Aerosol Control Strategies for Occupancy of State Buildings with Epidemic Conditions in Place

Summary

The purpose of this paper is to present additional methods and recommendations for Heating Ventilating and Air Conditioning (HVAC) systems based on the *American Society of Heating, Refrigeration and Air-Conditioning Engineers (ASHRAE) Position Document on Infectious Aerosols - Approved by ASHRAE Board of Directors April 14, 2020* and resources available at https://www.ashrae.org/technical-resources/resources to assist in infectious aerosol control in state owned buildings with epidemic conditions in place.

Pre-Occupancy Recommendations

1. Maintenance personnel should wear Personal Protection Equipment (PPE) when maintaining HVAC systems including air filters and plumbing systems.
2. Employ building professionals as needed to augment facility maintenance staff. Such as commissioning agents, testing and balancing agents, controls service professionals, contractors, architects, and engineers.
3. Inspect equipment, systems and controls to determine where existing problems may exist & remedy found/known issues.
    - 3.1. Boilers
    - 3.2. Chillers
    - 3.3. Air Handling Units (AHU)
    - 3.4. Control system calibration
4. Investigate capability of existing systems to implement enhanced HVAC mitigation strategies.
    - 4.1. Increased ventilation air
    - 4.2. Improved air filtration
5. Disinfect high touch areas of HVAC and other building service systems.
    - 5.1. Thermostats
    - 5.2. Light switches
    - 5.3. Interior of refrigerated devices
    - 5.4. Air devices (grilles, registers, and diffusers)

    Note: ASHRAE resources recommend consulting additional guidance prior to cleaning ductwork
6. Domestic water systems (plumbing) that have sat stagnate in vacated buildings without use for a prolonged period should follow the Building's Legionella Management Plan. In the absence of this plan:
    - 6.1. Flush domestic water piping through drinking fountains, lavatories, urinals, water closets and sinks.
    - 6.2. Where building contains a circulated hot water system, circulate hot water for a minimum of 2 hours.
    - 6.3. Verify sanitary system liquid-seal traps have proper liquid-seal.

Recommendations & Enhanced HVAC Mitigation Strategies

1. Maintain building temperature at normal building temperatures and maintain relative humidity between 40% and 60% Relative Humidity (RH) to decrease the infectivity of most viruses in the air.
    - 1.1. Confirm control sequences are established to maintain RH.
    - 1.2. Provide portable/space dehumidifiers or humidifiers (depending on season) in large occupancy spaces (10+) as necessary to maintain RH when existing systems are not capable.
2. During occupied hours, provide as much dilution air per person as possible.
    - 2.1. Increase outdoor air ventilation to the air-handling system's maximum capacity while still maintaining space conditions (specifically RH levels).
    - 2.2. Disable demand-controlled ventilation (DCV) (do not decrease ventilation air based on occupancy).
3. Ventilate the building during unoccupied hours.
    - 3.1. Operate air handling systems at normal ventilation rates and exhaust rates during off hours.
    - 3.2. Flush building 2 to 4 hours prior to occupancy at as much outdoor air as possible and still maintain space conditions.
4. Replace central air AHU filters with a Minimum Efficiency Reporting Value (MERV) of 13 or higher (14 preferred).

    4.1. Seal edges of filters and filter rack in AHU to limit air from bypassing around filters.
5. Where possible provide AHU with ultraviolet germicidal irradiation (UVGI) to render viruses inactive.
6. Where improved AHU filtrations and/or AHU UVGI is not possible, provide assembly spaces (conference rooms) with local air treatment systems
    6.1. Additional local High Efficiency Particulate Air (HEPA) filtration
    6.2. Upper-room UVGI.

Anticipated Challenges in Existing Buildings

1. Modifications to controls may require the services of a controls contractor or commissioning agent.
    1.1. Portable dehumidifiers require electrical power and disposal of condensate.
2. Maximizing outdoor air ventilation while maintaining space conditions is HVAC control strategy that may be beyond the capabilities of some HVAC control systems. Where this is the case, rebalance the outdoor air quantity to maximize the capacity of the cooling/heating coil.
3. Adjustment of ventilation operation hours present minimum challenges to most buildings. Older buildings or buildings with simple HVAC controls may have be operated manually.
4. Existing AHU filtration racks may not be capable of supporting MERV-13 filters or the fans/motors may not have sufficient capacity for the additional air pressure drop. Filters should be upgraded to the most efficient filter compatible with the rack. Filter replacement schedule shall be adjusted to change filters before they are fully loaded.
5. UVGI systems to be installed in air handling units typically require air velocities through the treatment area less than 500 feet per minute (fpm) and have specific installation requirements for effectiveness. They must also be positioned such that the light does not damage filter media. Existing air handling systems may not have sufficient room for retrofit. UVGI systems also require power that may not be readily available.
6. In room air filtration/treatment.
    6.1. Portable HEPA filter units may create a noise issue in sound sensitive spaces.
    6.2. UV radiation is hazardous to direct contact with the skin. Upper-room UVGI systems require the walls and ceiling to be covered with a low UV-reflective covering to prevent reflecting the UV radiation onto individuals. They also require higher ceilings such that the occupants are not exposed to the UV-radiation. Ceiling height may not be sufficient for upper-room UVGI installation. As the upper-room UVGI system treats only the air exposed to the UV radiation, additional air circulation is required to circulate the air into the treatment zone.

Conclusion

In support of reopening state buildings HVAC systems can be modified to assist in reducing the possible transmission of infectious aerosols such as COVID-19. It should be noted, however, that HVAC systems play a much less significant role in transmission of this virus than other modes. Modifications to the HVAC systems are not a substitute for social distancing, surface cleaning, disinfection, handwashing, and good hygiene.

For more detailed recommendations and procedures refer to https://www.ashrae.org/technical-resources/building-readiness#epidemic for general commercial buildings and to https://www.ashrae.org/technical-resources/reopening-of-schools-and-universities#filtration for universities Published May 7, 2020

"Even the most robust HVAC system cannot control all airflows and completely prevent dissemination of an infectious aerosol or disease transmission by droplets or aerosols" – *ASHRAE Position Document on Infectious Aerosols*

"The HVAC systems in most non-medical buildings play only a small role in infectious disease transmission including COVID-19" – *ASHRAE Guidance for Building Operations During the COVID-19 Pandemic*

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