

VENTILATION AND FILTRATION FOR INDOOR PUBLIC

GATHERING SPACES: A REVIEW

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A scientifically identified method for prevention of transmission of COVID-19 is properly designed, installed and maintained ventilation and/or filtration of air in indoor spaces. The more enclosed a space becomes; the more likely viral load will increase due to activities of people within that space. This is especially true if air exchange is below the minimum necessary to effectively clean the air with a frequency that will assist in removal of contaminants in the space.

Most highly recommended is encouraging people to gather outside as natural mixing and movement of air and physical spacing of people provides greater diffusion and dilution of viral particles than being in a room.

Control of viruses cannot be achieved singularly by ventilation and filtration, but rather they are tools that can complement other strategies such as social distancing, hand washing, hand sanitizing, wearing facemasks, limiting exposure through quarantine or isolation, vaccinations, medical monitoring and intervention.

The likely methods of transmission of COVID-19 include fomites, droplets and airborne (aerosol). Fomites relates to objects that may be contaminated with infectious material which is then transferred to another person through touch or ingestion. The primary strategy for addressing fomites is a regime of cleaning, sanitizing, and disinfecting using products from the US EPA N-List¹ as defined in previously issued guidance for restaurants and other commercial spaces.

Viral laden droplets are larger particles expelled by a person. Due to their size, droplets tend to fall to a surface within six feet of the ill person. The primary strategies for addressing droplets are distancing, masks, and cleaning/sanitizing/disinfecting. In a restaurant and other public gathering spaces, settling droplets are primarily addressed through disinfection and occupancy capacity restrictions. Fewer people spaced apart and regular disinfection of shared spaces increase safety.

Aerosol (airborne) are tiny particles of viral material that are small and light enough to linger in the air for minutes to hours and can be shared through normal breathing. Aerosol viral particles can travel in excess of 20 feet. It is unclear how much of the virus is needed to infect a person, but there are several well-known instances of large outbreaks implicated to this form of

transmission². The primary strategies for addressing aerosol transmission include ventilation/filtration, masks, capacity restrictions and distancing.

Indoor restaurant dining is an area of particular concern due to the inability to wear masks while dining, lack of distance between tables of diners from different households, haphazard air currents due to movement of people, disruption of airflow caused by improperly positioned barriers used to isolate diners and loud talking. Concern for staff exposure is a central issue in this setting.

The following recommendations are for Heating, Ventilation and Air Conditioning (HVAC) actions related to reducing the risk of airborne and droplet transmission;

- 1.) Have an existing HVAC system optimized for COVID-19 to address the need for optimal ventilation (fresh air) and filtration (air cleaning)³.
 - a. Have the system checked by technicians to adjust with updated goals and to service the system.
 - b. Determine highest MERV rating filter the system is capable of handling and install carefully to prevent air leakage or bypass. MERV 13/13A or greater is best³. If practical, purchase extra filters for scheduled replacements over colder months. Verify that the system can accept MERV 13/13A filters without creating pressure drops or other system disruptions.
 - c. Assess fresh air exchange rate settings and increase fresh air exchange rate as the system allows. Increased airflow dilutes the threat of viral load.
 - d. If controls allow, set for two hours of high air exchange before and after occupancy. Set the system for low exchange and reduced heat when unoccupied to save energy. Example, if the restaurant is occupied from 5 pm to midnight set the controls for a high exchange, 3-5 pm and midnight to 2 am. Opening windows, when appropriate, can play a low energy role in warm months by introducing fresh air.
 - e. Run restroom ventilation systems two hours before building occupancy. Consider setting them to run during building occupancy hours.
 - f. Office or other work areas that may not be part of the HVAC system could benefit from fresh air (as simple as opening a window) for increased ventilation. In addition to increased ventilation, include a portable (High Efficiency Particulate Air Filter) HEPA air purifier that is sized for the space. Small air exchange units are also available for installation by HVAC contractors to expel stagnant air and import fresh air.
 - g. Small offices without sufficient ventilation with employees performing tasks that involve frequent talking presents a concern, especially for vulnerable individuals. These conditions should be addressed by increasing ventilation and purification or relocating the work area.
 - h. Prevent workers from gathering outside in areas where the HVAC system exhausts (ex. outside break areas). Also, locate clean air intake registers away from external causes of pollution (ex. Smoking areas, roadways and building exhaust vents).

- i. Have a qualified technician examine heat recovery units, if equipped, to determine whether exhaust and fresh air are combined. If combined, determine whether that feature should be disabled and seek advice from an operator on whether to modify.
- j. Reference reliable 3rd party, neutral organizations prior to purchase and installation of mechanical devices intended to improve air quality and remove viral particles such as SARS CoV-2 (ex. American Society of Heating, Refrigerating and Air Conditioning Engineers [ASHRAE]).

2.) All adjustments should be made by a technician who understands the mechanical limits of the system and ask them to identify adjustments that can be made by staff once weather conditions warrant increased use of the system.

3.) There are many emerging technologies on the market designed to clean indoor air of particulates, viruses, mold and other contaminants. These are sold as Needlepoint Bipolar Ionization (NPBI), Ultraviolet (UV), Far-UV-C, dry hydrogen peroxide, tube ionization, ozone generators, electronic air filters, electrostatic precipitators, vaporized hydrogen peroxide, etc. While marketing claims encourage purchase of these products based on study results, it is very important to look for 3rd party, independent, peer reviewed confirmation of claims being made⁴, especially claims regarding COVID-19 removal. Three agencies to look to for confirmation of claims are the Centers for Disease Control and Prevention (CDC), Colorado Dept. of Public Health and Environment (CDPHE) and ASHRAE mentioned earlier. On the date of this post, technologies mentioned above may not be strategies endorsed by the agencies listed. With all technologies, a pivotal question to ask is “Is it safe to be used in an occupied area?”

Resources:

- 1) <https://www.epa.gov/coronavirus/list-n-advanced-search-page-disinfectants-coronaviruses-covid-19>
- 2) https://www.cdc.gov/coronavirus/2019-ncov/science/science-briefs/sars-cov-2-transmission.html?CDC_AA_refVal=https%3A%2F%2Fwww.cdc.gov%2Fcoronavirus%2F2019-ncov%2Fscience%2Fscience-briefs%2Fscientific-brief-sars-cov-2.html
- 3) <https://www.ashrae.org/technical-resources/filtration-disinfection>
- 4) <https://www.ashrae.org/technical-resources/building-readiness#ecip>