



AIR STERILIZATION THROUGH UV-C AND HEPA

Presented by CEC Technologies

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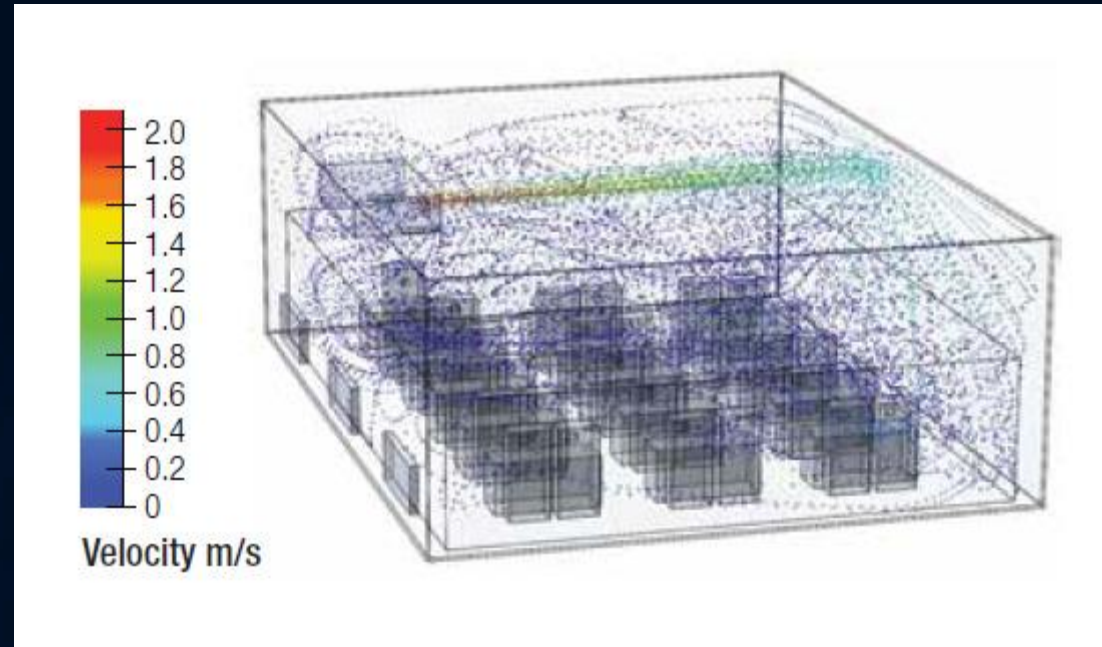
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Typical Office Setting

While there is some social distancing, air is being circulated and shared by all.



This illustration demonstrates the air particles in circulating within the room with only Central HVAC System.



CDC Guidelines for Offices Re-opening

CREATE A COVID-19 workplace or educational health and safety plan – Check to see if the building is ready for occupancy (an excerpt)

- Check for hazards associated with prolonged facility shutdown such as mold growth, etc.
- Increase circulation of outdoor air as much as possible by opening windows and doors if possible and using fans.

Source: Center for Disease Control and Prevention – COVID-19 Employer Information for Office Buildings, updated April 7, 2021

CDC Guidelines for School Reopening

Tools to Improve Ventilation (an excerpt)

- Increase the introduction of outdoor air
 - Open outdoor air dampers beyond minimum setting to reduce the HVAC air recirculation
 - Open windows and doors to increase outdoor air flow.
 - Use Fans to increase the effectiveness of open windows
 - Increase Air filtration as high as possible without significantly reducing the airflow. Add a minimum MERV-13 Filter to Air Handlers
 - Use portable High- efficiency particulate air (HEPA) fan/filtration systems to enhance air cleaning.
 - Use ultraviolet germicidal irradiation (UVGI) as a supplemental treatment to inactivate SARS-CoV-2 when options are limited. These systems can be used to provide air cleaning within occupied spaces, and in-duct UVI systems can help enhance air cleaning inside the central ventilation systems.

CDC HEPA Filtration Discussion

“In this study, the use of HEPA air cleaners in a conference room significantly reduced the exposure of nearby participants and a speaker to airborne particles produced by a simulated infected participant. The air cleaners were most effective when they were located in the center of the room close to the aerosol source. Moreover, the combination of HEPA air cleaners and universal masking was more effective than was either intervention alone. The use of masks without air cleaners reduced the aerosol exposure of the receivers by 72%, and the use of air cleaners without masks reduced the exposure by up to 65%. When used together, the HEPA air cleaners and masks reduced exposure to respiratory aerosols by up to 90%. These findings suggest that the use of portable HEPA air cleaners and universal masking can each reduce exposure to simulated SARS-CoV-2 aerosols in indoor environments, with larger reductions occurring when air cleaners and masking are used together.”

Source: CDC. “Efficacy of Portable Air Cleaners and Masking for Reducing Indoor Exposure to Simulated Exhaled SARS-COV-2 Aerosols - United States, 2021.” *Centers for Disease Control and Prevention*, Centers for Disease Control and Prevention, 8 July 2021,

<https://www.cdc.gov/mmwr/volumes/70/wr/mm7027e1.htm>.

PROVEN EFFECTIVE TECHNOLOGIES

HEPA FILTERS

Research shows that the particle size of SARS-CoV2 is around 0.1 micrometer. However, the virus generally does not travel through the air by itself. These viral particles are human-generated, so the virus is trapped in respiratory droplets and droplet nuclei that are larger. Most of the respiratory droplets and particles exhaled are less than 5 micrometer in size. By definition, a High Efficiency Particulate Air (HEPA) filter is at least 99.97% efficient at capturing particles 0.9 micrometer in size.

Source: Center for Disease Control and Prevention – Ventilation in Buildings

UV Disinfection for COVID-19

According to the International Ultraviolet Association (IUVA), there is existing evidence, that the UVC light has been used extensively for more than 40 years disinfecting drinking water, wastewater, air, pharmaceutical products and surfaces against many human pathogens. All bacteria and viruses to date respond to UV Disinfections.

The proper use of UV is not what exists in a tanning bed or normal sunlight. UVC Wavelengths rated at 200nm-280nm are effective in this application.

Source: IUVA – UV Disinfection for COVID-19

CEC Approach to COVID Mitigation

- Multi-stage process utilizing the top technologies available
 1. Pre-Filtration
 2. HEPA filtration – Captures COVID-19 size particles at 99.7%
 3. UV-C light to achieve the highest possible pathogen kill rate in a space
 4. CEC machines incorporate UV-C that provides a kill rate of 99.5% within a single pass



Four Stage Filtration

- CEC's air filtration ceiling units consist of a four stage filtration process.
- The smaller unit designated for offices and classrooms has a three stage filtration process.

CEC Filter Stages

Model	UVCO 5000	UVC 1400	UVC 2500
Stage 1	MERV 10	MERV 8	MERV 8
Stage 2	UVC	MERV 16	MERV 16
Stage 3	HEPA	UVC	UVC
Stage 4		HEPA	HEPA

Understanding the Rating of a Filter

MERV Std 52.2	Intended Dust Spot Efficiency Std 52.1 (2)	Average Arrestance	Particle Size Ranges	Typical Applications	Typical Filter Type
1 - 4	<20%	60 to 80%	> 10.0 µm	Residential/Minimum Light Commercial/ Minimum Equipment Protection	Permanent / Self Charging (passive) Washable / Metal, Foam / Synthetics Disposable Panels Fiberglass / Synthetics
5 - 8	<20 to 60%	80 to 95%	3.0-10.0 µm	Industrial Workplaces Commercial Better / Residential Paint Booth / Finishing	Pleated Filters Extended Surface Filters Media Panel Filters
9 - 12	40 to 85%	>90 to 98%	1.0-3.0 µm	Superior/Residential Better/Industrial Workplaces Better/Commercial Buildings	Non-Supported / Pocket Filter / Rigid Box Rigid Cell / Cartridge V-Cells
13 - 16	70 - 98%	>95 to 99%	0.30-1.0 µm	Smoke Removal General Surgery Hospitals & Health Care Superior/ Commercial Buildings	Rigid Cell / Cartridge Rigid Box / Non-Supported / Pocket Filter V-Cells
MERV Std 52.2	Efficiency		Typical Applications		Typical Filter Type
17 - 20 ¹ <small>Deleted from ASHRAE</small>	99.97%-99.9999%		Hospital Surgery Suites Cleanrooms Hazardous Biological Contaminants Nuclear Material		HEPA ULPA

Top 5 Benefits for the use of CEC Air Systems in protecting Tyson's Team Members and Enhancing the COVID Mitigation Strategies

- COVID has to attach to something larger in order to travel in the air. This is where the HEPA and the UV have been effective.
- COVID does not survive on surfaces for as long as first thought. Filtering the air is the best way to mitigate it.
- Filtration reduced the mold and yeast from To Numerous to Count (TNTC) on air plates to nothing in a couple days making high traffic areas cleaner for the people.
- What we did at the on set of COVID was so successful, it set the standards for the rest of the company. All business units are now filtering air and it is accepted by the CDC and OSHA.
- We proved the following in the R&D Installation:
 1. UV is an effective way to kill COVID. In the beginning, there was skepticism to the effectiveness however, we proved rotating the air at least 6 times per hour significantly reduced the bacteria and viruses in the air.
 2. We could reduce bacteria, viruses, mold and yeast by 80% in a single pass with the UVHD - 2500 unit.
 3. The use of this unit in a cafeteria took the mold and smell out of the cafeteria. In addition, we learned by shutting a unit off even over the weekend the counts will increase significantly.



Benefits within the School Community

1. This technology allows schools to provide a cleaner/safer environment for their students offering a recruitment advantage.
2. As in large corporations, the use of the machines provides for ongoing air sterilization, ultimately reducing the number of days that kids/teachers and staff are out of the building.
3. The use of UV-C technology has been widely documented in effectively killing Sars which is an envelope virus similar to that of COVID-19 as described earlier in the presentation.

THE END RESULT

CEC combines the proven technologies to develop a system that outperforms the minimum guidelines. While there is no perfect solution, our systems have worked at reducing the spread of COVID-19 and helped many stay open and operating through the Pandemic.

If there are any more questions or concerns, please contact - sales@cectechinc.com or bjohnston@cectechinc.com

