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Science + Technology Perspectives

Airing Out the Lab:
Mitigating Disease Transmission with HVAC Solutions

It is scientifically accepted that the SARS-CoV-2 virus that causes COVID-19 spreads through the air, putting an emphasis on proper air circulation and filtration in the past year. Below we present three options that MAY prove useful to the mitigation of airborne virus transmission. These options are presented based upon Hixson's experience, current knowledge of COVID-19 transmission, and guidance from codes, industry standards, and best practices published by the American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) and the WELL Building Standard:

1. **Ultraviolet Germicidal Irradiation (UVGI) and Bipolar Ionization**. UVGI has traditionally been used to mitigate biological and bacterial growth on fixed elements within HVAC equipment (cooling coils, drain pans, etc.). Another application is upper room UV lighting which kills airborne viruses, when applied appropriately, by bathing the airstream at the ceiling level with UV light. This kills airborne pathogens in the room where they are released and prevents them from being circulated throughout the building. Located in Air Handling Units (AHUs), traditional UVGI systems are relatively inexpensive ($3,000-$10,000) to install in new equipment, but are more expensive when retrofitted in existing systems. In addition, UV lamps typically need to be replaced every 9000 hours at an approximate cost of $10/sf installed.

Another technology to consider is bipolar ionization, which can inactivate the virus, preventing it from infecting occupants and spreading. This technology also gives airborne particles a charge, creating clumps of inactive viruses and dust, which are either caught by filters or which drop harmlessly to the floor.

2. **Filtration.** Filtration can provide an effective means of capturing particles within air streams. Current medical journals note that the diameter of the SARS-CoV-2 virus ranges between 60 to 140 nanometers (0.06 to 0.14 microns). To capture viruses of these sizes, most U.S. filter manufacturers are recommending, at a minimum, MERV 14 filters. Note that filtration effectiveness increases with proximity to the source of the airborne contamination. The use of multiple local, portable air filtration units may prove to be a more effective approach to capture the airborne virus at its origin than sole reliance upon central HVAC systems.

3. **Room Air Makeup.** Another technique to consider is to consistently remove a percentage of interior air from the building by increasing outside air (ventilation air) and exhaust airflows. It is important to not just recirculate the same air in the space. Airflow within the room, the location of the fresh outdoor air supply into the room, and the location of the return or exhaust air out of the room are also critical in reducing the spread of a pathogen within the room. For example, imagine air is supplied on one end of a break room and exhausted out on the other side of the room – a traditional setup. If someone coughs on the supply side, that cough will pass through the entire break room before exiting. Instead, consider creating smaller pockets in the space with targeted air distribution.

   While a higher percentage of outside air will increase overall energy cost due to higher cooling and heating loads, the energy cost may be reduced by using energy recovery, e.g., plate-to-plate heat exchangers, heat recovery wheels, etc. The minimum amount of outside air required for different types of spaces is described in both the ASHRAE 62.1 Standard and the International Mechanical Code (IMC).

Remember, these options are not suggested as absolute guarantees against the spread of COVID-19. Instead, think of them as "seatbelts:" they will not prevent an accident, but they might provide an extra layer of security should one occur.

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