CONSIDERATIONS FOR OPENING YOUR FACILITY POST-COVID-19 SHUTDOWN

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As buildings and facilities begin to reopen, there are a number of considerations for making sure you are protecting the health and safety of your employees and visitors. Below you will find questions to think about, information on COVID-19 and your facility systems, and potential steps you can take. This article is for informational purposes only and should not be used in place of engineering consultation.

COVID-19 AND RELATED INFORMATION

What is COVID-19 and how does it spread?

COVID-19 is the disease caused by the coronavirus SARS-CoV-2. Coronaviruses are a family of viruses that affect the respiratory tract and can cause a range of illnesses—from a mild cold to a serious case of pneumonia. Similarly, COVID-19 symptoms can range from mild (or no symptoms) to severe.

You can become infected with COVID-19 by coming into contact with a person who has the disease. COVID-19 is primarily spread from person to person through respiratory droplets that are released when talking, coughing, sneezing and breathing heavily. It is believed that the virus can live in the air for up to three hours, and a person can become infected if they breathe in virus particles. COVID-19 may also be transmitted by touching a surface or object that has the virus on it and then touching your mouth, nose or eyes. SARS-CoV-2 is approximately 125 nm, or .125 microns, in size and can survive on surfaces for up to a few days.

The best way to protect yourself against COVID-19 is to avoid being exposed, which means staying home as much as possible and avoiding close and lengthy interaction with others; wearing a face covering that covers your nose and mouth in public settings; cleaning and disinfecting frequently touched surfaces; and washing your hands often with soap and water for at least 20 seconds or using an alcohol-based hand sanitizer that contains at least 60% alcohol.

Influenza (flu) viruses are slightly smaller than SARS-CoV-2, at approximately 80-120 nm in size. They can also be aerosolized when an infected person coughs, sneezes, talks or possibly even just breathes. A person can become infected if they breathe in virus particles or touch an infected surface and then touch their nose, mouth or eyes. Influenza can survive on surfaces for up to 48 hours.

Have you adjusted cleaning protocols to meet the demands of the situation?

A one-time cleaning of building surfaces is not enough. Increase cleaning frequency, replenish cleaning supplies ahead of time and ensure that bathrooms stay stocked with hand soap, hand sanitizer, paper towels and tissues. Post educational hand-washing signage with the recommended guidance.

BUILDING DESIGN AND OPERATION

One area that has gone underrecognized in controlling the spread of COVID-19 is building design and operation. While much is still unknown about the disease, there are steps building operation managers can take to reduce the risk of infection.

- Increase Ventilation: While recirculating air has become commonplace in our buildings, ventilating with outdoor air is vital to diluting airborne contaminants and decreasing disease transmission.

- Maintain Optimal Humidity: Viruses can survive better in low-humidity environments. Building managers can increase humidity via heating and ventilation systems to maintain an optimal range of 40% to 60%, or by purchasing and installing portable humidifiers. It is important to not increase humidity above 60%, as this can cause mold growth. Molds are fungi that can appear on porous surfaces if there is moisture present. In large amounts, they can cause respiratory problems and allergic reactions, and symptoms can be worse in people with underlying health conditions. If mold is observed, it should be properly cleaned, and the source of the moisture should be mitigated. For more information, see this resource.
- Ensure Proper Filtration of Indoor Air: Improved filtration of recirculated air can provide similar results as increased ventilation rates and may be effective at reducing transmission of airborne infectious diseases.

Do you know your building's HVAC system and its components?

Your building's HVAC system includes all the components to provide heating, ventilation and air conditioning. It can either be a built-up system containing a heating plant, cooling plant and ventilation system; unitary equipment containing all these functions; or a combination of built-up and unitary equipment.

The ventilation system delivers the heated or cooled air to the building's interior spaces and should also introduce outdoor air based on building occupancy. Your building's ventilation system was designed to provide a certain amount of outdoor air for a maximum number of people. The higher the occupancy, the higher the ventilation rate and the more outdoor air required. The ventilation system can vary depending on when it was built. If the building has been repurposed, the ventilation system should be adjusted to address any change in occupancy levels.

Buildings or rooms with high occupancy are more prone to spreading viruses. They require higher ventilation rates, more fresh air or a higher degree of filtration than buildings or rooms with low occupancy**.** Some buildings, like retail and entertainment establishments, have occupancy rates that can vary greatly, while others, like offices, may see more stable occupancy.

HVAC System Basics

- Air Handler: The device that conditions and modulates the airflow for the ventilation system that is then provided to the space. Typically, it includes an air filter, a coil (heating or cooling or both) and a fan (or blower). Air handlers range in size from small fan coil units (FCUs) and blower coils to packaged rooftop equipment, 100% outside air units and large units serving entire buildings.
- Air-Side System: All HVAC equipment that pertains to distributing air into/out of the building, for example, the air handlers, fans, outside air, supply air, return air, exhaust air, diffusers, registers, grilles, etc.
- Outside Air: Air that has been introduced to the building from outside.
- Supply Air: Air that is being supplied to the building, room or space.
- Return Air: Air that is pulled from the building, room or space that is returned to the air handling unit to be mixed.

- Exhaust Air: Air that is removed from the building, room or space that is rejected to outside the building.
- Building Automation System (BAS): Building controls that can range from a simple thermostat that controls an air handler to a complex computer-based system capable of evaluating the entire HVAC system for a building or campus.

What is the condition of your HVAC air distribution system?

Think about the condition of the diffusers/grilles/registers. Do they need to be cleaned? How about the condition of the ductwork? Has it been cleaned recently? Do you have duct liner? What is the condition of the liner? Is it growing mold?

HVAC Air Distribution System Basics

- Air Device: Diffuser, grille or register that is supplying, returning or exhausting air in the building, room or space.
- Ductwork: The passage for supplying/removing air to/from a room/space/building. Typically, it comes in the form of rectangular sheet metal, but it can also be round or oval and made of different materials depending on the function of the space.
- Automatic Damper: A control device used to modify airflow based on an input (e.g., time of day, carbon dioxide levels). It can be used to modulate outside airflow and return airflow to increase or decrease ventilation.
- Manual Damper: A device used to limit airflow to a desired level. Typically, it is set by a test and balance (TAB) agent and left at that position.
- Terminal Unit: A control device that modulates airflow based on an input. While terminal units can be used for return air or exhaust air, they are typically used for controlling supply air based on space temperature by modulating the airflow and, in some cases, heating the air with a heating coil.

What type of air filtration does your HVAC system have? Do you know your air filter's MERV rating?

HVAC Filtration Basics

- Minimum Efficiency Reporting Value (MERV) Rating: The MERV rating of a filter is defined by the percentage of particles between 0.3 and 10 microns that can be filtered out of an airstream. The higher the MERV rating, the better the filter is at filtering out particles.
- High Efficiency Particulate Air (HEPA) Filters: Filters that can filter out 99.97% of particles that are 0.3 microns. Particles that are larger and smaller can be filtered out at a higher rate.
- Electronic Air Filters: Filters that electrically charge particles in the airstream, typically using ions, to remove them from the air. They can be in the air handler, in the airstream or portable.

HVAC Air Disinfection Basics

- Ultraviolet Lights: These lights utilize UV-C wavelengths to "kill" viruses, bacteria and fungi in the air. They can be installed in the air handler, in ductwork, in the space or as a portable system.

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Do you understand building indoor air quality and associated factors?

Do you know how to assess your building's indoor air quality? Is your building's indoor air quality sufficient to adequately protect the public? Do you know how to improve your indoor air quality? Do you know what it will cost to improve your indoor air quality?

Building Indoor Air Quality Basics

- Indoor Air Quality: How clean/dirty the air inside your building is. Clean air is important for the health of building occupants and can improve focus at work or school. If the air quality in a building is poor, it could lead to sick building syndrome.
- Sick Building Syndrome: A phenomenon in which occupants of a building suffer from symptoms of an illness or contract a chronic illness from the building.

POSSIBLE STEPS TO TAKE

There are many ways to limit the spread of COVID-19 (as well as influenza during flu season), and it is important to identify what is appropriate for your facility when reopening. Below are a few options and recommendations.

Check your HVAC System

Assess the system, its attributes and condition. Start by having a qualified HVAC professional check the condition of your HVAC system. Focus on the air-side components and the following items of typical components:

- Air devices
- Ductwork
- Air handlers
- Terminal units
- Cooling coils
- Heating coils
- Filters
- Fans
- Dampers
- Sensors
- BAS

A properly functioning HVAC system is critical for maintaining indoor air quality. If any issues are found, they should be fixed immediately. Some issues might require a qualified HVAC professional, while others may be resolvable in-house.

Indoor Air Quality

Review the following items:

- Determine the MERV rating of the filters in your air handling units.
- Determine the amount of outside air that is being supplied to your air handlers.

- Verify that there is no mold growth in your building. If you have been shut down for weeks or months, mold may have grown.
- Determine your building's operating temperatures (and humidity, if the building has humidity control) for heating and cooling.
- If your building has unoccupied setbacks, determine when the building will enter an unoccupied setback and the operating conditions.

Indoor Air Quality Improvement Options

- Increase Outside Air Provided to the Building/Room/Space:
  - By increasing the outside air, you will decrease the percentage of recirculated air, which will help reduce exposure to any pathogens in the building.
  - Increasing the outside air to the building may come with a significant installation cost. If the air handler has a modulating outside air damper and airflow monitoring station, you can likely increase the outside air from the BAS at little to no cost. However, if you have a fixed outside air opening with a manual damper, a TAB agent might be required to properly increase the outside air. In some cases, it might not be possible to increase the outside air without replacing the air handling equipment, which would have a large cost.
  - Increasing the outside air will increase the operating cost of the building. How much the outside air is increased will determine the additional cost. See this example from the American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) on the impact of increasing outside air on a cooling system.
  - Increasing the outside air could increase the cooling load in the summer and the heating load in the winter. It is important to not increase the outside air beyond what the heating and cooling equipment can handle. In the summer, keep the humidity below 60% relative humidity; beyond that could promote mold growth.

- Replace the Filters in the HVAC System with Filters with Higher MERV Ratings:
  - By increasing the MERV rating, you will decrease the number of pathogens that get introduced into the room/space/building. MERV 13 or greater filters are recommended.
  - Air filters with higher MERV ratings cost more.
  - Increasing the MERV rating will increase the static pressure drop through your HVAC system, which will cause your fan to work harder to overcome the additional pressure drop.

- Replace the Filters in the HVAC System with HEPA Filters:
  - HEPA filters are more efficient than MERV filters at removing particulates/pathogens from the supply air.
  - Replacing the air filters with HEPA filters will require significant modifications to the HVAC system. The filters will increase the pressure drop through your HVAC system. The filter rack, and possibly fans, will need to be replaced. An engineer might be required to determine if your equipment is capable of being retrofitted, or if it has to be replaced.
  - HEPA filters will increase the operating cost of your HVAC system to a greater extent than filters with higher MERV ratings.

- Add UV-C Lights:
  - UV-C lights have been shown to effectively inactivate COVID-19. For additional information, see this resource.
  - UV-C lights can be installed in the air handler, in ductwork, or in a space or room (above 7 feet). Portable UV-C lights are also an option. The size of your system and what you are trying to achieve will determine the cost.
  - UV-C lights are an additional electric load and will increase operating costs.
  - UV-C lights should be installed in a way to prevent occupants from looking directly at the light or having their skin exposed to the light.

Other Mitigation Strategies

- Flush the building for two hours before occupancy and for two hours after occupancy. To flush the building, turn on the ventilation and exhaust systems utilizing the building's BAS.
- Clean and disinfect commonly touched surfaces often.
- Require that occupants practice social distancing (i.e., stay at least 6 feet apart).
- Encourage or require the use of facemasks when inside your facility, especially where social distancing is not possible.
- Encourage proper hand-washing and provide hand-washing stations and hand sanitizer with at least 60% alcohol.

The content in this article was developed using guidance from ASHRAE and the Centers for Disease Control and Prevention (CDC). To learn more, visit www.ashrae.org/technical-resources/resources and www.cdc.gov/coronavirus/2019-ncov/prevent-getting-sick/prevention.html.