IndoorAirHygiene
SOLUTION CENTER

Sanitized Ventilation & Make-Up Air

Executive Summary

There has been an increased focus placed on ventilation and make-up air solutions as a result of the current pandemic. Increased ventilation rates (balanced, supply, or exhaust) are intended to dilute indoor air pollutants, but can also have the unintended consequence of bringing unwanted airborne pollutants inside. It is always advisable to sanitize the incoming air that is delivered to building occupants, but must be done in a way that does not create any level of harmful byproducts (possible with some air cleaning technologies). In the case of buildings with high potential for bioaerosols, such as a hospital during the COVID-19 pandemic, it may be advisable to scrub the air from the building as it is exhausted. In addition to air sanitization, air entering the building needs to be properly conditioned for occupant comfort. This additional ventilation conditioning load can be handled by the ventilation system itself by using technologies such as direct expansion and/or energy recovery or by the central HVAC system.

Explanation of the Science

As we think more about bioaerosols and disease transmission, we need to be aware that particulate matter can remain suspended for lengths of time and can be resuspended via natural processes and common human activities (Ferro et al. 2005). For particulate matter to settle 5 feet in calm air it takes: 0.5 micron- 41 hours, 1.0 micron- 12 hours, and 3.0 micron– 1.5 hours (Baron n.d.). COVID-19 is approximately 0.1um, but often is a hitchhiker on larger particles and therefore can remain suspended for quite a long time. The longer a virus is in the air, the more opportunity exists for it to infect people in the space. To reduce exposure levels we must alter the mechanicals. This includes increasing the supply of sanitized outdoor air to the building, exhausting air from high exposure rooms, and adding air cleaning to indoor spaces both locally and in the recirculation systems (ASHRAE Pandemic Task Force 2020).

As we understand more about pollutants and potential disease transmission through the air, we need to maximize the cleanliness of the air being delivered to buildings and potentially scrub the air being exhausted from buildings. The main delivery of outdoor air into buildings is through natural ventilation (windows/doors/building leakage), mechanical ventilation, and make-up air systems (which often are used to counteract exhaust systems and/or to maintain building pressurization). Air exhausted from buildings has similar mechanisms to supply air: mechanical exhaust from point source pollution locations, such as bathrooms or kitchens, balanced ventilation systems, and natural building leakage (doors/windows/leaks in building envelope). Exhaust systems that create negative pressurization are used in contagious disease situations in order to prevent other parts of the building from being contaminated – the Army Corp of Engineers has made this a requirement in their newly constructed field hospitals to battle COVID-19 (100-200CFM of exhaust per patient room to maintain a minimum of 0.01 IWG). It is important to remember that for every CFM exhausted, it needs to be replaced with air from the outdoors somewhere else in the building.

It is highly recommended to sanitize the outside air coming into the building through active and passive air cleaning technologies before it is delivered. In contaminate rich buildings, it would also be advisable to clean the exhaust air stream to not adversely affect the outdoor environment. These air sanitizing technologies, for both supply and exhaust, will need to be able to handle the maximum amount of ventilation air or make-up air the building will require. Resizing these systems based on protocols used during the COVID-19 pandemic and recent research on bioaerosols should be utilized. Technologies that can be applied to the incoming air must be occupant safe and not pose any adverse health effects; exhausted air can utilize any technologies that do not pose an environmental concern. For instance, heat in the summer or PCO might not be advisable on the outdoor air being supplied to the building as it may lead to poor thermal conditions or increase in formaldehyde.

By increasing ventilation rates (both supply and/or exhaust) there is an additional mechanical conditioning load put on the building. In many cases, this leads to uncontrolled conditions and/or delivery of uncomfortable air to the building which makes the occupants uncomfortable or leads to adverse health conditions. Thermal stress can negatively affect occupant health and occupants are more susceptible to certain pathogens in low and high relative humidity situations (Wolkoff 2018). The ASHRAE Pandemic Task Force recommends keeping temperature between 68-78F and relative humidity between 40-60% to support human comfort and minimize the potential for disease transmission. Maintaining these levels will likely require additional capacity of conditioning systems as ventilation rates are increased. This capacity can come from the ventilation system itself or a decoupled conditioning system. In Chicago, this additional load per 100 CFM can be as high as 8500 btuh in the winter and 5500 btuh in the summer (4900 btuh latent/600 btuh sensible). However, this ventilation load can be minimized through passive and active energy transfer technologies: enthalpy wheels, enthalpy cores, heat pipes, and DX systems. Heat pipes and DX systems are often the best at completely isolating air streams while transferring energy between the exhaust and supply.

IndoorAirHygiene
SOLUTION CENTER

PLEASE CONTACT ONE OF OUR EXPERTS TO HELP YOU IMPROVE YOUR INDOOR AIR HYGIENE

Email:
sales@indoorairhygiene.com

Website:
indoorairhygiene.com