

This is a first in a series of white papers covering the topic of infection control in buildings through enhanced HVAC strategies.

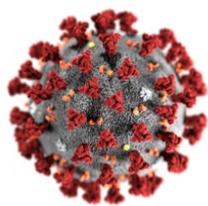
Introduction

The present world pandemic situation has brought up the question: "What can we do to improve the air quality and reduce the possibility of disease spread in our facilities and buildings?"

There are a vast array of available methods and technologies that can aid in the process of improving the air inside the occupied space and preventing infection. Air cleaning may be done as part of the HVAC system through enhanced filtration, fresh air regulation and sterilization, or by using in room devices, either permanent or temporary portable units.

Some of these technologies are time tested and proven in the medical and biotech fields. Some are promising new technologies that may prove to be effective in the long run, however, they have not been in use long enough to clearly identify their effectiveness. Some technologies are not proven to be effective at all at controlling infection agents. This series of white papers will try to separate the fact from the fiction and provide reliable guidance on how to effectively mitigate the spread of infection in buildings.

This first white paper will provide a very high level overview of the available technologies. Future white papers will go into greater detail on each of the topics herein.



0.12 microns

SARS-CoV-2

HVAC Systems:

Mechanical air filters, air filters, and Germicidal Ultraviolet (GUV) may be used individually or in combination to improve the air quality, however, mechanical filters have a very limited ability to effectively remove the very small particles associated with typical viruses. The particles are so small that most removal strategies have limited effectiveness. Therefore a combined approach is necessary to make a meaningful difference.



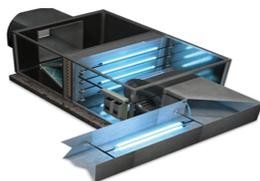
MERV 13 filter

Mechanical Air Filtration: Mechanical filtration should already be present in all HVAC systems. However, the efficiency of these filters can be increased to a rating greater than or equal to MERV 13 because filters of this rating are more efficient at capturing airborne particles of a smaller size (0.3 microns) than lower efficiency filters (3.0 microns). However, increased filter efficiency ratings comes with increased pressure drop at the filter. This increased pressure drop must be watched carefully or significant performance degradation or damage could occur to the HVAC equipment. The existing HVAC unit may or may not be capable of overcoming the additional pressure drop of a higher efficiency filter.



Electrostatic Air Filter

Electrostatic Air Filtration: This method of filtration is used to remove very small particles from the air stream. The removal of the particles is achieved by electrically charging the air particles and then collecting them on charged plates. The removal efficiency is the fraction of the particles removed from the air passing through the filter. Unfortunately, electronic air filters are only effective if the collection plates are kept very clean. The efficiency drops off very rapidly as the plates become loaded. Also, electronic air cleaners generate ozone as a byproduct of their operation. Ozone can be harmful to health, however, there is no consensus regarding what level of ozone is considered safe.



UV Light Sterilization

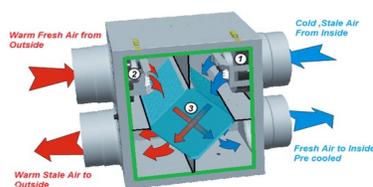
Germicidal Ultraviolet Sterilization: This method uses UV-C generating lamps installed within the supply air duct or within the unit itself. UV-C light kills bacteria and inactivates viruses. This technology has been in use in the medical and biotech fields for many years and is considered very effective at eliminating biological hazards, when properly applied.

Bipolar Ionization: This technology uses high voltage electrodes designed to create reactive ions in the air, which in turn are supposed to react with the airborne contaminants. Rigorous independent scientific studies on this method are not readily available. Ionization may also create ozone as a byproduct of its operation, similar to electrostatic filtration equipment.

Fresh Air:

The first step in any indoor air quality assessment is to verify that the existing fresh air ventilation rates meet the latest code requirements and industry recommendations, including ASHRAE 62.1-2019. Consider increasing the ventilation rates beyond current levels. Additional fresh air will improve the overall indoor air quality.

Increasing the ventilation rates decreases the amount of recirculated air to the space, thus diminishing the number of contaminants recirculated. However, the existing HVAC system may not be capable of maintaining the intended comfort levels in terms of temperature and relative humidity. In order to address this problem, energy recovery ventilators (ERV units) can ease the burden of increased ventilation air and save energy in the process.



Energy Recovery Ventilator

Implementing CO2 monitoring and control lends a way to ensure adequate ventilation at all occupied times, while providing a good balance of energy consumption versus ventilation dilution.

In Room Devices:

There are many in room and portable devices that can reduce the spread of infectious particles in buildings. These include:

Upper Room Germicidal Ultraviolet: UV fixtures installed in the room at 7'-0" A.F.F. or higher.

Portable UV-C Decontamination: Fully automated robotic units. This method is used for surface decontamination. The room must not be occupied during decontamination using this equipment.

Portable Electronic Air Filter: These units use the same technology as the electronic air filters installed within the HVAC system, however, they are self-contained. HEPA filter versions are also common.

Room Ionization Units: These units use the same technology as Bipolar Ionization, with similar drawbacks.

Summary:

There are many options for improving the air quality of your facility. Depending upon your building, your existing HVAC system, and the function of your facility, you may choose one path or a combination of the options discussed in this white paper. Stay tuned for a more in depth look at each of these technologies in future white papers.

About Pedro:



Pedro Ferrer, P.E., has been involved in the design of mechanical systems for malls, mixed-use developments, corporate offices, national retail roll-outs, commercial and institutional buildings for over 26 years with Schnackel Engineers.

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RESOURCES	
ASHRAE COVID-19 (CORONAVIRUS) PREPAREDNESS RESOURCES	https://www.ashrae.org/technical-resources/resources
Illuminating Engineering Society IES.	IES Committee Report: Germicidal Ultraviolet (GUV) – Frequently Asked Questions
American Air Filter AAF	https://www.aafintl.com/
American Ultraviolet	https://www.americanultraviolet.com/