly or too frequently. The efficacy of chlorine can be decreased by pH >7, with significant loss of effectiveness at pH >8. Also, use caution when exercising this method to avoid exposure to high disinfectant levels. Procedures for conducting shock chlorination effectively and safely are summarized below:

- If possible, shut off and bypass water treatment equipment (e.g., water softeners, carbon filters).
- Correct areas that may allow Legionella growth (e.g., sediment in tanks, stagnant water, or rubber fixtures and fittings).
- Add enough chlorine to achieve a free chlorine residual between 2-3 mg/L throughout the system, which may require chlorination of the water heater or tank to levels between 20 and 50 mg/L. Maintain the water pH between 7.0 and 8.0.
- Flush each outlet until the odor of chlorine is detected.
- Allow the chlorine to remain in the system for a minimum of 2 hours (but not to exceed 24 hours).
- Flush the system until the residual chlorine is returned to its normal level (typically between 0.2 and 0.5 mg/L).
- After the residual chlorine concentration has returned to normal, collect water samples from multiple locations, including the most distant outlets, and test water quality. Repeat the sampling procedure approximately 2 weeks later to determine if short-term control has been achieved.
- Inspect and monitor the plumbing system for pipe damage.

Testing Water Quality

Following system disinfection and flushing, collect samples to check the water quality. Test for temperature, pH, free chlorine, and other desired parameters. Also, test for the presence of total coliforms and *E. coli* to determine if the water is sanitary for consumption. Public health personnel should also implement heterotrophic plate count (HPC) testing on each floor of the building when the building is reoccupied. Although HPC tests are not an indicator of health risk, they are used to measure the variety of bacteria common in the water and can show where microbial regrowth is occurring within a distribution system. Public health and infection control personnel should also consider testing for *Legionella* if the building will be used to house an immunocompromised population.

Timeframe

A minimum of 4 days will be required to return the building water system to service prior to reoccupation. It will likely take longer to flush the pipes, as well as to clean and disinfect all the fixtures in larger buildings with more complex water systems. A sample timeline is shown below and additional considerations which may prolong the timeframe follow:

- Day 1: Flush water mains via hydrant flushing.
- Day 2: Clean and disinfect all fixtures and other equipment as appropriate. Disinfect the water supply via shock chlorination or thermal disinfection.
- Day 3: If applicable, verify that chlorine residuals have decreased to normal levels (0.5 ppm) and collect water samples for coliform testing (minimum 22-hour incubation time).
- Day 4: Obtain, read, and report coliform test results.

Two factors that could extend the timeframe follow: (1) depending on how long the system has been dormant, the state may have additional sampling requirements, and (2) if conducting testing specific to Legionella, the turnaround time to obtain results is more than a week.

Routine Environmental Monitoring of Water Systems

Once the system is placed back into operation, DPW and/or PH personnel will need to perform ongoing maintenance activities. Initially these activities may need to be conducted more frequently than for a well-established water system. Consider more frequent periodic testing of disinfectant residual and HPCs at multiple locations throughout the building. Disinfectant residual concentrations should be between 0.2 and 0.5 mg/L, and HPC should be less than 500 colony forming units per milliliter [CFU/mL].

Administrative Controls:

Administrative controls are a combination of procedures, polices, and training that reduce the exposure of the workforce to COVID-19 or other hazards. For Building Readiness, most of the changes are incorporated into the Engineering Controls outlined in this document.

Personal Protective Equipment:

PPE recommendations are based on the APHC Fact Sheet No: 98-006-0420, Guidance for HVAC Filter Removal and Disposal, and the most current ASHRAE guidance.

The following PPE should be worn for all HVAC filter maintenance on a system where there is a potential for viral contamination:

- Properly fitted respirator (N-95 or higher)
- Disposable gloves
- Eye protection (safety glasses, goggles or face shield)
- Disposable coveralls are preferred but not required

References and Resources

ASHRAE Standard 180-2018, Standard Practice for the Inspection and Maintenance of Commercial HVAC Systems.

ASHRAE. 2020. Epidemic Task Force Building Readiness Guidance.

Army TM 5-610, Preventive Maintenance Facilities Engineering, Buildings and Structures.

EPA and CDC, Guidance for Cleaning and Disinfecting Public Spaces, Workplaces, Businesses, Schools and Homes, https://www.epa.gov/coronavirus/guidance-cleaning-and-disinfecting-public-spaces-workplaces-businesses-schools-and-homes.

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CDC/NIOSH Storm, Flood and Hurricane Response, Recommendations for the Cleaning and Remediation of Flood-Contaminated HVAC Systems: A Guide for Building Owners and Managers, https://www.cdc.gov/niosh/topics/emres/cleaning-flood-hvac.html.

APHC Mold & Indoor Air Quality guidance, https://phc.amedd.army.mil/topics/workplacehealth/ih/Pages/Indoor-Air-Quality-Mold.aspx.

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APHC. 2017. Technical Information Paper No. 55-066-0617, *Legionella* Control in Cooling Towers, Evaporative Condensers, and Indirect Evaporative Coolers. Retrieved 26 May 2020, https://phc.amedd.army.mil/PHC%20Resource%20Library/TIP_No_55-066-0617_LegionellaControlinCoolingTowers.pdf.

NIOSH. Recommendations for the Cleaning and Remediation of Flood-Contaminated HVAC Systems: A Guide for Building Owners and Managers, *Heating, Ventilation, and Air Conditioning [HVAC] Cleaning and Remediation guidance.*

Additional information on mold prevention is available from APHC (https://phc.amedd.army.mil/topics/workplacehealth/ih/Pages/Indoor-Air-Quality-Mold.aspx) and CDC/NIOSH.

Appendix 1: Draft Checklist for Building Readiness Assessments

COVID-19 Building Readiness Assessment Checklist

Date:

Building:

Building POC:

Assessor Name:

This is a draft checklist to be modified by the assessors to ensure that locally determined COVID-19 mitigation measures have been considered and implemented

Heating Ventilation and Air Conditioning (HVAC) Systems	
Assess building HVAC components	Yes/No/NA
PPE for performing HVAC assessment and maintenance	
Filter banks	
Outdoor air intakes	
Exhaust outlets	
Room supply diffusers	
Room return diffusers	
System control (set points, occupied mode, unoccupied mode)	

HVAC building flush (prior to re-occupation)	Yes/No/NA
Change to highest outdoor air setting	
Maintain desired temperature and humidity	
Exhaust fans operational	
If flush not possible with HVAC system, open windows and doors for 2 hours	

HVAC building flushes (while occupied)	Yes/No/NA
Flush 2 hours before building is opened	
Flush 2 hours after building is closed	

HVAC routine maintenance	Yes/No/NA
Inspect filters and replace as needed	
Monitor levels of outdoor air	
Ensure temperature and humidity levels are maintained	
Ensure exhaust fans are working properly	

Indoor Environment Quality (IEQ)	Yes/No/NA
Assess all areas of the building including unoccupied areas, storage areas, stairwells, etc.	
Temperature and humidity are following Army seasonal set points	

Odors	Yes/No/NA
Assess all areas (including unoccupied rooms) for odors. Investigate sources & find solutions.	

Water intrusion and damage	Yes/No/NA
Assess all areas (including unoccupied rooms) for water related issues	

Waste and pest issues	Yes/No/NA
Indoor and outdoor waste areas should be emptied and cleaned if necessary	
Look for evidence of pest activity (droppings, etc)	
Clean and air out areas, do not cover up any odors from waste & pests	

Mold	Yes/No/NA
Visual inspection for any signs of mold growth	
Address water intrusion issues first, then mold growth	
Assess for 'musty' odors and air out until odors are not detected	

Building water system	Yes/No/NA
Flush external water mains	
Inspect backflow prevention devices, flow valves and water treatment system components	
Clean and disinfect water storage devices and water fixtures (faucets, showerheads, drinking water fountains and ice machines)	
Replace point-of-use filters	
Thoroughly flush the building water system	
Disinfect the building water system (especially barracks and quarters, gymnasiums and other buildings with showering facilities)	
Test building water quality prior to reoccupation	