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Diocese of Cleveland Facilities Services Corporation

Then and Now—Indoor Air & Environmental Quality for Your Building Occupants

Indoor air quality (IAQ) came about as a concern back in the 1970's after the oil embargo woke people up to how wasteful we were with our building systems. Prior to this crisis heating, ventilating, and air-conditioning (HVAC) engineers would usually design building systems for constant volume supply air and generous quantities of outdoor air because energy costs were very inexpensive e.g., $0.08 per gallon of oil. Once fuel oil and electrical costs began to skyrocket followed by natural gas prices, engineers began to reassess the design criteria for facilities. Energy conservation became the "buzz" word followed by "energy retrofit". Mechanical and electrical consulting firms began to branch out with creation of in-house energy departments assigned to pursue energy conservation project opportunities. Other engineers chose to leave the design firms they worked for and start up independent energy conservation consulting firms.

In many ways the design community was given the opportunity to redo all those wasteful past project designs with new more energy conserving building operating challenges. Utility companies also encouraged the design community and building owners to "tighten up" existing buildings while also focusing on how to make a more energy efficient design for new construction projects. States introduced energy conservation code criteria leading to some existing and new buildings becoming "sick buildings" in a short period of time. Buildings became "tight" often without operable windows, reduced outdoor air, and variable volume supply air systems. A result for many of these more energy efficient building projects was the concern towards IAQ. A bi-product of this inadequate IAQ was a building environment that created space comfort complaints.

Jump ahead from the 1980's and 1990's to today, design engineers, operating engineers, and equipment manufacturers are still struggling with improving IAQ while shifting away from space comfort to occupant

comfort. Even prior to the 2020 COVID-19 pandemic the United States, as well as the world were now looking for occupant health guidelines for the building environment.

The CDC's Interim Guidance for Businesses and Employers to Plan and Respond to Coronavirus Disease (COVID-19) specifically advises to "increase ventilation rates" and "increase percentage of outdoor air." Furthermore, ASHRAE's Building Readiness Guidelines also recommends that building engineers "…increase their system's outdoor air ventilation to reduce the recirculation air back to the space." In many ways, these increases in ventilation and outdoor air are short-term fixes to the problem as physicians and researchers, design engineers, and operating engineers, strive for long-term solutions.

Although it might seem counterintuitive to increase the flow of air that could be moving viral particles around, moving more air and providing more outdoor air is beneficial because of pathogen dispersal. In fact, the ASHRAE guidance indicates that this must be done as much as the system and or space conditions will allow. The guidance also cautions that, "It is very important that

these overall building systems are evaluated by a qualified testing, adjusting, and balancing TAB professional, Commissioning agent, or design professional to ensure that the modifications for pandemic safety do not create additional operational issues."

Building engineers are encouraged to improve the efficiency of the filters serving their HVAC systems within the guidance provided for most of the building types listed on the ASHRAE COVID-19 Preparedness Resources website. Mechanical filters are the most common types of filters found in HVAC systems and, with the higher the MERV number, the better the ability of a filter to remove particles from the air. ASHRAE recommends that mechanical filter efficiency be at least MERV 13 and preferably MERV 14 or better to help mitigate the transmission of infectious aerosols. Many existing HVAC systems were designed and installed to operate using MERV-6 to MERV-8 filters. While MERV 13 and greater filters are better at removing particles in the 0.3 micron to 1 micron diameter size (the size of many virus particles) the higher efficiency does not come without a penalty. Higher efficiency filters require greater air pressures to drive or force air through the filter.

Before simply going out and buying MERV 14 filters a qualified engineer should assess the central air equipment to determine if more efficient filters can replace the existing filters without compromising the quantity of supply air CFM (cubic feet per minute) to the occupied spaces. When surveying this central air system equipment, the HVAC engineer should also assess the potential to increase the total supply air ventilation to the occupied spaces. Care must also be taken when increasing this system's outdoor air quantity and the total supply air quantity to determine if the primary heating and cooling capacity e.g., air-handling unit's heating and cooling coils have sufficient capacity to satisfy the space temperature and humidity thermostat and humidistat set points.

ASHRAE's Building Readiness Guidelines also states that, "…research indicates that maintaining the space relative humidity between 40% and 60% decreases the bio-burden of infectious particles in the space and decreases the infectivity of many viruses in the air." The [engineering] team should consider adjusting the space comfort set points to increase the system's ability to use more outside. Viruses are least viable in buildings with humidity between 40% and 60%. Buildings in cooler climates are susceptible to humidity levels lower than optimal, making humidifiers a necessity. Unfortunately, most buildings today are not constructed to accommodate occupant health recommendations, e.g., maintaining space humidity in this relative humidity range that is now being advocated today to improve occupant health.

It should be well understood that a healthy building, whether a school, office building, public space, or even a home, involves tradeoffs of energy consumption, comfort, and safety. Some of the remedies advocated above can increase energy usage, but with health being a top priority, particularly in the time of pandemic, most will find that the resulting increase in comfort and safety necessary and worthwhile.

A properly installed, properly maintained central HVAC system with adequate ventilation using outside air, proper filtration, and appropriate humidity control, all of which are accomplished through readily available technologies, can go a long way toward mitigating potential viral spread.

For more information on "Indoor Air Quality and Indoor Environmental Quality for Your Building Occupants" please refer to:

https://www.ashrae.org/technical-resources/building-readiness#upgrading

https://www.ashrae.org/technical-resources/resources

https://wwwnc.cdc.gov/eid/article/26/7/20-0764_article#suggestedcitation/

https://www.cdc.gov/coronavirus/2019-ncov/community/guidance-business-response.html

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