Go with the Flow

Ventilation and the spread of SARS-CoV-2 (COVID-19)

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As the COVID-19 pandemic continues and businesses resume operation, emphasis on the development of an infectious disease plan and choosing the proper control measures continue to gain importance. Many industries continue to focus on fomite transmission (i.e., transmission of the virus from an inanimate object) by implementing additional cleaning procedures focused on surface decontamination, but, with evidence that SARS-CoV-2 can transmit from respiratory droplets and via airborne particles in the indoor environment, implementing ventilation controls should also be considered (https://www.epa.gov/; Van Doremalen et. al. 2020).

Researchers have determined that large infectious aerosol particles (i.e., 5 to 15 micrometers) will remain airborne for several minutes and smaller particles (i.e., less than 5 micrometers) will remain in the air for many minutes to hours. In the absence of air currents, air particles will disperse slowly and over a longer period of time (https://www.aiha.org/blog/commentary). A research letter posted in the Centers for Disease Control and Prevention (CDC) Emerging Infectious Disease Journal titled "COVID-19 Outbreak Associated with Air Conditioning in Restaurant, Guangzhou, China, 2020" concluded that "virus transmission in this (COVID-19) outbreak cannot be explained by droplet transmission alone" and "strong airflow from the air conditioner could have propagated droplets." (Jianyou Lu et. al., 2020 / cdc.gov).

The use of building Heating, Ventilating, and Air Conditioning (HVAC) systems cannot interrupt the spread of the virus by close contact, however, with proper maintenance, they can be used to reduce transmission.

The CDC recommends considering the following steps to reduce transmission by improving ventilation in buildings based on local environmental conditions (temperature/humidity) and ongoing community transmission in the area by:

- Increasing the percentage of outdoor air and consider use of natural ventilation (i.e., opening windows if possible and safe to do so) to increase outdoor air dilution of indoor air.
- Increasing the total airflow supply to occupied spaces, if possible.

- Disabling demand-control ventilation (DCV) controls that reduce air supply based on temperature or occupancy.
- Improving central air filtration:
    - Increase air filtration external icon to as high as possible without significantly diminishing design airflow.
    - Inspect filter housing and racks to ensure appropriate filter fit and check for ways to minimize filter bypass.
- Considering running the HVAC system at maximum outside airflow for 2 hours before and after occupied times, in accordance with industry standards.
- Generating clean-to-less-clean air movements by re-evaluating the positioning of supply and exhaust air diffusers and/or dampers and adjusting zone supply and exhaust flow rates to establish measurable pressure differentials. Have staff work in "clean" ventilation zones that do not include higher-risk areas such as visitor reception or exercise facilities (if open). Remember to consider air movement changes and flow blockage if you are using barriers such as plexiglass or new wall construction or dividers.
- Considering using portable high-efficiency particulate air (HEPA) fan/filtration systems to help enhance air cleaning (especially in higher-risk areas).
- Ensuring exhaust fans in restroom facilities are functional and operating at full capacity when the building is occupied.
- Considering using ultraviolet germicidal irradiation (UVGI) as a supplemental technique to inactivate potential airborne virus in the upper-room air of common occupied spaces, in accordance with industry guidelines.

Air Cleaners and HVAC Filters

The US Environmental Protection Agency (EPA) stated that "When used properly, air cleaners and HVAC filters can help reduce airborne contaminants including viruses in a building or small space. By itself, air cleaning or filtration is not enough to protect people from exposure to the virus that causes COVID-19. When used along with other best practices recommended by CDC and others, filtration can be part of a plan to protect people indoors" (www.epa.gov).

ASHRAE encourages building owners to improve the efficiency of the filters serving the current HVAC system and recommend that the Minimum Efficiency Reporting Value (MERV) rating be at least MERV 13 and preferably MERV 14 or better (ashrae.org). In addition to considering improving central filtration, the CDC recommends considering the use of ultraviolet germicidal irradiation (UVGI) as a supplemental technique to inactivate airborne viruses. UVGI uses short-wave ultraviolet energy to inactivate viral, bacterial, and fungal organisms (ashrae.org / ASHRAE Filtration and Disinfection FAQ).

A research study by Morawska et. al. titled "How can airborne transmission of COVID-19 indoors be minimized?" provided the following key ventilation associated recommendations to reduce airborne transmission of COVID-19:

1. Remind and highlight to building managers, administrators, and infection control teams that engineering controls are effective to control and reduce the risks of airborne infection;
2. Increase the existing ventilation rates (outdoor air change rate) and enhance ventilation effectiveness - using existing systems;

3. Eliminate any air-recirculation within the ventilation system and supply fresh (outdoor) air.
4. Supplement existing ventilation with portable air cleaners, where there are areas of known air stagnation, changes in interior spaces, or isolate high patient exhaled airborne viral loads. Adequate replacement of the filters in the air cleaners and their maintenance is crucial; and
5. Avoid over-crowding.

Morawska, et al. reported "If implemented correctly, these recommended building-related measures will lower the overall environmental concentrations of airborne pathogens and thus will reduce the spread of infection by the airborne route. Together with other guidance on minimizing the risk of contact and droplet transmission (through hand-washing, cleaning of hand-touch sites, and the appropriate use of PPE), these ventilation-related interventions will reduce the airborne infection rates not just for SARS-CoV-2 in the current COVID-19 pandemic, but also for other airborne infectious agents." (Morawska et. al., 2020).

Installation of new filters as well as any other significant change to a HVAC system can have an impact on overall efficiency and it is recommended to consult with a qualified HVAC technician when making any change to a building's HVAC system. RHP's group of Certified Industrial Hygienists (CIHs) and Environmental Technicians have decades of combined experience and knowledge to assist clients in navigating simple or complex indoor air quality projects including assessment of HVAC performance, measuring ambient temperature and relative humidity, measuring and calculating air exchange rate (air changes per hour (ACH)), and assessment of local exhaust ventilation and fume and dust extraction.

As the COVID-19 pandemic continues and more information becomes available, we recommend staying informed and continue to follow the most up-to-date safe and effective hygiene and work practices. Effective solutions should not be limited to a single task as each barrier such as social distancing, cloth masks, personal hygiene, and engineering controls work together to reduce risk.

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